



**7450 ETHERNET SERVICE SWITCH
7750 SERVICE ROUTER
7950 EXTENSIBLE ROUTING SYSTEM
VIRTUALIZED SERVICE ROUTER**

**ROUTER CONFIGURATION GUIDE
RELEASE 19.5.R1**

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1 Getting Started

1.1 About This Guide

This guide describes logical IP routing interfaces, virtual routers, IP and MAC-based filtering, and cflowd support and presents configuration and implementation examples.

This guide is organized into functional chapters and provides concepts and descriptions of the implementation flow, as well as Command Line Interface (CLI) syntax and command usage.

The topics and commands described in this document apply to the:

- 7450 ESS
- 7750 SR
- 7950 XRS
- VSR

[Table 1](#) lists the available chassis types for each SR OS router.

Table 1 Supported SR OS Router Chassis Types

7450 ESS	7750 SR	7950 XRS
• 7450 ESS-7/12 running in default mixed mode	• 7750 SR-a4/a8 • 7750 SR-1e/2e/3e • 7750 SR-7/12 • 7750 SR-12e • 7750 SR-7s/14s • 7750 SR-1	• 7950 XRS-16c • 7950 XRS-20/40

For a list of unsupported features by platform and chassis, refer to *SR OS 19.x.Rx Software Release Notes*, part number 3HE 15407 000x TQZZA.

Command outputs shown in this guide are examples only; actual displays may differ depending on supported functionality and user configuration.



Note: This guide generically covers Release 19.x.Rx content and may contain some content that will be released in later maintenance loads. Refer to *SR OS 19.x.Rx Software Release Notes*, part number 3HE 15407 000x TQZZA for information about features supported in each load of the Release 19.x.Rx software.

1.2 Router Configuration Process

[Table 2](#) lists the tasks necessary to configure logical IP routing interfaces, virtual routers, IP and MAC-based filtering, and cflowd.

This guide is presented in an overall logical configuration flow. Each section describes a software area and provides CLI syntax and command usage to configure parameters for a functional area.

Table 2 Configuration Process

Area	Task	Section
Router configuration	Configure IP router parameters	Configuring IP Router Parameters
	Configure IP router	Configuring an IP Router with CLI
	Perform service management	Service Management Tasks
Protocol configuration	Configure VRRP parameters	Basic VRRP Configurations
	Configure VRRP	Common Configuration Tasks
	Configure VRRP policy components	Configuring VRRP Policy Components
	VRRP configuration management	VRRP Configuration Management Tasks
	Configure IP, MAC, and IP exception filter policies	Common Configuration Tasks
	Filter management	Filter Management Tasks
	Configure cFlowd	Configuring Cflowd with CLI
	cFlowd configuration management	Cflowd Configuration Management Tasks

2 IP Router Configuration

2.1 Configuring IP Router Parameters

To provision services on a Nokia router, logical IP routing interfaces must be configured to associate attributes such as an IP address, port, or the system with the IP interface.

A special type of IP interface is the system interface. A system interface must have an IP address with a 32-bit subnet mask. The system interface is used as the router identifier by higher-level protocols such as OSPF and BGP, unless overwritten by an explicit router ID.

The following router features can be configured:

- [Interfaces](#)
- [Creating an IP Address Range](#)
- [Autonomous Systems \(AS\)](#)
- [Confederations](#)
- [Proxy ARP](#)

Refer to the *7450 ESS, 7750 SR, and VSR Triple Play Service Delivery Architecture Guide* for information about DHCP and support as well as configuration examples for the 7750 SR and 7450 ESS.

2.1.1 Interfaces

Nokia routers use different types of interfaces for various functions. Interfaces must be configured with parameters such as the interface type (network and system) and address. A port is not associated with a system interface. An interface can be associated with the system (loopback address).

2.1.1.1 Network Interface

A network interface (a logical IP routing interface) can be configured on one of the following entities:

- Physical or logical port
- A SONET/SDH channel for the 7750 SR or 7450 ESS

2.1.1.2 Network Domains

To determine which network ports (and, therefore, which network complexes) are eligible to transport traffic of individual SDPs, network-domain is provided. Network-domain information is then used for the sap-ingress queue allocation algorithm applied to VPLS SAPs. This algorithm is optimized in so that no sap-ingress queues are allocated if the specified port does not belong to the network-domain used in the specified VPLS. Also, sap-ingress queues will not be allocated toward network ports (regardless of the network-domain membership) if the specified VPLS does not contain any SDPs.

Sap-ingress queue allocation considers the following:

- SHG membership of individual SDPs
- Network-domain definition under SDP to restrict the topology in which the specified SDP can be set-up

The implementation supports four network-domains within any VPLS.

Network-domain configuration at the SDP level is ignored when the SDP is used for Epipe, Lpipe, or Apipe bindings.

Network-domain configuration is irrelevant for Layer 3 services (Layer 3 VPN and/or IES service). Network-domain configuration can be defined in the base routing context and associated only with network interfaces in this context. Network domains are not applicable to loopback and system interfaces.

The network-domain information will only be used for ingress VPLS sap queue-allocation. It will not be considered by routing during SDP setup. Therefore, if the specified SDP is routed through network interfaces that are not part of the configured network domain, the packets will be still forwarded, but their QoS and queuing behavior will be based on default settings. Also, the packet will not appear in SAP statistics.

There will always be one network-domain with reserved name default. The interfaces will always belong to a default network-domain. It will be possible to assign a specific interface to different user-defined network-domains. The loopback and system interfaces will be also associated with the default network-domain at the creation. However, any attempt to associate those interfaces with any explicitly defined network-domain will be blocked at the CLI level because there is no benefit for that association.

Any SDP can be assigned only to one network domain. If none is specified, the system will assign the default network-domain. This means that all SAPs in VPLS will have queue reaching all fwd-complexes serving interfaces that belong to the same network-domains as the SDPs.

It is possible to assign/remove network-domain association of the interface/SDP without requiring deletion of the respective object.

2.1.1.3 System Interface

The system interface is associated with a network entity (such as a specific router or switch), not a specific interface. The system interface is also referred to as the loopback address. The system interface is associated during the configuration of the following entities:

- Termination point of service tunnels
- Hops when configuring MPLS paths and LSPs
- Addresses on a target router for BGP and LDP peering

The system interface is used to preserve connectivity (when routing reconvergence is possible) when an interface fails or is removed. The system interface is used as the router identifier, and a system interface must have an IP address with a 32-bit subnet mask.

2.1.1.4 Unicast Reverse Path Forwarding Check (uRPF)

uRPF helps to mitigate problems that are caused by the introduction of malformed or forged (spoofed) IP source addresses into a network by discarding IP packets that lack a verifiable IP source address. For example, a number of common types of denial-of-service (DoS) attacks, including smurf and tribe flood network (TFN), can take advantage of forged or rapidly changing source addresses to allow attackers to thwart efforts to locate or filter the attacks. For Internet service providers (ISPs) that provide public access, uRPF deflects such attacks by forwarding only packets with source addresses that are valid and consistent with the IP routing table. This action protects the network of the ISP, its customer, and the rest of the Internet.

uRPF is supported for both IPv4 and IPv6 on network and access. It is supported on any IP interface, including base router, IES, VPRN, and subscriber group interfaces.

In strict mode, uRPF checks whether the incoming packet has a source address that matches a prefix in the routing table, and whether the interface expects to receive a packet with this source address prefix.

In loose mode, uRPF checks whether the incoming packet has a source address that matches a prefix in the routing table; loose mode does not check whether the interface expects to receive a packet with a specific source address prefix.

Loose mode uRPF check is supported for ECMP, IGP shortcuts, and VPRN MP-BGP routes. Packets coming from a source that matches any ECMP, IGP shortcut, or VPRN MP-BGP route will pass the uRPF check even when uRPF is set to strict mode on the incoming interface.

In the case of ECMP, this allows a packet received on an IP interface configured in strict uRPF mode to be forwarded if the source address of the packet matches an ECMP route, even if the IP interface is not a next-hop of the ECMP route or not a member of any ECMP routes. The strict-no-ecmp uRPF mode may be configured on any interface that is known to not be a next-hop of any ECMP route. When a packet is received on this interface, and the source address matches an ECMP route, the packet is dropped by uRPF.

If there is a default route, the following is included in the uRPF check:

- A loose mode uRPF check always succeeds.
- A strict mode uRPF check only succeeds if the source address matches any route (including the default route) where the next-hop is on the incoming interface for the packet.

Otherwise, the uRPF check fails.

If the source IP address matches a discard/blackhole route, the packet is treated as if it failed the uRPF check.

2.1.1.5 Creating an IP Address Range

An IP address range can be reserved for exclusive use for services by defining the **config>router>service-prefix** command. When the service is configured, the IP address must be in the range specified by a service prefix. If no service prefix is configured, no limitation exists.

Addresses in the range of a service prefix can be allocated to a network port unless the exclusive parameter is specified. Then, the address range is exclusively reserved for services.

When defining a range that is a superset of a previously defined service prefix, the subset will be replaced with the superset definition. For example, if a service prefix exists for 10.10.10.0/24, and a new service prefix is configured as 10.10.0.0/16, then the old address (10.10.10.0/24) will be replaced with the new address (10.10.0.0/16).

When defining a range that is a subset of a previously defined service prefix, the subset will replace the existing superset, providing that addresses used by services are not affected. For example, if a service prefix exists for 10.10.0.0/16, and a new service prefix is configured as 10.10.10.0/24, then the 10.10.0.0/16 address will be removed, provided that no services are configured that use 10.10.x.x addresses other than 10.10.10.x.

2.1.1.6 QoS Policy Propagation Using BGP (QPPB)

This section describes QPPB as it applies to VPRN, IES, and router interfaces. Refer to the “Internet Enhanced Service” section in the *7450 ESS, 7750 SR, 7950 XRS, and VSR Layer 3 Services Guide: IES and VPRN* and the “IP Router Configuration” section in the *7450 ESS, 7750 SR, 7950 XRS, and VSR Router Configuration Guide*.

QoS policy propagation using BGP (QPPB) is a feature that allows a route to be installed in the routing table with a forwarding-class and priority so that packets matching the route can receive the associated QoS. The forwarding-class and priority associated with a BGP route are set using BGP import route policies. This feature is called QPPB, even though the feature name refers to BGP specifically. On SR OS, QPPB is supported for BGP (IPv4, IPv6, VPN-IPv4, VPN-IPv6), RIP, and static routes.

SAP ingress and network QoS policies can achieve the same result as QPPB (for example, by assigning a packet arriving on an IP interface to a specific forwarding-class and priority/profile, based on the source address or destination address of the packet). However, the effort involved in creating the QoS policies, keeping them up-to-date, and applying them across many nodes is much greater than with QPPB. In a typical application of QPPB, a BGP route is advertised with a BGP community attribute that conveys a specific QoS. Routers that receive the advertisement accept the route into their routing table and set the forwarding-class and priority of the route from the community attribute.

2.1.1.6.1 QPPB Applications

There are two typical applications of QPPB:

1. Coordination of QoS policies between different administrative domains
2. Traffic differentiation within a single domain, based on route characteristics

2.1.1.6.2 Inter-AS Coordination of QoS Policies

The operator of an administrative domain “A” can use QPPB to signal to a peer administrative domain “B” that traffic sent to certain prefixes advertised by domain A should receive a specific QoS treatment in domain B. For example, an ASBR of domain A can advertise a prefix to domain B and include a BGP community attribute with the route. The community value implies a specific QoS treatment, as agreed by the two domains (in their peering agreement or service level agreement, for example). When the ASBR and other routers in domain B accept and install the route for that prefix into their routing table, they apply a QoS policy on selected interfaces that classifies traffic toward that prefix into the QoS class implied by the BGP community value.

QPPB may also be used to request that traffic sourced from specific networks receive appropriate QoS handling in downstream nodes that may span different administrative domains. This can be achieved by advertising the source prefix with a BGP community, as described. However, in this case, other approaches are equally valid, such as marking the DSCP or other CoS fields based on the source IP address, so that downstream domains can take action based on a common understanding of the QoS treatment implied by different DSCP values.

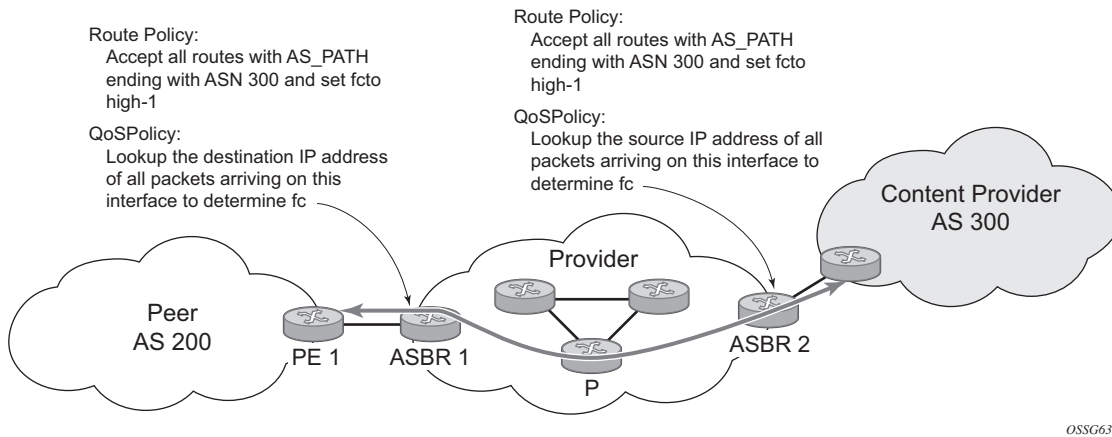
In the preceding examples, coordination of QoS policies using QPPB could be between a business customer and their IP VPN service provider, or between one service provider and another.

2.1.1.6.3 Traffic Differentiation Based on Route Characteristics

A network operator might need to provide differentiated service to specific traffic flows within its network, and these traffic flows can be identified with known routes. For example, the operator of an ISP network might need to give priority to traffic originating in a specific ASN (the ASN of a content provider offering over-the-top services to the ISP’s customers), following a specific AS_PATH, or destined for a specific next-hop (remaining on-net vs. off-net).

[Figure 1](#) shows an example of an ISP that has an agreement with the content provider managing AS300 to provide traffic sourced and terminating within AS300 with differentiated service appropriate to the content being transported. In this example, ASBR1 and ASBR2 mark the DSCP of packets terminating and sourced, respectively, in AS300 so that other nodes within the ISP’s network do not need to rely on QPPB to determine the correct forwarding-class to use for the traffic. The DSCP or other CoS markings could be left unchanged in the ISP’s network and QPPB used on every node.

Figure 1 Use of QPPB to Differentiate Traffic in an ISP Network



2.1.1.7 QPPB

There are two main aspects of the QPPB feature:

- The ability to associate a forwarding-class and priority with specific routes in the routing table.
- The ability to classify an IP packet arriving on a specific IP interface to the forwarding-class and priority associated with the route that best matches the packet.

2.1.1.7.1 Associating an FC and Priority with a Route

This feature uses the **fc** command in the route-policy hierarchy to set the forwarding class and, optionally, the priority associated with routes accepted by a route-policy entry. The command has the following structure:

```
fc fc-name [priority {low | high}]
```

The use of the **fc** command is shown by the following example:

```
config>router>policy-options
begin
community gold members 300:100
policy-statement qppb_policy
entry 10
from
protocol bgp
community gold
exit
```

```
        action accept
        fc hl priority high
    exit
exit
exit
commit
```

The **fc** command is supported with all existing from and to match conditions in a route policy entry, with any action other than reject, and with next-entry, next-policy, and accept actions. If a next-entry or next-policy action results in multiple matching entries, then the last entry with a QPPB action determines the forwarding class and priority.

A route policy that includes the **fc** command in one or more entries can be used in any import or export policy, but the **fc** command has no effect except in the following types of policies:

- VRF import policies:
 - config>service>vprn>vrf-import**
- BGP import policies:
 - config>router>bgp>import**
 - config>router>bgp>group>import**
 - config>router>bgp>group>neighbor>import**
 - config>service>vprn>bgp>import**
 - config>service>vprn>bgp>group>import**
 - config>service>vprn>bgp>group>neighbor>import**
- RIP import policies:
 - config>router>rip>import**
 - config>router>rip>group>import**
 - config>router>rip>group>neighbor>import**
 - config>service>vprn>rip>import**
 - config>service>vprn>rip>group>import**
 - config>service>vprn>rip>group>neighbor>import**

As shown, QPPB route policies support routes learned from RIP and BGP neighbors of a VPRN, as well as for routes learned from RIP and BGP neighbors of the base/global routing instance.

QPPB is supported for BGP routes belonging to any of the following address families:

- IPv4 (AFI=1, SAFI=1)
- IPv6 (AFI=2, SAFI=1)

- VPN-IPv4 (AFI=1, SAFI=128)
- VPN-IPv6 (AFI=2, SAFI=128)

A VPN-IP route may match both a VRF import policy entry and a BGP import policy entry (if `vpn-apply-import` is configured in the base router BGP instance). In this case, the VRF import policy is applied first, then the BGP import policy, so the QPPB QoS is based on the BGP import policy entry.

This feature also provides the ability to associate a forwarding-class and, optionally, priority with IPv4 and IPv6 static routes. This is achieved by specifying the forwarding-class within the **static-route-entry next-hop** or **indirect** context.

Priority is optional when specifying the forwarding class of a static route, but when configured it can only be deleted and returned to unspecified by deleting the entire static route.

2.1.1.7.2 Displaying QoS Information Associated with Routes

The following commands are enhanced to show the forwarding-class and priority associated with the displayed routes:

- `show router route-table`
- `show router fib`
- `show router bgp routes`
- `show router rip database`
- `show router static-route`

This feature uses a **qos** keyword with the **show>router>route-table** command. When this option is specified, the output includes an additional line per route entry that displays the forwarding class and priority of the route. If a route has no fc and priority information, the third line is blank. The following CLI shows an example:

**show router route-table [family] [ip-prefix[/prefix-length]] [longer | exact]
[protocol protocol-name] qos**

An example output of this command is as follows:

```
A:Dut-A# show router route-table 10.1.5.0/24 qos
=====
Route Table (Router: Base)
=====
Dest Prefix                                Type  Proto  Age      Metric  Pref
      Next Hop[Interface Name]
      QoS
-----
10.1.5.0/24                               Remote BGP     15h32m52s  0
```

```

PE1_to_PE2                                0
h1, high
-----
No. of Routes: 1
=====
A:Dut-A#

```

2.1.1.7.3 Enabling QPPB on an IP interface

To enable QoS classification of ingress IP packets on an interface based on the QoS information associated with the routes that best match the packets, configure the **qos-route-lookup** command in the IP interface. The **qos-route-lookup** command has parameters to indicate whether the QoS result is based on lookup of the source or destination IP address in every packet. There are separate **qos-route-lookup** commands for the IPv4 and IPv6 packets on an interface, which allows QPPB to be enabled for IPv4 only, IPv6 only, or both IPv4 and IPv6. Currently, QPPB based on a source IP address is not supported for IPv6 packets or for ingress subscriber management traffic on a group interface.

The **qos-route-lookup** command is supported on the following types of IP interfaces:

- base router network interfaces (**config>router>interface**)
- VPRN SAP and spoke SDP interfaces (**config>service>vprn>interface**)
- VPRN group-interfaces (**config>service>vprn>sub-if>grp-if**)
- IES SAP and spoke SDP interfaces (**config>service>ies>interface**)
- IES group-interfaces (**config>service>ies>sub-if>grp-if**)

When the **qos-route-lookup** command with the destination parameter is applied to an IP interface and the destination address of an incoming IP packet matches a route with QoS information, the packet is classified to the fc and priority associated with that route. The command overrides the FC and priority/profile determined from the SAP ingress or network QoS policy associated with the IP interface (see section 5.7 for more information). If the destination address of the incoming packet matches a route with no QoS information, the fc and priority of the packet remain as determined by the sap-ingress or network qos policy.

Similarly, when the **qos-route-lookup** command with the source parameter is applied to an IP interface and the source address of an incoming IP packet matches a route with QoS information, the packet is classified to the FC and priority associated with that route. The command overrides the FC and priority/profile determined from the SAP ingress or network QoS policy associated with the IP interface. If the source address of the incoming packet matches a route with no QoS information, the FC and priority of the packet remain as determined by the SAP ingress or network QoS policy.

Currently, QPPB is not supported for ingress MPLS traffic on network interfaces or on CsC PE'-CE' interfaces (**config>service>vprn>nw-if**).



Note: QPPB based on a source IP address is not supported for ingress subscriber management traffic on a group interface.

2.1.1.7.4 QPPB When Next-Hops are Resolved by QPPB Routes

In some cases (IP VPN inter-AS model C, Carrier Supporting Carrier, indirect static routes, and so on), an IPv4 or IPv6 packet may arrive on a QPPB-enabled interface and match a route A1 whose next-hop N1 is resolved by a route A2 with next-hop N2. Similarly, N2 is resolved by a route A3 with next-hop N3, and so on. The QPPB result is based only on the forwarding-class and priority of route A1. If A1 does not have a forwarding-class and priority association, the QoS classification is not based on QPPB, even if routes A2, A3, and so on, have forwarding-class and priority associations.

2.1.1.7.5 QPPB and Multiple Paths to a Destination

When ECMP is enabled, some routes may have multiple equal-cost next-hops in the forwarding table. When an IP packet matches such a route, the next-hop selection is typically based on a hash algorithm that tries to load balance traffic across all the next-hops while keeping all packets of a flow on the same path. The QPPB configuration model described in [Associating an FC and Priority with a Route](#) allows different QoS information to be associated with the different ECMP next-hops of a route. The forwarding-class and priority of a packet matching an ECMP route is based on the next-hop used to forward the packet.

When Edge PIC [1] is enabled, some BGP routes may have a backup next-hop in the forwarding table, as well as the one or more primary next-hops representing the equal-cost best paths allowed by the ECMP/multipath configuration. When an IP packet matches such a route, a reachable primary next-hop is selected (based on the hash result) but if all the primary next-hops are unreachable, the backup next-hop is used. The QPPB configuration model described in [Associating an FC and Priority with a Route](#) allows the forwarding-class and priority associated with the backup path to be different from the QoS characteristics of the equal-cost best paths. The forwarding class and priority of a packet forwarded on the backup path is based on the **fc** and priority of the backup route.

2.1.1.7.6 QPPB and Policy-Based Routing

When an IPv4 or IPv6 packet with destination address arrives on an interface with both QPPB and policy-based-routing enabled:

- There is no QPPB classification if the IP filter action redirects the packet to a directly connected interface, even if the destination address is matched by a route with a forwarding-class and priority.
- QPPB classification is based on the forwarding-class and priority of the route matching IP address Y if the IP filter action redirects the packet to the indirect next-hop IP address Y, even if the destination address is matched by a route with a forwarding-class and priority.

2.1.1.8 QPPB and GRT Lookup

Source-address based QPPB is not supported on any SAP or spoke SDP interface of a VPRN configured with the **grt-lookup** command.

2.1.1.8.1 QPPB Interaction with SAP Ingress QoS Policy

When QPPB is enabled on a SAP IP interface, the forwarding class of a packet may change from **fc1** (the original **fc** determined by the SAP ingress QoS policy) to **fc2**, the new **fc** determined by QPPB. In the ingress datapath, SAP ingress QoS policies are applied in the first P chip and route lookup/QPPB occurs in the second P chip. This has the following implications:

- Ingress remarking (based on profile state) is always based on the original **fc** (**fc1**) and sub-class (if defined).
- The profile state of a SAP ingress packet that matches a QPPB route depends on the configuration of **fc2** only. If the de-1-out-profile flag is enabled in **fc2**, and **fc2** is not mapped to a priority mode queue, the packet will be marked out of profile if its DE bit = 1. If the profile state of **fc2** is explicitly configured (in or out) and **fc2** is not mapped to a priority mode queue, the packet is assigned this profile state. In both cases, there is no consideration of whether **fc1** was mapped to a priority mode queue.
- The priority of a SAP ingress packet that matches a QPPB route depends on several factors. If the de-1-out-profile flag is enabled in **fc2** and the DE bit is set in the packet, priority will be low regardless of the QPPB priority or **fc2** mapping to profile mode queue, priority mode queue, or policer. If **fc2** is associated with a profile mode queue, the packet priority will be based on the explicitly configured profile state of **fc2** (in profile = high, out profile = low, undefined =

high), regardless of the QPPB priority or **fc1** configuration. If **fc2** is associated with a priority mode queue or policer, the packet priority will be based on QPPB (unless DE=1). If no priority information is associated with the route, the packet priority will be based on the configuration of **fc1**. If **fc1** mapped to a priority mode queue, the priority is based on DSCP/IP prec/802.1p. If **fc1** mapped to a profile mode queue, the priority is based on the profile state of **fc1**.

Table 3 summarizes these interactions.

Table 3 QPPB Interactions with SAP Ingress QoS

Original FC object mapping	New FC object mapping	Profile	Priority (drop preference)	DE=1 override	In/out of profile marking
Profile mode queue	Profile mode queue	From new base FC unless overridden by DE=1	From QPPB, unless packet is marked in or out of profile in which case follows profile. Default: high priority.	From new base FC	From original FC and sub-class
Priority mode queue	Priority mode queue	Ignored	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then from original dot1p/exp/DSCP mapping or policy default.	From new base FC	From original FC and sub-class
Policer	Policer	From new base FC unless overridden by DE=1	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then from original dot1p/exp/DSCP mapping or policy default.	From new base FC	From original FC and sub-class
Priority mode queue	Policer	From new base FC unless overridden by DE=1	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then from original dot1p/exp/DSCP mapping or policy default.	From new base FC	From original FC and sub-class

Table 3 QPPB Interactions with SAP Ingress QoS (Continued)

Original FC object mapping	New FC object mapping	Profile	Priority (drop preference)	DE=1 override	In/out of profile marking
Policer	Priority mode queue	Ignored	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then from original dot1p/exp/DSCP mapping or policy default.	From new base FC	From original FC and sub-class
Profile mode queue	Priority mode queue	Ignored	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then follows original FC's profile mode rules.	From new base FC	From original FC and sub-class
Priority mode queue	Profile mode queue	From new base FC unless overridden by DE=1	From QPPB, unless packet is marked in or out of profile in which case follows profile. Default: high priority.	From new base FC	From original FC and sub-class
Profile mode queue	Policer	From new base FC unless overridden by DE=1	If DE=1 override then low otherwise from QPPB. If no DEI or QPPB overrides then follows original FC's profile mode rules.	From new base FC	From original FC and sub-class
Policer	Profile mode queue	From new base FC unless overridden by DE=1	From QPPB, unless packet is marked in or out of profile in which case follows profile. Default: high priority.	From new base FC	From original FC and sub-class

2.1.2 Router ID

The router ID, a 32-bit number, uniquely identifies the router within an autonomous system (AS) (see [Autonomous Systems \(AS\)](#)). In protocols such as OSPF, routing information is exchanged between areas—groups of networks that share routing information. It can be set to be the same as the loopback address. The router ID is used by both OSPF and BGP routing protocols in the routing table manager instance.

There are several ways to obtain the router ID. On each router, the router ID can be obtained in the following ways.

- Define the value in the **config>router** *router-id* context. The value becomes the router ID.
- Configure the system interface with an IP address in the **config>router>interface** *ip-int-name* context. If the router ID is not manually configured in the **config>router** *router-id* context, the system interface acts as the router ID.
- If neither the system interface or router ID are implicitly specified, the router ID is inherited from the last four bytes of the MAC address.
- The router can be obtained from the protocol level; for example, BGP.

2.1.3 Autonomous Systems (AS)

Networks can be grouped into areas. An area is a collection of network segments within an AS that have been administratively assigned to the same group. An area's topology is concealed from the rest of the AS, which results in a significant reduction in routing traffic.

Routing in the AS takes place on two levels, depending on whether the source and destination of a packet reside in the same area (intra-area routing) or different areas (inter-area routing). In intra-area routing, the packet is routed solely on information obtained within the area; no routing information obtained from outside the area can be used. This protects intra-area routing from the injection of bad routing information.

Routers that belong to more than one area are called area border routers. All routers in an AS do not have an identical topological database. An area border router has a separate topological database for each area it is connected to. Two routers, which are not area border routers, belonging to the same area, have identical area topological databases.

Autonomous systems share routing information, such as routes to each destination and information about the route or AS path, with other ASs using BGP. Routing tables contain lists of next hops, reachable addresses, and associated path cost metrics to each router. BGP uses the information and path attributes to compile a network topology.

2.1.4 Confederations

Configuring confederations is optional and should only be implemented to reduce the IBGP mesh inside an AS. An AS can be logically divided into smaller groupings called sub-confederations and then assigned a confederation ID (similar to an autonomous system number). Each sub-confederation has fully meshed IBGP and connections to other ASs outside of the confederation.

The sub-confederations have EBGP-type peers to other sub-confederations within the confederation. They exchange routing information as if they were using IBGP. Parameter values such as next hop, metric, and local preference settings are preserved. The confederation appears and behaves like a single AS.

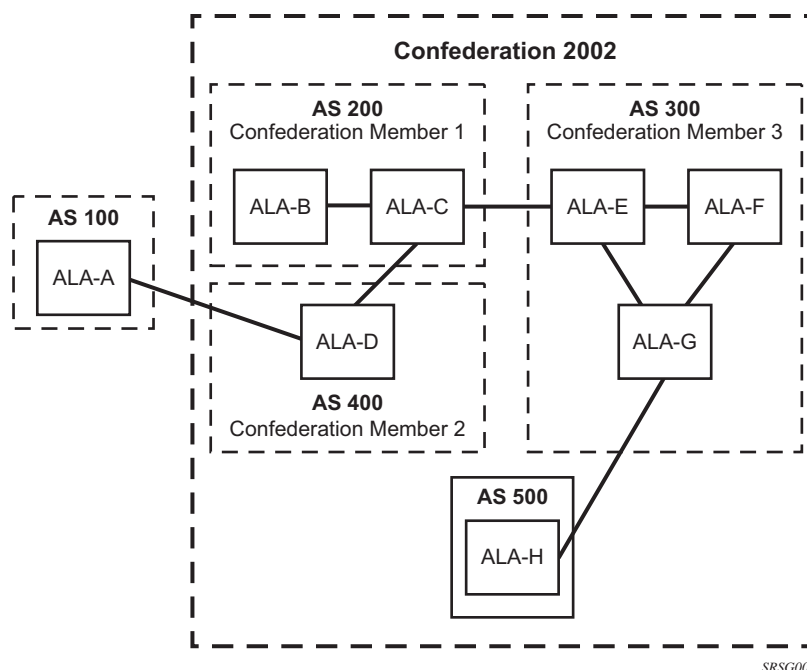
Confederations have the following characteristics:

- A large AS can be sub-divided into sub-confederations.
- Routing within each sub-confederation is accomplished via IBGP.
- EBGP is used to communicate between sub-confederations.
- BGP speakers within a sub-confederation must be fully meshed.
- Each sub-confederation (member) of the confederation has a different AS number. The AS numbers used are typically in the private AS range of 64512 to 65535.

To migrate from a non-confederation configuration to a confederation configuration requires a major topology change and configuration modifications on each participating router. Setting BGP policies to select an optimal path through a confederation requires other BGP modifications.

There are no default confederations. Router confederations must be explicitly created. [Figure 2](#) shows an example of a confederation configuration.

Figure 2 Confederation Configuration



2.1.5 Proxy ARP

Proxy ARP is the technique in which a router answers ARP requests intended for another node. The router appears to be present on the same network as the “real” node that is the target of the ARP and takes responsibility for routing packets to the “real” destination. Proxy ARP can help nodes on a subnet reach remote subnets without configuring routing or a default gateway.

Typical routers only support proxy ARP for directly attached networks; the router is targeted to support proxy ARP for all known networks in the routing instance where the virtual interface proxy ARP is configured.

To support DSLAM and other edge-like environments, proxy ARP supports policies that allow the provider to configure prefix lists that determine for which target networks proxy ARP will be attempted and prefix lists that determine for which source hosts proxy ARP will be attempted.

Also, the proxy ARP implementation will support the ability to respond for other hosts within the local subnet domain. This is needed in environments such as DSL where multiple hosts are in the same subnet but can not reach each other directly.

Static ARP is used when a Nokia router needs to know about a device on an interface that cannot or does not respond to ARP requests. The configuration can state that, if it has a packet with a specific IP address, to send it to the corresponding ARP address. Use proxy ARP so the router responds to ARP requests on behalf of another device.

2.1.6 Exporting an Inactive BGP Route from a VPRN

The **export-inactive-bgp** command under **config>service>vprn** provides an IP VPN configuration option that allows the best BGP route learned by a VPRN to be exported as a VPN-IP route even when that BGP route is inactive due to the presence of a more preferred BGP-VPN route from another PE. This “best-external” type of route advertisement is useful in active/standby multi-homing scenarios because it can ensure that all PEs have knowledge of the backup path provided by the standby PE.

2.1.7 DHCP Relay

Refer to the *7450 ESS, 7750 SR, and VSR Triple Play Service Delivery Architecture Guide* for information about DHCP relay and support, as well as configuration examples.

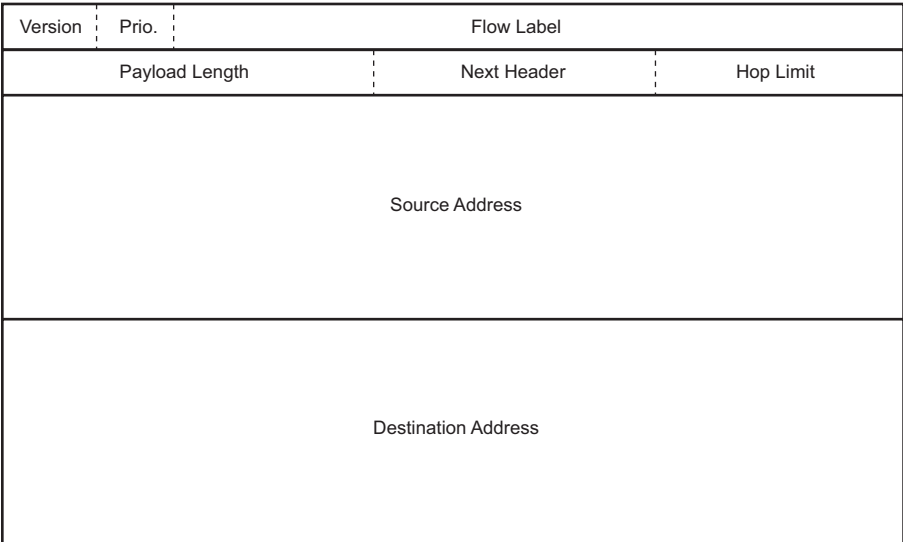
2.1.8 Internet Protocol Versions

The TiMOS implements IP routing functionality, providing support for IP version 4 (IPv4) and IP version 6 (IPv6). IP version 6 (RFC 1883, *Internet Protocol, Version 6 (IPv6)*) is a version of the Internet Protocol designed as a successor to IP version 4 (IPv4) (RFC-791, *Internet Protocol*). The changes from IPv4 to IPv6 affect the following categories:

- Expanded addressing capabilities — IPv6 increases the IP address size from 32 bits (IPv4) to 128 bits, to support more levels of addressing hierarchy, a much greater number of addressable nodes, and simpler auto-configuration of addresses. The scalability of multicast routing is improved by adding a scope field to multicast addresses. Also, a type of address called an anycast address is defined that is used to send a packet to any one of a group of nodes.

- Header format simplification — Some IPv4 header fields have been dropped or made optional to reduce the common-case processing cost of packet handling and to limit the bandwidth cost of the IPv6 header.
- Improved support for extensions and options — Changes in the way IP header options are encoded allows for more efficient forwarding, less stringent limits on the length of options, and greater flexibility for introducing options in the future.
- Flow labeling capability — The capability to enable the labeling of packets belonging to traffic flows for which the sender requests special handling, such as non-default quality of service or “real-time” service was added in IPv6.
- Authentication and privacy capabilities — Extensions to support authentication, data integrity, and (optional) data confidentiality are specified for IPv6.

Figure 3 IPv6 Header Format



al_0892

Table 4 IPv6 Header Field Descriptions

Field	Description
Version	4-bit Internet Protocol version number = 6.
Prio.	4-bit priority value.
Flow Label	24-bit flow label.
Payload Length	16-bit unsigned integer. The length of payload, for example, the rest of the packet following the IPv6 header, in octets. If the value is zero, the payload length is carried in a jumbo payload hop-by-hop option.

Table 4 IPv6 Header Field Descriptions (Continued)

Field	Description
Next Header	8-bit selector. Identifies the type of header immediately following the IPv6 header. This field uses the same values as the IPv4 protocol field.
Hop Limit	8-bit unsigned integer. Decrement by 1 by each node that forwards the packet. The packet is discarded if the hop limit is decremented to zero.
Source Address	128-bit address of the originator of the packet.
Destination Address	128-bit address of the intended recipient of the packet (possibly not the ultimate recipient if a routing header is present).

2.1.8.1 IPv6 Address Format

IPv6 uses a 128-bit address, as opposed to the IPv4 32-bit address. Unlike IPv4 addresses, which use the dotted-decimal format, with each octet assigned a decimal value from 0 to 255, IPv6 addresses use the colon-hexadecimal format X:X:X:X:X:X:X:X, where each X is a 16-bit section of the 128-bit address. For example:

2001:0db8:0000:0000:0000:0000:0000:0000

Leading zeros must be omitted from each block in the address. A series of zeros can be replaced with a double colon. For example:

2001:db8::

The double colon can only be used once in an address.

The IPv6 prefix is the part of the IPv6 address that represents the network identifier, which appears at the beginning of the address. The IPv6 prefix length, which begins with a forward slash (/), shows how many bits of the address make up the network identifier. For example, the address 2001:db8:8086:6502::1/64 means that the first 64 bits of the address represent the network identifier; the remaining 64 bits represent the node identifier.



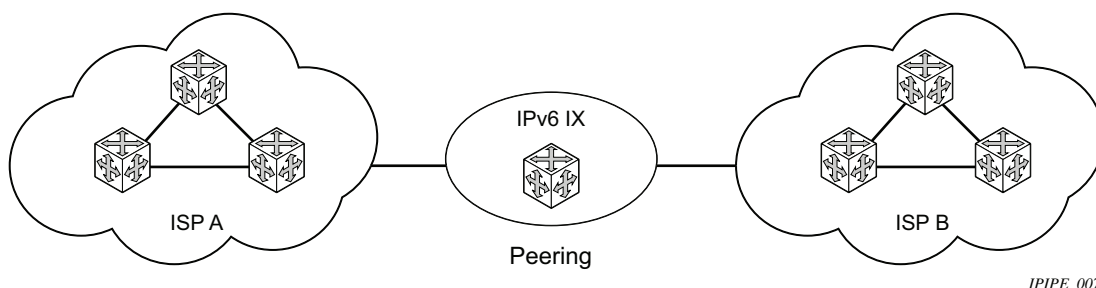
Note: IPv6 addresses and prefixes are displayed according to RFC 5952, *A Recommendation for IPv6 Address Text Representation*.

2.1.8.2 IPv6 Applications

Examples of the IPv6 applications supported by the SR OS include:

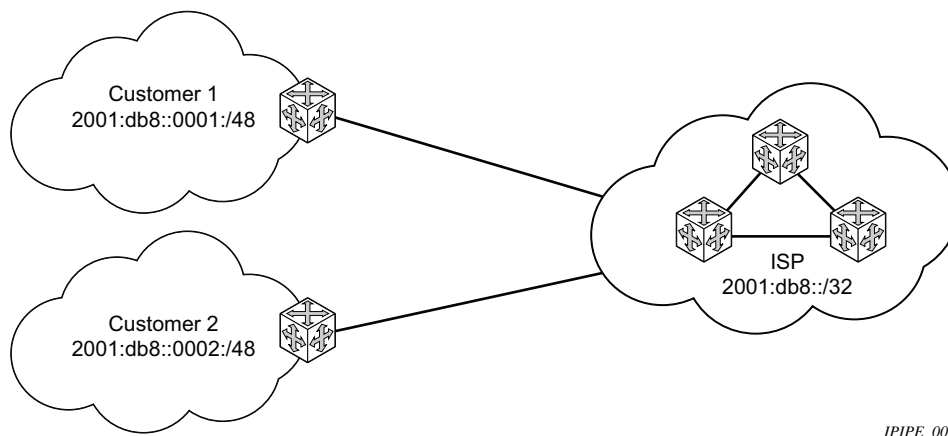
- IPv6 Internet exchange peering — [Figure 4](#) shows an IPv6 Internet exchange where multiple ISPs peer over native IPv6.

Figure 4 IPv6 Internet Exchange

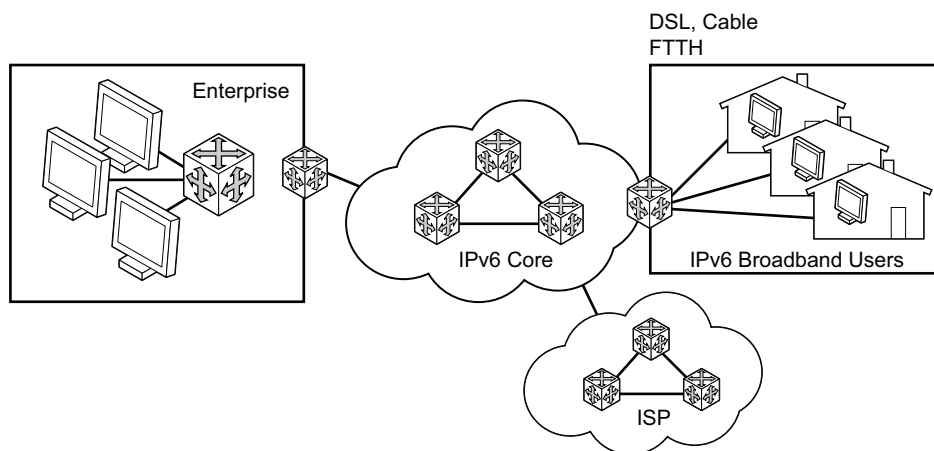


- IPv6 transit services — [Figure 5](#) shows IPv6 transit services provided by an ISP.

Figure 5 IPv6 Transit Services



- IPv6 services to enterprise customers and home users — [Figure 6](#) shows IPv6 services to enterprise and home broadband users.

Figure 6 IPv6 Services to Enterprise Customers and Home Users

IPIPE_009

- IPv6 over IPv4 relay services — IPv6 over IPv4 tunnels are one of many IPv6 transition methods to support IPv6 in an environment where not only IPv4 exists but native IPv6 networks depend on IPv4 for greater IPv6 connectivity. Nokia routers support dynamic IPv6 over IPv4 tunneling. The IPv4 source and destination address are taken from configuration, the source address is the IPv4 system address and the IPv4 destination is the next hop from the configured IPv6 over IPv4 tunnel.

IPv6 over IPv4 is an automatic tunnel method that gives a prefix to the attached IPv6 network. [Figure 7](#) shows IPv6 over IPv4 tunneling to transition from IPv4 to IPv6.

Figure 7 IPv6 over IPv4 Tunnels

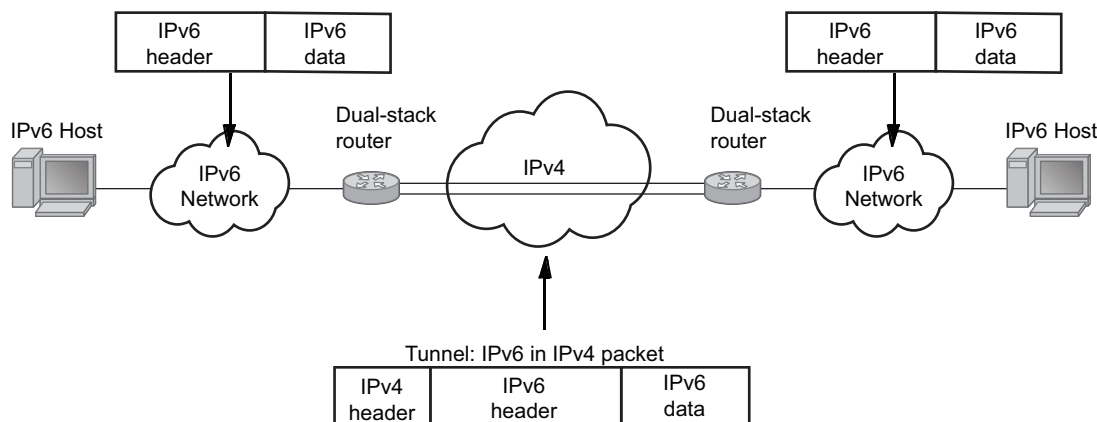


Fig_29a

2.1.8.3 DNS

The DNS client is extended to use IPv6 as transport and to handle the IPv6 address in the DNS AAAA resource record from an IPv4 or IPv6 DNS server. An assigned name can be used instead of an IPv6 address because IPv6 addresses are more difficult to remember than IPv4 addresses.

2.1.8.4 Secure Neighbor Discovery (SeND)

Secure Neighbor Discovery (SeND) in conjunction with Cryptographically Generated Addresses (CGAs) allows operators to secure IPv6 neighbor discovery between nodes on a common Layer 2 network segment.

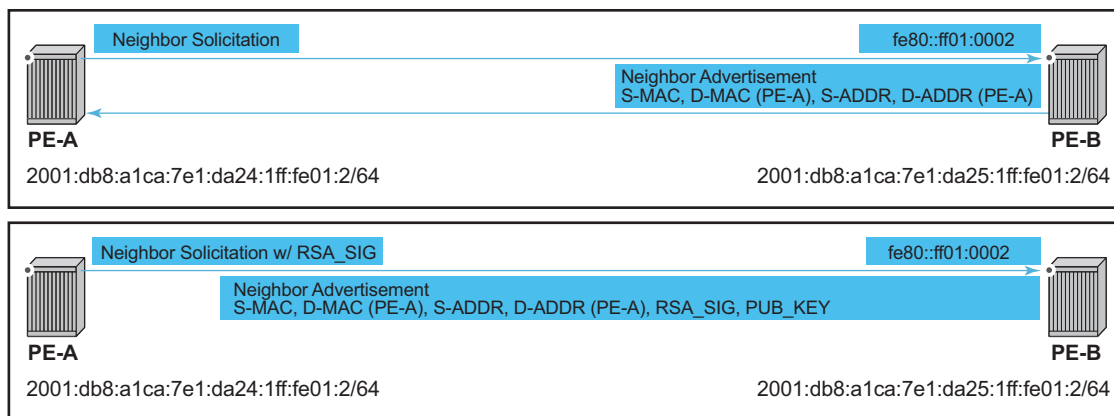
When SeND is enabled on an interface, CGAs must be enabled and static GUA/LLA IPv6 addressing is not supported. In this case, the router will generate a CGA from the configured prefix (GUA, LLA) and use that address for all communication. The router will validate NS/ND messages from other nodes on the network segment, and only install them in the neighbor cache if they pass validation.

A number of potential use-cases for SeND exist in order to secure the network from deliberate or accidental tampering during neighbor discovery, SeND can prevent hijacking of in-use IPv6 addressing or man-in-the-middle attacks, but also to validate whether a node is permitted to participate in neighbor discovery, or validate which routers are permitted to act as default gateways.

SeND affects the following areas of neighbor discovery:

- Neighbor solicitation (solicited-node multicast address; target address)
- Neighbor advertisement (solicited; unsolicited)
- Router solicitation
- Router advertisement
- Redirect messages

Figure 8 Neighbor Discovery with and without SeND



al_0747

When SeND is enabled on a node, basic neighbor discovery messaging is changed as shown in [Figure 8](#). In the example, PE-A needs to find the MAC address of PE-B.

1. PE-A sends an NS message to the solicited node multicast address for PE-B's address with the CGA option, RSA signature option, timestamp option, and nonce option.
2. PE-B processes the NS message and, because it is configured for SeND operation, processes the NS. PE-B will validate the source address of the packet to ensure it is a valid CGA, then validate the cryptographic signature embedded in the NS message.
3. PE-B generates an NA message, which is sent back to PE-A with the solicited bit, router bit set. The source address is that of PE-B, while the destination address is that of PE-A from the NS message. The timestamp is generated from PE-B, while the nonce is copied from PE-A's NS message.

4. PE-A receives the NA and completes similar checks as PE-B did.

If all steps process correctly, both nodes will install each other's addresses into their neighbor cache database.

2.1.8.5 SeND Persistent CGAs

Persistent CGAs is a feature of SeND.

Previously, all generated CGAs on SeND-enabled interfaces remained unchanged after a CPM switchover, but after a reboot from a saved configuration file, all CGAs were regenerated.

To keep the same CGAs after a reboot from a saved configuration file:

1. Save the RSA key pair used for SeND.
2. Save the modifiers used during the CGA generation.

To make the CGAs persistent:

1. Import an online or offline generated RSA key pair for SeND.
2. Ensure that the CompactFlash (CF) files containing an RSA key pair that is used for SeND, are synchronized to the standby CPM by making use of the HA infrastructure used for certificates.
3. Ensure that the configuration file is saved when one or more CGAs are generated.

2.1.8.5.1 Persistent RSA Key Pair

The RSA key pair is stored in a file on the CF.

Generate an RSA Key Pair

To generate an RSA key pair, use the **admin certificate gen-keypair** command:

admin certificate gen-keypair *local-url* [**type rsa**] **size 1024**

For example:

```
admin certificate gen-keypair cf1:\myDir\myRsaKeyPair type rsa size 1024
```

This generates a der formatted file.

Import an online/offline generated RSA key pair

To import a generated RSA key pair, use the **admin certificate secure-nd-import** command:

admin certificate secure-nd-import *local-url* **format** {der | pem | pkcs12}
[password <password>] [key-rollover]

For example:

```
admin certificate secure-nd-import cfl:\myDir\myRsaKeyPair format der
```

- Because SeND only uses RSA key pairs, the command is refused if the imported key type is not RSA.
- Because SeND only supports key size 1024, the command is refused if the imported key size is not 1024.
- The password has to be specified when an offline generated file in pkcs12 format has to be imported.
- **key-rollover** keyword: see the *RSA key pair rollover mechanism* section that follows.
- This command creates the file cfx:\system-pki\secureNdKey (fixed directory and file name) and saves the imported key in that file in encrypted der format (same as the **admin certificate import** command).
- The RSA key pair is uploaded in the memory of SeND.

RSA key pair rollover mechanism

To trigger a key rollover, use the **admin certificate secure-nd-import** command described in the previous section [Import an online/offline generated RSA key pair](#).

For example:

```
admin certificate secure-nd-import cfl:\myDir\myOtherRsaKeyPair format der key-rollover
```

- If CGAs exist that are generated based on an auto-generated or previously imported RSA key pair and the **key-rollover** keyword is not specified, the **secure-nd-import** command is refused.
- If a **secure-nd-import** with **key-rollover** is requested while a previous key rollover is still being handled, the new command is refused.
- If the **secure-nd-import** command is accepted, the imported RSA key pair is written to the file cfx:\system-pki\secureNdKey and loaded to SeND. Existing CGAs if any will be regenerated.

- While handling a key rollover, SeND keeps track of which interface uses which RSA key pair. Temporarily, SeND can have two RSA key pairs in use. At all times, only the latest RSA key pair is stored in the file `cfx:\system-pki\secureNdKey`. When the rollover is finished, the RSA key pair that is no longer referred to, is deleted from SeND's memory.

Auto-generation of RSA key pair

The first time an interface becomes SeND enabled, SeND needs an RSA key pair to generate or check a modifier and to generate a CGA.

If the operator did not import an RSA key pair for SeND, an auto-generated RSA key pair will be used as a fallback.

The auto-generated RSA key pair is synchronized to the standby CPM, but will not be written to the CF. Therefore, all CGAs generated via an auto-generated RSA key pair are not persistent. A warning will be raised whenever a non-persistent CGA is generated.

The **admin certificate secure-nd-import** command without the **key-rollover** keyword will be refused if CGAs exist that made use of the auto-generated RSA key pair. Specifying the **key-rollover** keyword will result in regeneration of the CGAs.

See the section [Making non-persistent CGAs persistent](#) for more information about the procedure to make non-persistent CGAs persistent.

HA

For the synchronization of the RSA key pair file in `cfx:\system-pki\` used by SeND, the following commands for manual and automatic certificate synchronization are used:

- manual: **admin redundancy synchronize cert**
- automatic: **configure redundancy cert-sync**

SeND also synchronizes the RSA key pair to the standby CPM.

2.1.8.5.2 Persistent CGA Modifier

The modifier used during the CGA generation will be saved in the configuration file. The CGA itself is not stored.

Based on the stored modifier and RSA key pair, the same CGA can be regenerated.

The modifier is needed to be sent out in ND messages.

By storing the modifier in the configuration file, the operator can also configure an offline generated modifier (possibly with a security parameter > 1).

Example 1: Configure a SeND interface without modifiers:

```
configure router interface itf1
  address 10.10.10.1
  port 1/1/1
  ipv6
    secure-nd
    no shutdown
```

=> A modifier is generated based on the actual RSA key pair (that is, imported or auto-generated). The modifier is used to generate a link-local CGA.

=> The modifier is saved in the interface configuration file:

```
exit
address 2000:1::/64
```

=> A modifier is generated based on the actual RSA key pair. The modifier is used to generate the global CGA.

=> The modifier is stored in the interface configuration file.

Example 2: Configure a SeND interface with modifiers:

```
configure router interface itf2
  address 10.10.10.2
  port 1/1/2
  ipv6
    secure-nd
    link-local-modifier 0xABCD
```

=> The offline generated modifier is used to generate the link-local CGA:

```
no shutdown
exit
address 3000:1::/64
```

=> A modifier is generated based on the actual RSA key pair. The modifier is used to generate the global CGA.

=> The modifier is stored in the interface configuration file:

```
address 3000:2::/64 modifier 0xABCD
```

=> The same offline generated modifier as the preceding link-local address is used for the generation of a global address:

```
address 3000:3::/64 modifier 0xABCD
```

=> Another offline generated modifier (*) is used for the generation of a global address.

=> For an offline generated modifier, a check is performed to see if it is generated with the actual RSA key pair and the security parameter applicable for the interface. If this check fails, the command is refused, unless the command is triggered in the context of an exec of a config file. In that case, the modifier is replaced by a new one that is generated based on the actual RSA key pair.

2.1.8.5.3 Making non-persistent CGAs persistent

CGAs can be non-persistent because:

- The operator forgot to configure an RSA key pair for SeND, so hence the CGAs were generated based on an auto-generated RSA key pair.
- The operator forgot to synchronize an RSA key pair file to the stand-by CPM and a switch-over happens.
- The CGAs were generated by a software version not having persistent CGAs (such as, ISSU).
- The system was booted from a configuration file generated by a software version not having persistent CGAs.

Key rollover

You can import a new RSA key pair for SeND with the **key-rollover** keyword. This will result in the regeneration of all CGAs on all interfaces.

Exporting the SeND RSA key pair

Another method that does not result in the regeneration of the CGAs is to export the RSA key pair that is currently in use by SeND to the system-pki directory via an admin command:

admin certificate secure-nd-export

This command will write the RSA key pair to the file cfx:\system-pki\secureNdKey in encrypted der format.

2.1.8.5.4 Booting from a saved configuration file

Configuration saved by a software version with persistent CGAs

The file `cfx:\system-pki\secureNdKey` should exist. This file will be automatically uploaded by SeND during initialization.

The configuration file should contain a modifier for each address on a SeND enabled interface.

Modifiers in the configuration file are checked against the current RSA key pair. If the check fails, a new modifier and CGA is generated and a warning is raised that a new CGA is generated.

If a modifier is missing from the configuration file for an IPv6 /64 prefix on a SeND enabled interface, a new modifier and CGA will be generated based on the active RSA key pair.

Configuration saved by a software version having non-persistent CGAs

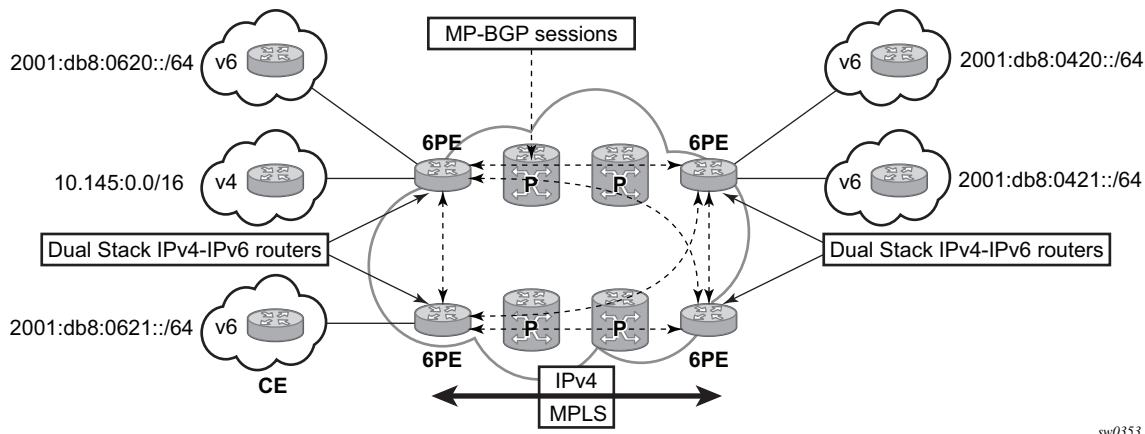
The file `cfx:\system-pki\secureNdKey` does not exist nor does the configuration file contain a modifier for any of the IPv6 /64 prefixes on secure-nd enabled interfaces.

New CGAs have to be generated (from the CLI context). Follow one of the procedures described in section [Making non-persistent CGAs persistent](#) to make the non-persistent CGA's persistent.

2.1.8.6 IPv6 Provider Edge Router over MPLS (6PE)

6PE allows IPv6 domains to communicate with each other over an IPv4 MPLS core network. Because forwarding is based on MPLS labels, backbone infrastructure upgrades and core router re-configuration is not required in this architecture. 6PE is a cost-effective solution for IPv6 deployment.

Figure 9 Example of a 6PE Topology within One AS



sw0353

2.1.8.6.1 6PE Control Plane Support

The 6PE MP-BGP routers support:

- IPv4 and IPv6 dual-stack
- MP-BGP to exchange IPv6 reachability information:
 - The 6PE routers exchange IPv6 reachability information using MP-BGP (AFI 2, SAFI 4).
 - An IPv4 address of the 6PE router is encoded as an IPv4-mapped IPv6 address in the BGP next-hop field. This is usually the IPv4 system address.
 - The 6PE router binds MPLS labels to the IPv6 prefixes it advertises. SR OS routers advertise the IPv6 explicit null (value 2) in advertised 6PE routes but accept any arbitrary label from peers.
- The most preferred tunnel to the BGP next-hop allowed by the 6PE resolution filter (**config>router>bgp>next-hop-resolution>labeled-routes>transport-tunnel>family label-ipv6>resolution-filter**) is used to tunnel the traffic to the remote 6PE router.

2.1.8.6.2 6PE Data Plane Support

The ingress 6PE router can push two or more MPLS labels to send the packets to the egress 6PE router. The top labels are associated with resolving the transport tunnels. The bottom label is advertised in MP-BGP by the remote 6PE router. Typically, the IPv6 explicit null (value 2) label is used, but any arbitrary value can be received when the remote 6PE router is not an SR OS router.

The egress 6PE router pops the top transport labels. When the IPv6 explicit null label is exposed, the egress 6PE router knows that an IPv6 packet is encapsulated. It pops the IPv6 explicit null label and performs an IPv6 route lookup to find the next hop for the IPv6 packet.

2.1.9 Static Route Resolution Using Tunnels

The user can forward packets of a static route to an indirect next-hop over a tunnel programmed in TTM by configuring the following static route tunnel binding command:

```
config>router>static-route-entry {ip-prefix/prefix-length} [mcast] indirect {ip-  
address}  
    tunnel-next-hop  
        resolution {any|disabled|filter}  
        resolution-filter
```

```

[no] ldp
[no] rsvp-te
    [no] lsp <name1>
    [no] lsp <name2>
    .
    .
    [no] lsp <namen>
exit
[no] sr-isis
[no] sr-ospf
[no] sr-te
    [no] lsp <name1>
    [no] lsp <name2>
    .
    .
    [no] lsp <namen>
exit
[no] disallow-igp
exit
exit

```

If **tunnel-next-hop** context is configured and **resolution** is set to **disabled**, the binding to tunnel is removed and resolution resumes in RTM to IP next-hops.

If **resolution** is set to **any**, any supported tunnel type in static route context will be selected following TTM preference.

The following tunnel types are supported in a static route context: LDP, RSVP-TE, Segment Routing (SR) Shortest Path, and Segment Routing Traffic Engineering (SR-TE):

- LDP

The **ldp** value instructs the code to search for an LDP LSP with a FEC prefix corresponding to the address of the indirect next-hop. Both LDP IPv4 FEC and LDP IPv6 FEC can be used as the tunnel next-hop. However, only an indirect next-hop of the same family (IPv4 or IPv6) as the prefix of the route can use an LDP FEC as the tunnel next-hop. In other words, an IPv4 (IPv6) prefix can only be resolved to an LDP IPv4 (IPv6) FEC.

- RSVP-TE

The **rsvp-te** value instructs the code to search for the set of lowest metric RSVP-TE LSPs to the address of the indirect next-hop. The LSP metric is provided by MPLS in the tunnel table. The static route treats a set of RSVP-TE LSPs with the same lowest metric as an ECMP set.

The user has the option of configuring a list of RSVP-TE LSP names to be used exclusively instead of searching in the tunnel table. In that case, all LSPs must have the same LSP metric in order for the static route to use them as an ECMP set. Otherwise, only the LSPs with the lowest common metric value are selected.

A P2P auto-lsp that is instantiated via an LSP template can be selected in TTM when **resolution** is set to **any**. However, it is not recommended to configure an auto-lsp name explicitly under the **rsvp-te** node as the auto-generated name can change if the node reboots, which will blackhole the traffic of the static route.

- SR Shortest Path

When the **sr-isis** or **sr-ospf** value is enabled, an SR tunnel to the indirect next-hop is selected in the TTM from the lowest preference ISIS or OSPF instance, and if many instances have the same lowest preference, it is selected from the lowest numbered IS-IS or OSPF instance. Both SR-ISIS IPv4 and SR-ISIS IPv6 tunnels can be used as tunnel next-hops. However, only an indirect next-hop of the same family (IPv4 or IPv6) as the prefix of the route can use an SR-ISIS tunnel as a tunnel next-hop. In other words, an IPv4 (IPv6) prefix can only be resolved to a SR-ISIS IPv4 (IPv6).

- SR-TE

The **sr-te** value instructs the code to search for the set of lowest metric SR-TE LSPs to the address of the indirect next-hop. The LSP metric is provided by MPLS in the tunnel table. The static route treats a set of SR-TE LSPs with the same lowest metric as an ECMP set.

The user has the option of configuring a list of SR-TE LSP names to be used exclusively instead of searching in the tunnel table. In that case, all LSPs must have the same LSP metric in order for the static route to use them as an ECMP set. Otherwise, only the LSPs with the lowest common metric value are selected.

Realize that the resolution filter, under **static-route-entry**, does not validate the provided *lsp-name* type of the LSP against the requested protocol type in the filter context.

If one or more explicit tunnel types are specified using the **resolution-filter** option, only these tunnel types will be selected again following the TTM preference.

The user must set **resolution** to **filter** to activate the list of tunnel-types configured under resolution-filter.

If **disallow-igp** is enabled, the static route will not be activated using IP next-hops in RTM if no tunnel next-hops are found in TTM.

2.1.9.1 Static Route ECMP Support

The following is the ECMP behavior of a static route:

-
- ECMP is supported when resolving in RTM multiple static routes of the same prefix with multiple user-entered indirect IP next-hops. The system picks as many direct next-hops as available in RTM beginning from the first indirect next-hop and up to the value of the **ecmp** option in the system.
 - ECMP is also supported when resolving in TTM a static route to a single indirect next-hop using a LDP tunnel when LDP has multiple direct next-hops.
 - ECMP is supported when resolving in TTM a static route to a single indirect next-hop using a RSVP-TE tunnel type when there is more than one RSVP LSP with the same lowest metric to the indirect next-hop.
 - ECMP is supported when resolving in TTM a static route to a single indirect next-hop using a list of user-configured RSVP-TE LSP names when these LSPs have the same metric to the indirect next-hop.
 - ECMP is supported when resolving in TTM multiple static routes of the same prefix with multiple user-entered indirect next-hops, each binding to a tunnel type. The system picks as many tunnel next-hops as available in TTM beginning from the first indirect next-hop and up to the value of the **ecmp** option in the system. The spraying of flow packets is performed over the entire set of resolved next-hops that correspond to the selected indirect next-hops.
 - ECMP is supported when resolving concurrently in RTM and TTM multiple static routes of the same prefix with multiple user-entered indirect tunnel next-hops. There is no support for mixing IP and tunnel next-hops for the same prefix using different indirect next-hops. Tunnel next-hops are preferred over IP next-hops.

2.2 Weighted Load Balancing over MPLS LSP

The weighted load-balanced, or weighted-ecmp, feature sprays packets of IGP, BGP, and static route prefixes, resolved to a set of ECMP tunnel next hops, proportionally to the weights configured for each MPLS LSP in the ECMP set.

Weighted load balancing is supported in the following forwarding contexts:

- IGP prefix resolved to IGP shortcuts in RTM (**igp-shortcut** or **advertise-tunnel-link** enabled in the IGP instance)
- BGP prefix with the BGP next hop resolved to IGP shortcuts in RTM (**rsvp-shortcut** enabled in the IGP instance)
- static route prefix resolved to an indirect next hop, which is resolved to a set of equal-metric MPLS LSPs in TTM. The user can allow automatic selection or specify the names of the equal-metric MPLS LSPs in TTM to be used in the ECMP set.
- static route prefix resolved to an indirect next hop, which is resolved to IGP shortcuts in RTM
- BGP prefix with a BGP next hop resolved to a static route, which resolves to a set of tunnel next hops toward an indirect next hop in RTM or TTM
- BGP prefix resolving to another BGP prefix, whose next hop is resolved to a set of ECMP tunnel next hops with a static route in RTM or TTM or to IGP shortcuts in RTM
- BGP labeled IPv6 packets (6PE) over RSVP LSPs resolving in TTM

This feature does not modify the route calculation: the same set of ECMP next hops is computed for a prefix. The feature also does not change the hash routine; only the spraying of the flows over the tunnel next hops is modified to reflect the normalized weight of each tunnel next hop.

Static route implementation supports ECMP over a set of equal-cost MPLS LSPs. The user can allow automatic selection or specify the names of the equal-metric MPLS LSPs in TTM to be used in the ECMP set. For more information, see [Static Route Resolution Using Tunnels](#).

2.2.1 Weighted Load Balancing IGP, BGP, and Static Route Prefix Packets over IGP Shortcut

2.2.1.1 Feature Configuration

The user must have the IGP shortcut or forwarding adjacency feature enabled in one or more IGP instances:

```
config>router>ospf(isis)>igp-shortcut
```

```
config>router>ospf(isis)>advertise-tunnel-link
```

The user can also disable specific MPLS LSPs from being used in IGP shortcut or forwarding adjacency by configuring the following:

```
config>router>mpls>lsp>no igp-shortcut
```

The user enables the weighted load balancing feature using the following router level command:

```
config>router>weighted-ecmp
```

When this command is enabled, packets of IGP, BGP, and static route prefixes resolved to a set of ECMP tunnel next-hops are sprayed proportionally to the weights configured for each MPLS LSP in the ECMP set.

The user can configure a weight for each LSP using the following command:

```
config>router>mpls>lsp>load-balancing-weight <32-bit-integer>
```

For an auto-LSP signaled via an LSP template, the weight is configured using the following command:

```
config>router>mpls>lsp-template>load-balancing-weight <32-bit-integer>
```

There is no default weight value for an LSP. If any LSP in the ECMP set of a prefix does not have a weight configured, the regular ECMP spraying for the prefix will be performed. The user-entered weight is normalized to the closest integer value that represents the number of entries in the ingress prefix hash table assigned to the LSP for the purpose of spraying packets of all prefixes resolved to this LSP. The higher the normalized weight, the more entries will be assigned to the LSP, the more packets will be sent to this LSP.

2.2.1.2 Feature Behavior

This section describes the behavior of the weighted load-balancing feature for IGP, BGP, and static route prefixes resolved in RTM to IGP shortcuts.

When an IGP, BGP, or a static route prefix is resolved in RTM to a set of ECMP tunnel next-hops of type RSVP-TE, and the router level **weighted-ecmp** option is enabled, the ingress hash table for the next-hop selection is populated with a number of tunnel next-hop entries for each LSP equal to the normalized LSP weight value. All prefixes resolving to the same set of ECMP tunnel next-hops use the same table.

This feature performs the following:

1. MPLS populates the user-configured LSP weight in TTM. When the global command **weighted-ecmp** is enabled, and any LSP in the ECMP set of a prefix does not have a weight configured, the regular ECMP spraying for the prefix will be performed.
2. IGP computes the normalized weight for each prefix tunnel next-hop. The minimum value of the normalized weight is 1 and the maximum is 64. IGP updates the route in RTM with the set of tunnel next-hops and normalized weights. RTM downloads the information to IOM for inclusion in the FIB.
3. The normalized weights of route tunnel next-hops are updated in the following cases:
 - When the main SPF is run following a trigger, for example, network failure, and updates a route with a modified set of tunnel next-hops. This will trigger a route re-download to the IOM and all users of RTM are notified.
 - The user adds or changes the weight of one or more LSPs. In this case, RTM will perform a route download to IOM, but other users of RTM are not notified because the route resolution did not change.
4. The weighted load balancing feature is only applied to a prefix when all the tunnel next-hops in the ECMP set have the same endpoint. If an IGP prefix resolves in RTM to a set of ECMP tunnel next-hops that do not terminate on the same endpoint, the regular ECMP spraying is performed. If BGP performs BGP ECMP to a set of BGP ECMP next-hops for a prefix (**weighted-bgp-ecmp-prd**), regular ECMP spraying is performed toward a BGP next-hop if the subset of its tunnel next-hops does not terminate on the same endpoint.
5. Regular ECMP spraying is also applied if a prefix is resolved in RTM to an ECMP set that consists of a mix of IP and tunnel next-hops.
6. This feature is not supported in the following contexts:
 - Packets of BGP prefix with the BGP next-hop resolved in TTM to RSVP LSP (BGP shortcut).

- CPM generated packets, including OAM packets, which are looked-up in RTM and which are forwarded over tunnel next-hops. These will be forwarded using either regular ECMP or by selecting one next-hop from the set.

2.2.1.3 ECMP Considerations

The weight assigned to an LSP affects only the forwarding decision, not the routing decision. It does not change the selection of the set of ECMP tunnel next-hops of a prefix when more next-hops exist than the value of the router **ecmp** option. This selection continues to follow the algorithm used in the IGP shortcut feature.

After the set of tunnel next-hops is selected, the LSP weight is used to modulate the amount of packets forwarded over each next-hop.

2.2.1.4 Weighted Load Balancing Static Route Packets over MPLS LSP

2.2.1.4.1 Feature Configuration

The configuration of the resolution of a static route prefix to set of MPLS LSPs is described in [Static Route Resolution Using Tunnels](#) which also provides the selection rules among multiple LSP types: RSVP-TE, SR-TE, LDP, SR-ISIS, and SR-OSPF. A static route of a prefix can only be resolved to a set of tunnel next-hops of the same type though, for each indirect next-hop.

To perform ECMP over a set of configured MPLS LSPs, the user must enter two or more LSP names to be used as tunnel next-hops. If automatic selection is performed, ECMP is performed if two or more MPLS LSPs are in TTM to the indirect next-hop of the static route. However, all LSPs must have the same LSP metric; otherwise, only the tunnel next-hops with the same lowest metric will be activated for the static route.

The user can force the metric of an LSP to a constant value using the following command:

CLI Syntax: `config>router>mpls>lsp>metric`

If the user enters, for the same static route, more LSP names with the same LSP metric than the value of the router level **ecmp** option, only the first configured LSPs equal to the **ecmp** value will be selected. The remaining tunnel next-hops for the route will not be activated. When automatic MPLS LSP selection is performed in TTM, the lowest tunnel ID is used as a tie-breaker among the same lowest metric LSPs.

To perform weighted load-balancing over the set of MPLS LSPs, either when the LSP names are provided or when auto-selection in TTM is performed, the user must also enable the weighted ECMP globally like for static, IGP, and BGP prefixes resolving to IGP shortcuts:

CLI Syntax: `config>router>weighted-ecmp`

2.2.1.4.2 Feature Behavior

The behavior of this feature in terms of RTM and IOM is exactly the same as in the case of BGP, IGP, and static route prefixes resolving to IGP shortcuts. See [Feature Behavior](#) for more information. In this case, the static route module computes the normalized weight for each prefix tunnel next-hop of the static route indirect next-hop. The minimum value of the normalized weight is 1 and the maximum is 64. The static route module updates the route in RTM with the set of tunnel next-hops and normalized weights. RTM downloads the information to IOM for inclusion in the FIB.

If any LSP in the ECMP set of a prefix static route does not have a weight configured, the regular ECMP spraying for the prefix will be performed.

ECMP is also supported when resolving in TTM the same static route with multiple user-entered indirect next-hops, each binding to the same or different tunnel types. The system picks as many tunnel next-hops as available in RTM, beginning from the first indirect next-hop and up to the value of the **ecmp** option in the system. In this case, the weighted load-balancing will be applied directly using the weights of the selected set of tunnel next-hops. If any LSP in the ECMP set of a prefix static route does not have a weight configured, or if any of the indirect next-hops binds to an LDP LSP, the regular ECMP spraying for the prefix will be performed.

If the same prefix is resolved via both a static route and an IGP shortcut route, the RTM default protocol preference will install the static route only. Therefore, the set of ECMP tunnel next-hops and the weighted load balancing behavior will be determined by the static route configuration and not by the IGP shortcut configuration.

2.2.2 Weighted Load Balancing for 6PE

ECMP-like spraying for BGP labeled IPv6 packets (6PE) is controlled using the **config>router>ecmp** *max-ecmp-routes* command, where *max-ecmp-routes* represents the maximum number of RSVP tunnels in the set representing equal-cost paths to the BGP next hop.

Weighted ECMP behavior, where the load-balancing weight of the RSVP tunnel is considered in the packet spraying behavior, is configured using the **config>router>bgp>next-hop-resolution>weighted-ecmp** command. Weighted ECMP is disabled by default.

2.3 Class-Based Forwarding of IPv4/IPv6 Prefix Over IGP IPv4 Shortcut

This feature enables class-based forwarding (CBF) over IGP shortcuts. When the **class-forwarding** command is enabled, the following types of packets are forwarded based on their forwarding class:

- packets of BGP prefixes
- packets that are CPM-originated for the IPv4, IPv6, or both IPv4 and IPv6 families that have been enabled over IGP shortcuts using the **igp-shortcut** CLI context in one or more IGP instances

The SR OS CBF implementation supports spraying of packets over a maximum of six forwarding sets of ECMP LSPs. The user must define a class-forwarding policy object in MPLS to configure the mapping of FCs to the forwarding sets. Then, the user assigns the CBF policy name and set ID to each MPLS LSP that is used in IGP shortcuts.

When a BGP IPv4 or IPv6 prefix is resolved, the FC of the packet, is used to look up the forwarding set ID. Then, a modulo operation is performed on the tunnel next-hops of this set ID only, to spray packets of this FC. The data path concurrently implements, CBF and ECMP within the tunnels of each set ID.

CPM-originated packets on the router, including control plane and OAM packets, are forwarded over a single LSP from the set of LSPs that the packet's FC is mapped to, as per the CBF configuration.

2.3.1 Feature Configuration

The user enables CBF over IGP shortcuts using the following command:

```
A:Reno 194# configure>router$ class-forwarding
```

```
config
  router
    [no] mpls
      class-forwarding-policy policy-name create
      fc be forwarding-set set-id <1..6>
      fc l2 forwarding-set set-id <1..6>
      fc af forwarding-set set-id <1..6>
      fc l1 forwarding-set set-id <1..6>
      fc h2 forwarding-set set-id <1..6>
      fc ef forwarding-set set-id <1..6>
      fc h1 forwarding-set set-id <1..6>
      fc nc forwarding-set set-id <1..6>
```

```
[no] default-set set-id <1..4>
```

All FCs are mapped to set 1 as soon as the policy is created. The user can make changes to the mapping of FCs as required. An FC, which is not added to the class-forwarding policy, is thus always mapped to set 1. At most, an FC can be mapped to a single forwarding set. One or more FCs can map to the same set. The user can indicate the initial default set by including the **default-set** option.

The default forwarding set is used to forward packets of any FC in cases where all LSPs of the forwarding set the FC maps to become operationally down. The router uses the user-configured default set as the initial default set. Otherwise, the router elects the lowest numbered set as the default forwarding set in a class-forwarding policy. When the last LSP in a default forwarding set goes into an operationally down state, the router designates the next lowest-numbered set as the new default forwarding set.

A mapping to a class-forwarding policy and set is added to the existing CBF configuration of an RSVP-TE LSP and to the LSP template of an RSVP-TE auto-LSP. The following commands perform this function.

```
A:Reno 194# config>router>mpls>lsp>class-forwarding$ forwarding-set policy  
policy-name set set-id <1..6>
```

```
A:Reno 194# config>router>mpls>lsp-template>class-forwarding$ forwarding-  
set policy policy-name set set-id <1..6>
```

An MPLS LSP can map only to a single class-forwarding policy and forwarding set. Multiple LSPs can map to the same policy and set. If they form an ECMP set, from the IGP shortcut perspective, packets of the FCs mapped to this set will be sprayed over these LSPs based on a modulo operation of the output of the hash routine on the packet's headers and the number of LSPs in the set.

2.3.2 Feature Behavior

When a BGP IPv4 or IPv6 prefix is resolved to a BGP next-hop, consisting of up to 64 resolved next-hops (LSPs and IP links), the default behavior of the data path is to spray the packets over the entire ECMP set using a modulo operation of the number of resolved next-hops in the ECMP set and the output of the hash on the packet header fields.

Both the CBF feature in LDP-over-RSVP and this CBF feature over IGP IPv4 shortcuts make use of the CBF class-forwarding policy. IGP always passes the CBF information populated by MPLS for each LSP used as a tunnel next-hop by an IGP prefix. The new CBF information is checked for consistency. If more than a single class-forwarding policy exists in the tunnel next-hops of a IGP prefix, IGP removes the new CBF information from all the corresponding tunnels and the behavior will be as if there were no CBF info.

When the CBF feature is enabled (**class-forwarding** option, enabled under **config>router** context), each application (BGP, CPM), when looking up a prefix in RTM, will find up to 64 IP and tunnel next-hops. This lookup is split into three subsets:

- Subset 1 — tunnel next-hops with older CBF information (FCs mapped to this LSP, default LSP (true/false), CBF Policy ID=0, Set ID=any valid value). This information is usable by LDP only. Other applications treat this like non-CBF information.
- Subset 2 — tunnel next-hops with new CBF information (FCs mapped to this LSP, default LSP (true/false), CBF Policy ID>0, Set ID>0). This information is usable by both LDP and other applications.
- Subset 3 — tunnel-next-hops with no CBF information and IP next-hops. Usable by all applications, except that LDP will use tunnel next-hops only.

The BGP application performs a lookup in RTM for a prefix matching each BGP next-hop of a prefix. The BGP application selects tunnels belonging to the class-forwarding sets in Subset 2 and for each BGP next-hop of a prefix. The remaining tunnels, with no CBF configuration or with the older CBF information and the IP next-hops, are still programmed to IOM. However, BGP and the data path will use them only when all the class-forwarding sets are not available as explained below.

The SR OS implements a hierarchical ECMP architecture for BGP prefixes in the data path. The first level is the ECMP at the BGP next-hop level. The second level is ECMP at the resolved next-hop (IP or tunnel next-hop) level. The CBF feature is independently applied to the set of resolved tunnel next-hops of each BGP next-hop of a prefix. The user must make sure that the sets of LSPs that are used as IGP shortcuts to reach each of the BGP next-hops have the appropriate FC mappings.

The following procedures are enforced in the CBF feature.

- The tunnels in the full next-hop ECMP set, with set size greater or equal to 1 and less than or equal to 64, can use MPLS LSPs that terminate on multiple endpoints (BGP next-hop itself or otherwise) to reach the next-hop of a BGP prefix. The existing ECMP tunnel and IP next-hop selection behavior, when resolving a prefix over IGP shortcuts, continues to be used.

- If no LSP among the full ECMP set of a BGP next-hop has a class-forwarding policy configuration assigned, then the set is considered inconsistent from a CBF perspective. No CBF-related information is programmed in IOM and regular ECMP spraying over the full set occurs.
- If only a single class-forwarding policy is referenced by one or more LSPs in the full ECMP set of a BGP next-hop, the full set is considered consistent from a CBF perspective and the class-forwarding policy is used to spray packets of each FC over the LSPs within each forwarding set. As a result of this processing, only the LSPs that have been selected for forwarding traffic are programmed in IOM with CBF information. The remaining LSPs and IP next-hops of the BGP next-hop, are also programmed in IOM but without any CBF information associated and, therefore, will not be used for CBF.
- If multiple class-forwarding policies are referenced by LSPs in the full ECMP set of a BGP next-hop, the set is considered inconsistent from a CBF perspective. No CBF related information is programmed in IOM and regular ECMP spraying over the full set occurs.

The following describes the fallback behavior in data path of the CBF feature.

- An FC, for which all LSPs in the forwarding set are operationally down, has its packets forwarded over the default forwarding set. The default forwarding set is either the initial default forwarding set configured by the user or the lowest numbered set in the class-forwarding policy that has one or more LSPs in the operationally UP state. If the initial or subsequently elected default forwarding set has all its LSPs operationally down, the next lower numbered forwarding set, which has at least one LSP in the operationally up state, is elected as the default forwarding set.
- If all LSPs of all forwarding sets become operationally down, the router resumes regular ECMP spraying on the remaining LSPs and IP next-hops in the full ECMP set.
- Whenever the first LSP in a forwarding set becomes operationally UP, the router triggers the re-election of the default set and will select this set as the new default set, if it is the initial default set, otherwise, it will select lowest numbered set.

2.3.3 Feature Limitations

The following are the limitations of the CBF feature.

- CBF applies to packets of IPv4 and IPv6 BGP prefixes only. CBF does not apply to IGP prefixes and static route prefixes resolved over IGP IPv4 shortcuts. The latter are forwarded using regular ECMP over the entire set of up to 64 tunnel next-hops.
- CPM originated packets on the router, including control plane and OAM packets, are forwarded over a single LSP from the set of LSPs the packet's FC is mapped to, as per the CBF configuration. CPM, however, only maintains a maximum of 64 next-hops for a given destination prefix. Therefore, if there are multiple BGP next-hops for a prefix, CPM selects 64 tunnel next-hops by cycling over the BGP next-hops in ascending order. Then, the first LSP in the first set ID that the FC of the packet maps to is selected to forward the packet.

Furthermore, the CBF information consistency check, the CBF default set determination, and the CBF set failover procedures are applied to this set of 64 tunnel next-hops.

The user can configure the SGT-QoS feature to change the DSCP and FC of CPM-originated packets of a specific control plane protocol to select an LSP from a different set ID. This configuration allows, for instance, the forwarding of BGP Keep-Alive packets over an LSP of the same set ID as that of the data plane packets of the BGP prefixes destined to the same BGP next-hop.

- Weighted ECMP, at the transport tunnel level of BGP prefixes over IGP shortcuts, and the CBF feature on a per-BGP next-hop basis are mutually exclusive. Specifically, if the user enables both weighted ECMP (**configure>router>weighted-ecmp**) and CBF (**configure>router> class-forwarding**), weighted ECMP applies as long as all the LSPs used as tunnel next-hops to reach the BGP next-hop of a prefix have a user-configured weight. Otherwise, the CBF feature applies as per the procedures described in [Feature Behavior](#).

2.3.4 Data Path Support

When a packet of a BGP IPv4 or IPv6 prefix is received, the data path uses the FC that the packet was classified into to look up the forwarding set ID. The data path then performs a modulo operation on the tunnel next-hops of this set ID, to select the one next-hop for forwarding the packet. Therefore, packets matching an FC are only sprayed over the ECMP tunnel-next-hops of the set ID this FC maps to.

Both the BGP or CPM application and IOM use the same algorithm for failover and default class-forwarding set determination, as described in [Feature Behavior](#) and illustrated in [Example Configuration and Default CBF Set Election](#).

If MPLS deletes an LSP from a specified set ID, the IOM handles failover within the same set ID. The IOM reprograms the data path to spray packets of the impacted FCs over the remaining tunnel next-hops of the set ID.

Similarly, the IOM handles failover between class-forwarding sets when MPLS deletes the last LSP in a set ID. The IOM reprograms the data path to spray packets of the impacted FCs over the tunnel next-hops of the failover set ID. In both cases, the failover does not make use of the uniform failover procedure; however, if an LSP activated its FRR backup path, it remains in the set ID and continues to forward traffic of the mapped FCs.

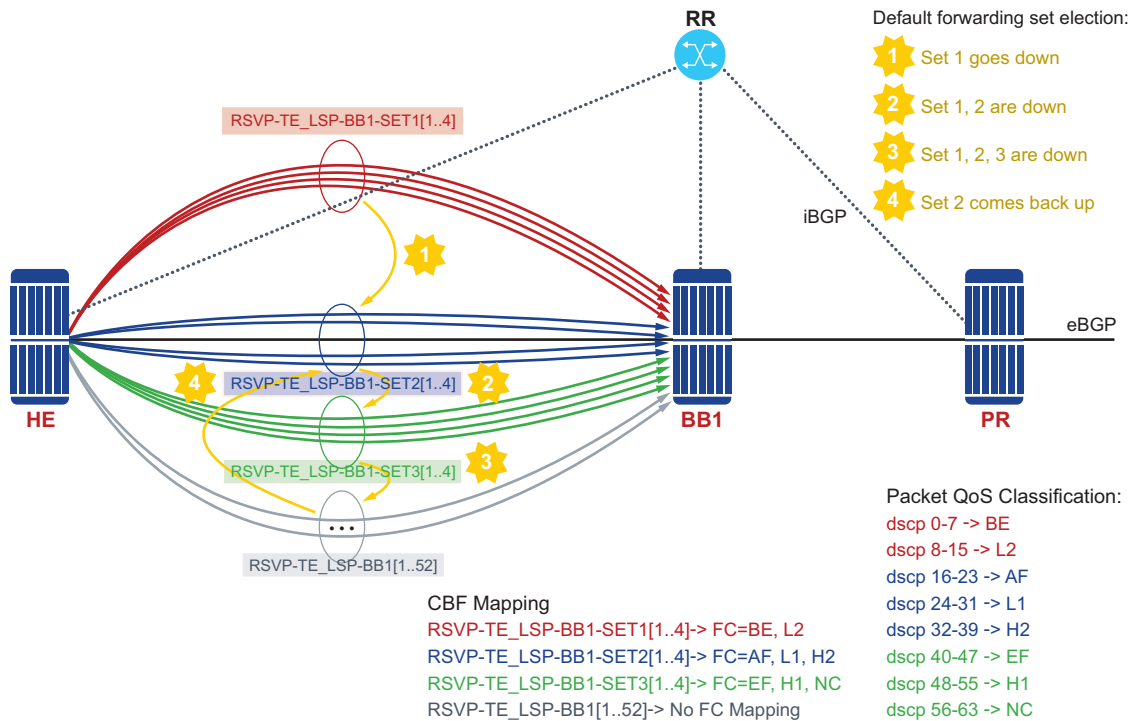
Finally, BGP updates the set IDs, used to reach a BGP next-hop, any time IGP updates the information in the RTM.

2.3.5 Example Configuration and Default CBF Set Election

Assume the following user configuration.

- The FC mapping to the sets and the default forwarding set election are illustrated in [Figure 10](#).
- All sets and RSVP-TE LSPs outside of the three class-forwarding sets are up initially.
- Set 1 is elected as the default class-forwarding set (because the user did not configure an initial default set).
- If All LSPs in Set 1 go operationally down, Set 2 is elected as the default class-forwarding set.
- If Set 2 subsequently goes down, Set 3 is elected as the default class-forwarding set.
- If Set 3 subsequently goes down, then packets of BGP prefixes will be ECMP sprayed over the remaining non-CBF RSVP-TE LSPs.
- If Set 2 comes back up, then Set 2 is elected as the default class-forwarding set.

Figure 10 Default Forwarding Set Election



sw0232

```
*A:Reno 194>config>router# info
-----
#-----
echo "IP Configuration"
#-----
interface "system"
  address 192.0.2.194/32
  ipv6
    address 3ffe::a14:194/128
  exit
  no shutdown
exit
interface "toSim199"
  address 10.202.5.194/24
  secondary 10.101.0.194/32
  port 1/1/1
  ipv6
    address 2001:db8:a0b:12f0::1/64
  exit
  no shutdown
exit
interface "toSim213"
  address 10.202.4.194/24
  port 1/1/2
  no shutdown
exit
interface "toSim219"
  address 10.202.8.194/24
  port 1/1/3
```

```
        no shutdown
    exit
    class-forwarding
    // Enables CBF feature for BGP and CPM traffic

*A:Reno 194>config>router>isis# info
-----
    igp-shortcut
    // Enables IGP shortcut in this ISIS instance with both families IPv4 and IPv6
    resolving to RSVP-TE LSPs
        tunnel-next-hop
            family ipv4
                resolution filter
                resolution-filter
                rsvp
            exit
        exit
        family ipv6
            resolution filter
            resolution-filter
            rsvp
        exit
    exit
    exit
    no shutdown
    exit
    no shutdown
-----
*A:Reno 194>config>router>mpls# info
-----
    class-forwarding-policy cbf1
        fc be forwarding-set 1
        fc l2 forwarding-set 1
        fc af forwarding-set 2
        fc l1 forwarding-set 2
        fc h2 forwarding-set 2
        fc ef forwarding-set 3
        fc h1 forwarding-set 3
        fc nc forwarding-set 3
    cspf-on-loose-hop
    exit
    interface "system"
        no shutdown
    exit
    interface "toSim199"
        no shutdown
    exit
    interface "toSim213"
        admin-group "olive"
        no shutdown
    exit
    interface "toSim219"
        no shutdown
    exit
    path "empty"
        no shutdown
    exit
    lsp "RSVP-TE_LSP-BB1-SET1[1..4]" // Four LSPs in Set1
        shutdown
```



```

        to 192.0.2.194/32
        cspf
        class-forwarding
            forwarding-set policy "cbf1" set 1
        exit
        primary "empty"
        exit
    exit
no shutdown
lsp "RSVP-TE_LSP-BB1-SET2[1..4]" // Four LSPs in Set2
    shutdown
    to 192.0.2.194/32
    cspf
    class-forwarding
        forwarding-set policy "cbf1" set 2
    exit
    primary "empty"
    exit
exit
lsp "RSVP-TE_LSP-BB1-SET3[1..4]" // Four LSPs in Set3
    shutdown
    to 192.0.2.194/32
    cspf
    class-forwarding
        forwarding-set policy "cbf1" set 3
    exit
    primary "empty"
    exit
exit
lsp "RSVP-TE_LSP-BB1[1..52]" //
Other LSP configuration with no CBF options for a total of 64 LSPs to BB1
    shutdown
    to 192.0.2.194/32
    cspf
    primary "empty"
    exit
exit
no shutdown
-----

```

2.4 Bidirectional Forwarding Detection

Bidirectional Forwarding Detection (BFD) is an efficient, short-duration detection of failures in the path between two systems. If a system stops receiving BFD messages for a long enough period (based on configuration), it is assumed that a failure along the path has occurred and the associated protocol or service is notified of the failure.

BFD can provide a mechanism used for failure detection over any media, at any protocol layer, with a wide range of detection times and overhead, to avoid a proliferation of different methods.

SR OS supports asynchronous and on-demand modes of BFD in which BFD messages are sent to test the path between systems.

If multiple protocols are running between the same two BFD endpoints, only a single BFD session is established, and all associated protocols will share the single BFD session.

As well as the typical asynchronous mode, there is also an echo function defined within RFC 5880, *Bidirectional Forwarding Detection*, that allows either of the two systems to send a sequence of BFD echo packets to the other system, which loops them back within that system's forwarding plane. If a number of these echo packets are lost, the BFD session is declared down.

2.4.1 BFD Control Packet

The base BFD specification does not specify the encapsulation type to be used for sending BFD control packets. Instead, use the appropriate encapsulation type for the medium and network. The encapsulation for BFD over IPv4 and IPv6 networks is specified in draft-ietf-bfd-v4v6-1hop-04.txt, *BFD for IPv4 and IPv6 (Single Hop)*. This specification requires that BFD control packets be sent over UDP with a destination port number of 3784 and the source port number must be within the range 49152 to 65535.

Also, the TTL of all transmitted BFD packets must have an IP TTL of 255. All BFD packets received must have an IP TTL of 255 if authentication is not enabled. If authentication is enabled, the IP TTL should be 255, but can still be processed if it is not (assuming the packet passes the enabled authentication mechanism).

If multiple BFD sessions exist between two nodes, the BFD discriminator is used to de-multiplex the BFD control packet to the appropriate BFD session.

2.4.2 Control Packet Format

The BFD control packet has two sections: a mandatory section and an optional authentication section.

Figure 11 Mandatory Frame Format

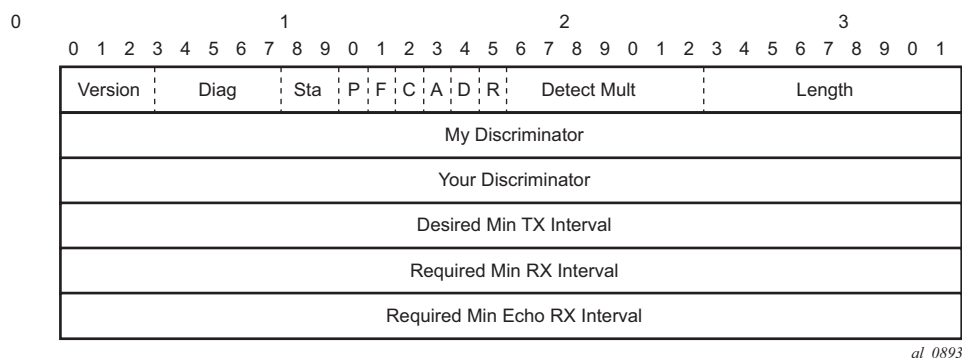


Table 5 BFD Control Packet Field Descriptions

Field	Description
Vers	The version number of the protocol. The initial protocol version is 0.
Diag	A diagnostic code specifying the local system's reason for the last transition of the session from Up to some other state. Possible values are: 0-No diagnostic 1-Control detection time expired 2-Echo function failed 3-Neighbor signaled session down 4-Forwarding plane reset 5-Path down 6-Concatenated path down 7-Administratively down
D Bit	The demand mode bit. (Not supported)
P Bit	The poll bit. If set, the transmitting system is requesting verification of connectivity, or of a parameter change.
F Bit	The final bit. If set, the transmitting system is responding to a received BFD control packet that had the poll (P) bit set.
Rsvd	Reserved bits. These bits must be zero on transmit and ignored on receipt.

Table 5 BFD Control Packet Field Descriptions (Continued)

Field	Description
Length	Length of the BFD control packet, in bytes.
My Discriminator	A unique, non-zero discriminator value generated by the transmitting system, used to demultiplex multiple BFD sessions between the same pair of systems.
Your Discriminator	The discriminator received from the corresponding remote system. This field reflects back the received value of my discriminator, or is zero if that value is unknown.
Desired Min TX Interval	This is the minimum interval, in microseconds, that the local system would like to use when transmitting BFD control packets.
Required Min RX Interval	This is the minimum interval, in microseconds, between received BFD control packets that this system is capable of supporting.
Required Min Echo RX Interval	This is the minimum interval, in microseconds, between received BFD echo packets that this system is capable of supporting. If this value is zero, the transmitting system does not support the receipt of BFD echo packets.

2.4.3 BFD for RSVP-TE

BFD will notify RSVP-TE if the BFD session goes down, in addition to notifying other configured BFD enabled protocols (for example, OSPF, IS-IS, and PIM). This notification will then be used by RSVP-TE to begin the reconvergence process. This greatly accelerates the overall RSVP-TE response to network failures.

All encapsulation types supporting IPv4 and IPv6 are supported because all BFD packets are carried in IPv4 and IPv6 packets; this includes Frame Relay and ATM.

BFD is supported on the following interfaces:

- Ethernet (Null, Dot1Q & QinQ)
- Spoke SDPs
- LAG interfaces

The following interfaces are supported only on the 7750 SR and 7450 ESS:

- VSM interfaces
- POS interfaces (including APS)
- Channelized interfaces (PPP, HDLC, FR, and ATM) on ASAP (priority 1) and channelized MDAs (priority 2) including link bundles and IMA

2.4.4 Echo Support

Echo support for BFD calls for the support of the echo function within BFD. By supporting BFD echo, the router loops back received BFD echo messages to the original sender based on the destination IP address in the packet.

The echo function is useful when the local router does not have sufficient CPU power to handle a periodic polling rate at a high frequency. Therefore, it relies on the echo sender to send a high rate of BFD echo messages through the receiver node, which is only processed by the receiver's forwarding path. This allows the echo sender to send BFD echo packets at any rate.

SR OS does not support the sending of echo requests, only the response to echo requests.

2.4.5 BFD Support for BGP

This feature allows BGP peers to be associated with the BFD session. If the BFD session fails, BGP peering will also be torn down.

2.4.6 Centralized BFD

The following applications of centralized BFD require BFD to run on the SF/CPM.

2.4.6.1 IES Over Spoke SDP

One application for a central BFD implementation is so BFD can be supported over spoke SDPs used to inter-connect IES or VPRN interfaces. When there are spoke SDPs for inter-connections over an MPLS network between two routers, BFD is used to speed up failure detections between nodes so re-convergence of unicast and multicast routing information can begin as quickly as possible.

The MPLS LSP associated with the spoke SDP can enter or egress from multiple interfaces on the router. BFD for these types of interfaces cannot exist on the IOMXCM by itself.

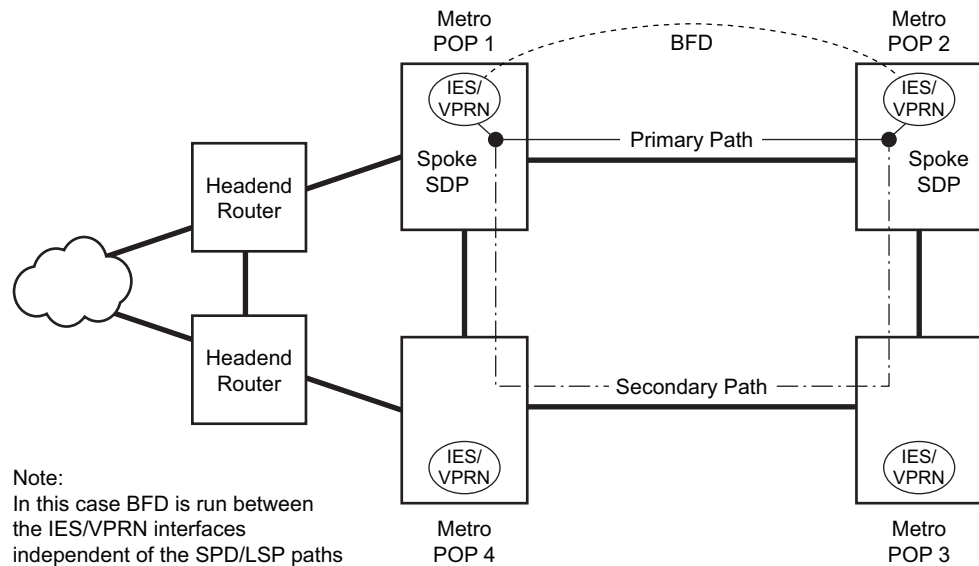
Figure 12 BFD for IES/VPRN over Spoke SDP

Fig_31

2.4.6.2 BFD Over LAG and VSM Interfaces

A second application for a central BFD implementation is so BFD can be supported over LAG or VSM interface. This is useful where BFD is not used for link failure detection, but for node failure detection. In this application, the BFD session can run between the IP interfaces associated with the LAG or VSM interface, but there is only one session between the two nodes. There is no requirement for the message flow to across a certain link, or VSM, to get to the remote node.

Figure 13 BFD Over LAG and VSM Interfaces

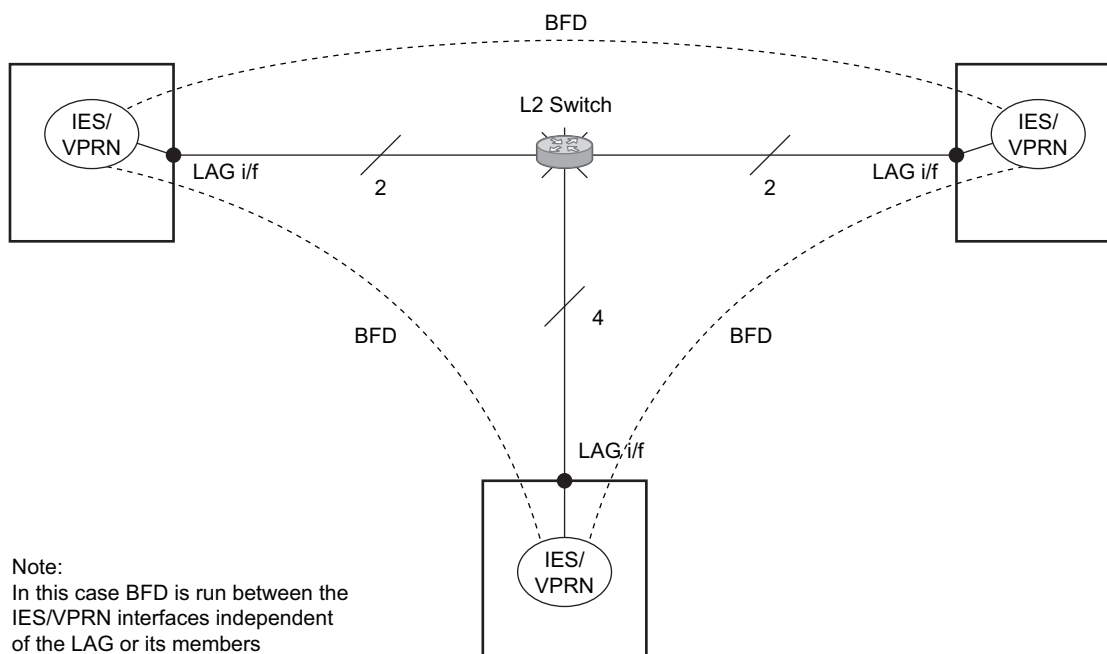


Fig_32

2.4.6.3 LSP BFD and VCCV BFD

BFD is supported over MPLS-TP, RSVP, and LDP LSPs, as well as over pseudowires that support Layer 2 services such as Epipe VPLS spoke-SDPs and mesh-SDPs using centralized BFD. See the *7450 ESS, 7750 SR, 7950 XRS, and VSR MPLS Guide* and *7450 ESS, 7750 SR, 7950 XRS, and VSR Layer 2 Services and EVPN Guide: VLL, VPLS, PBB, and EVPN* for more information.

2.4.7 Aggregate Next Hop

This feature adds the ability to configure an indirect next-hop for aggregate routes. The indirect next-hop specifies where packets will be forwarded if they match the aggregate route, but is not a more-specific route in the IP forwarding table.

2.4.8 Invalidate Next-Hop Based on ARP/Neighbor Cache State

This feature invalidates next-hop entries for static routes when the next-hop is no longer reachable on directly connected interfaces. This invalidation is based on ARP and Neighbor Cache state information.

When a next-hop is detected as no longer reachable due to ARP/Neighbor Cache expiry, the route's next-hop is set as unreachable to prevent the SR from sending continuous ARPs/Neighbor Solicitations triggered by traffic destined for the static route prefix. When the next-hop is detected as reachable via ARP or Neighbor Advertisements, the state of the next-hop is set back to valid.

2.4.8.1 Invalidate Next-Hop Based on IPV4 ARP

This feature invalidates a static route based on the reachability of the next-hop in the ARP cache when the **validate-next-hop** command is enabled within the **static-route-entry>next-hop** context for an IPv4 static route.

In this case, when the ARP entry for the next-hop is INVALID or not populated, the static route must remain invalid/inactive. When an ARP entry for the next-hop is populated based on a gratuitous ARP received or periodic traffic destined for it and the usual ARP who-has procedure, the static route becomes valid/active and is installed.

2.4.8.2 Invalidate Next-Hop Based on Neighbor Cache State

This feature invalidates a static route based on the reachability of the next-hop in the neighbor cache when the **validate-next-hop** command is enabled within the **static-route-entry>next-hop** context for an IPv6 static route.

In this case, when the Neighbor Cache entry for next-hop is INVALID or not populated, the static route must remain invalid/inactive. When an NC entry for next-hop is populated based on a neighbor advertisement received, or periodic traffic destined for it and the usual NS/NA procedure, the static route becomes valid/active and is installed.

2.4.9 LDP Shortcut for IGP Route Resolution

This feature enables you to forward user IP packets and specified control IP packets using LDP shortcuts over all network interfaces in the system that participate in the IS-IS and OSPF routing protocols. The default is to disable the LDP shortcut across all interfaces in the system.

```
config>router>ldp-shortcut [ipv4] [ipv6]
```

2.4.9.1 IGP Route Resolution

When LDP shortcut is enabled, LDP populates the RTM with next-hop entries corresponding to all prefixes for which it activated an LDP FEC. For an activated prefix, two route entries are populated in RTM. One corresponds to the LDP shortcut next-hop and has an owner of LDP. The other one is the regular IP next-hop. The LDP shortcut next-hop always has preference over the regular IP next-hop for forwarding user packets and specified control packets over a specific outgoing interface to the route next-hop.

The prior activation of the FEC by LDP is done by performing an exact match with an IGP route prefix in RTM. It can also be done by performing a longest prefix match with an IGP route in RTM if the aggregate-prefix-match option is enabled globally in LDP *ldp-interarea-prd*.

The LDP next-hop entry is not exported to the LDP control plane or to any other control plane protocols except OSPF, IS-IS, and an OAM control plane specified in [Handling of Control Packets](#).

This feature is not restricted to /32 IPv4 prefixes or /128 IPv6 FEC prefixes. However, only /32 IPv4 and /128 IPv6 FEC prefixes will be populated in the tunnel table for use as a tunnel by services.

All user and specified control packets for which the longest prefix match in RTM yields the FEC prefix will be forwarded over the LDP LSP. The following is an example of the resolution process.

Assume that the egress LER advertised a FEC for some /24 prefix using the fec-originate command. At the ingress LER, LDP resolves the FEC by checking in RTM that an exact match exists for this prefix. After the LDP activates the FEC, it programs the NHLFE in the egress data path and the LDP tunnel information in the ingress data path tunnel table.

Next, LDP provides the shortcut route to RTM, which will associate it with the same /24 prefix. There will be two entries for this /24 prefix: the LDP shortcut next-hop and the regular IP next-hop. The latter was used by LDP to validate and activate the FEC. RTM then resolves all user prefixes that succeed a longest prefix match against the /24 route entry to use the LDP LSP.

Now assume that the aggregate-prefix-match was enabled and that LDP found a /16 prefix in RTM to activate the FEC for the /24 FEC prefix. In this case, RTM adds a new, more-specific route entry of /24 and has the next-hop as the LDP LSP. However, RTM will still not have a specific /24 IP route entry. RTM then resolves all user prefixes that succeed a longest prefix match against the /24 route entry to use the LDP LSP. All other prefixes that succeed a longest prefix match against the /16 route entry will use the IP next-hop. LDP shortcut will also work when using RIP for routing.

2.4.9.2 LDP-IGP Synchronization

See the *7450 ESS, 7750 SR, 7950 XRS, and VSR MPLS Guide* for information about LDP-IGP Synchronization.

2.4.9.3 LDP Shortcut Forwarding Plane

After the LDP activates an FEC for a prefix and programs RTM, it also programs the ingress tunnel table in IOM or on linecards with the LDP tunnel information.

When an IPv4 packet is received on an ingress network interface, a subscriber IES interface, or a regular IES interface, the lookup of the packet by the ingress IOM or linecard will result in the packet being sent labeled with the label stack corresponding to the NHLFE of the LDP LSP when the preferred RTM entry corresponds to an LDP shortcut.

If the preferred RTM entry corresponds to an IP next-hop, the IPv4 packet is forwarded unlabeled.

The switching from the LDP shortcut next-hop to the regular IP next-hop when the LDP FEC becomes unavailable depends on whether the next-hop is still available. If it is (for example, the LDP FEC was withdrawn due to LDP control plane issues) the switchover should be faster. If the next-hop determination requires IGP to re-converge, this will take longer. However, no target is set.

The switching from a regular IP next-hop to an LDP shortcut next-hop will usually occur only when both are available. However, the programming of the NHLFE by LDP and the programming of the LDP tunnel information in the ingress IOM or linecards tunnel table are asynchronous. If the tunnel table is configured first, it is possible that traffic will be black-holed for some time.

2.4.9.4 ECMP Considerations

When ECMP is enabled and multiple equal-cost next-hops exist for the IGP route, the ingress IOM or linecard will spray the packets for this route based on the hashing routine currently supported for IPv4 packets.

When the preferred RTM entry corresponds to an LDP shortcut route, spraying will be performed across the multiple next-hops for the LDP FEC. The FEC next-hops can either be direct link LDP neighbors or T-LDP neighbors reachable over RSVP LSPs, in the case of LDP-over-RSVP, but not both. This is as per ECMP for LDP.

When the preferred RTM entry corresponds to a regular IP route, spraying will be performed across regular IP next-hops for the prefix.

Spraying across regular IP next-hops and LDP-shortcut next-hops concurrently is not supported.

2.4.9.5 Handling of Control Packets

All control plane packets will not see the LDP shortcut route entry in RTM with the exception of the following control packets, which will be forwarded over an LDP shortcut when enabled:

- A locally generated or in transit ICMP ping and trace route of an IGP route. The transit message appears as a user packet to the ingress LER node.
- A locally generated response to a received ICMP ping or trace route message.

All other control plane packets that require an RTM lookup and knowledge of which destination is reachable over the LDP shortcut will continue to be forwarded over the IP next-hop route in RTM.

2.4.9.6 Handling of Multicast Packets

Multicast packets cannot be forwarded or received from an LDP LSP. This is because there is no support for the configuration of such an LSP as a tunnel interfaces in PIM. Only an RSVP P2MP LSP is currently allowed.

If a multicast packet is received over the physical interface, the uRPF check will not resolve to the LDP shortcut because the LDP shortcut route in RTM is not made available to multicast application.

2.4.9.7 Interaction with BGP Route Resolution to an LDP FEC

There is no interaction between an LDP shortcut for BGP next-hop resolution and the LDP shortcut for IGP route resolution. BGP will continue to resolve a BGP next-hop to an LDP shortcut if the user enabled the following option in BGP:

```
config>router>bgp>next-hop-res>shortcut-tunnel
      family ipv4
      resolution-filter ldp
```

2.4.9.8 Interaction with Static Route Resolution to an LDP FEC

A static route will continue to be resolved by searching an LDP LSP whose FEC prefix matches the specified indirect next-hop for the route. In contrast, the LDP shortcut for IGP route resolution uses the LDP LSP as a route. The most specific route for a prefix will be selected and, if both a static and IGP routes exist, the RTM route type preference will be used to select one.

2.4.9.9 LDP Control Plane

For the LDP shortcut to be usable, SR OS must originate a <FEC, label> binding for each IGP route it learns of even if it did not receive a binding from the next-hop for that route. The router must assume that it is an egress LER for the FEC until the route disappears from the routing table or the next-hop advertises a binding for the FEC prefix. In the latter case, SR OS becomes a transit LSR for the FEC.

SR OS will originate a <FEC, label> binding for its system interface address only by default. The only way to originate a binding for local interfaces and routes that are not local to the system is by using the fec-originate capability.

You must use the **fec-originate** command to generate bindings for all non-local routes for which this node acts as an egress LER for the corresponding LDP FEC. Specifically, this feature must support the FEC origination of IGP learned routes and subscriber/host routes statically configured or dynamically learned over subscriber IES interfaces.

An LDP LSP used as a shortcut by IPv4 packets may also be tunneled using the LDP-over-RSVP feature.

2.5 Weighted Load-Balancing over Interface Next-hops

When the **weighted-ecmp** command is configured in the base router context (**config>router**) or a VPRN (**config>service>vprn**), any IPv4 or IPv6 static or IS-IS route associated with the routing instance can be programmed into the datapath to use weighted load-balancing across the interface next-hops of the route.

In order for weighted ECMP to be supported across the interface next-hops of an IS-IS route the following conditions must be met.

- All of the calculated ECMP next-hops must be interface next-hops.
- All of the calculated ECMP next-hops must be associated with the same neighbor IS-IS router.
- All of the calculated ECMP next-hop interfaces must have a non-zero load-balancing-weight value configured in the **isis>interface** context. By default, IS-IS interfaces have a zero weight (no load-balancing-weight); non-zero values must be configured explicitly. Values cannot be auto-derived.

In order for weighted ECMP to be supported across the interface next-hops of a static route the following conditions must be met.

- All of the configured ECMP next-hops must be direct next-hops (resolved to an interface). The ECMP next-hops are the next-hops with the lowest preference that also have the lowest metric.
- All of the configured ECMP next-hop interfaces must have a non-zero load-balancing-weight value configured in the **static-route-entry>next-hop** context. By default, static route next-hops have a zero weight (no load-balancing-weight); non-zero values must be configured explicitly. Values cannot be auto-derived. The ECMP next-hops are the next-hops with the lowest preference that also have the lowest metric.

The **load-balancing-weight** commands in both the IS-IS and static route configuration trees accept a value between 0 and 4294967295.

If an IPv4 or IPv6 BGP route has a BGP next-hop resolved by a static or IS-IS ECMP route and **ibgp-multipath** is configured under BGP, traffic forwarded to the BGP next-hop is sprayed according to the load-balancing-weights of the interface next-hops.

2.6 IP-over-GRE and MPLS-over-GRE Termination on a User-Configured Subnet

This feature enables the termination of MPLS-over-GRE and IP-over-GRE packets on destination IP addresses from a user-configured subnet. SR OS supports processing received GRE encapsulated packets concurrently when the destination address in the outer IPv4 header matches the system interface address (exact match) and when it matches an address on the user-configured GRE termination subnet (longest prefix match).

RFC 2890 specifies the following format for the GRE header:

```

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-----+-----+-----+-----+-----+-----+-----+-----+
|C| |K|S| Reserved0          | Ver |          Protocol Type          |
+-----+-----+-----+-----+-----+-----+-----+-----+
|          Checksum (optional)          |          Reserved1 (Optional)          |
+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     Key (optional)                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+
|                                     Sequence Number (Optional)                                     |
+-----+-----+-----+-----+-----+-----+-----+-----+

```

All the fields of the GRE encapsulation in RFC 2890 are optional except for the base header (first 4 bytes). The C, K, and S flags are used to indicate if the header includes the optional fields of Checksum (plus Reserved field), Key, and Sequence Number. SROS can process packets received with the base 4-byte header or with the 8-byte header which includes the Key field. In other words, packets with the flags set to {C=0, K=0/1, S=0}. Any other GRE header setting will result in the packet being dropped.

When originating a GRE encapsulated packet, SR OS supports the following header formats:

1. The 4-byte base header {C=0, K=0, S=0} in the IP-over-GRE feature using a Port Cross Connect (PXC) port (see [GRE Tunnel Overview](#)).
2. The 4-byte base header {C=0, K=0, S=0} in the IP-over-GRE feature using the Multiservice Integrated Service Adapter.

Refer to *Section 4.1, IP Tunnel Overview*, of the *7450 ESS, 7750 SR, and VSR Multiservice Integrated Service Adapter Guide*.

3. The 4-byte base header {C=0, K=0, S=0} in the MPLS-over-GRE tunnel and SDP.

Refer to the *7450 ESS, 7750 SR, 7950 XRS, and VSR Layer 2 Services and EVPN Guide: VLL, VPLS, PBB, and EVPN*, the *7450 ESS, 7750 SR, 7950 XRS, and VSR Layer 3 Services Guide: IES and VPRN*, and the *7450 ESS, 7750 SR, 7950 XRS, and VSR Services Overview Guide*.

4. The 8-byte header which includes the Key field {C=0, K=1, S=0} in the filter-based GRE tunneling feature (See [Configuring Filter-Based GRE Tunneling](#)).

2.6.1 Feature Configuration

The user defines a subnet for the termination of GRE packets by applying the **gre-termination** command to a numbered network IP interface, including a loopback interface, using the **config>router>interface>gre-termination** command.

The following rules apply to termination of IP-over-GRE and MPLS-over-GRE on a user-defined subnet.

- The termination of MPLS-over-GRE on the system interface address can be performed concurrently and extends to terminating IP-over-GRE packets as well.
- A single GRE termination subnet is permitted per router. If the user attempts to configure another subnet on another interface, the command is rejected.
- The GRE termination subnet length can be of maximum size of /16.
- The subnet of the primary IPv4 address of the numbered loopback interface or the numbered network IP interface is used as the GRE termination subnet.
- When the GRE termination subnet is enabled on a numbered network IP interface, the packet can be received from the interface itself and any other network IP interface as long as the target IPv4 termination subnet is reachable.
- The feature can terminate packets with the base 4-byte header {C=0, K=0, S=0} or with the 8-byte header which includes the Key field {C=0, K=1, S=0}. Any other GRE header setting will result in the packet being dropped.
- For routers in the network to forward MPLS-over-GRE or IP-over-GRE packets to this router, the prefix of the GRE subnet must be advertised in IGP or BGP. This is performed by adding the interface to IGP or BGP. Alternatively, a static route is added to the other routers.
- The GRE termination subnet is not supported with the following interface types. If these interface types are configured, the configuration of the **gre-termination** option is rejected:
 - unnumbered network IP interface
 - IES interface
 - VPRN interface

–CSC VPRN interface

- The configuration of the **gre-termination** option is also rejected when applied to the system interface, as the system interface supports the termination of MPLS-over-GRE packet on its /32 subnet with no explicit configuration.
- This feature introduces full support of LER and LSR roles for the packet after the GRE encapsulation is removed, regardless if the GRE termination was on the system interface address or the GRE termination subnet.
- In an LSR role, this feature will spray the decapsulated packets over LAG and ECMP links by attempting a hash on the SA/DA and Layer 4 ports of the inner IP header if the payload below the label stack is IPv4 or IPv6. Otherwise, a hash is performed on the SA/DA of the outer IPv4 header of the GRE encapsulation.

2.6.2 MPLS-over-GRE and IP-over-GRE Termination Function

When a GRE packet is received over any network IP interface, the router checks if destination address matches the system interface address (exact match) or the GRE termination subnet (Longest Prefix Match). The router then processes the packet according to the following criteria:

- If a match exists and the GRE Protocol Type field indicates an MPLS payload, continue processing the MPLS label stack as normal. This includes:
 - Pop one or more labels and forward to CPM if a MPLS exception exists (TTL expiry, RA label, 127/8 destination address in underlying IP packet).
 - Pop one or more labels and look up the packet in the FIB or in a local service context. The router operates as an egress LER.
 - Pop one or more labels and swap a label out to the outgoing interface with NHLFE encapsulation pushed on the packet. The router operates as an LSR.
 - When the incoming label is swapped to an implicit-null label, the user is able to remark the DSCP field of the exposed IPv4 or IPv6 packet on egress of the data path.
- If a match exists and the GRE Protocol Type field indicates an IPv4 or an IPv6 payload, continue processing in the pipeline as an IP packet and forward out based on FIB lookup.
- If a match exists and the GRE Protocol Type field indicates a Bridged Ethernet payload, drop the packet. To enable the feature to terminate the Bridged Ethernet payload, ensure that the termination subnet for that feature does not overlap with the GRE termination subnet of MPLS-over-GRE and IP-over-GRE termination.

- If a match exists and the GRE protocol Type field is set to any other payload value, drop the packet.
- If a match exists and the packet is not dropped, the application of ACL filter on the incoming interface matches against the **inner** (payload) header of the received GRE-encapsulated packet.
- If a match does not exist, continue processing in the pipeline as an IPv4 packet. In this case, the application of ACL filter on the incoming interface matches against the outer IPv4 header of the received GRE-encapsulated packet.

This feature supports GRE/IPv4 encapsulation when the payload is MPLS, IPv4, or IPv6.

All MPLS egress LER and LSR features associated with the processed label are supported.

2.6.3 Outgoing Packet Ethertype Setting and TTL Handling in MPLS-over-GRE Termination

The router sets the Ethertype field value of the outgoing packet according to the following criteria.

- If the swapped label is not the Bottom-of-Stack label, Ethertype is set to MPLS value.
- If the swapped label is the Bottom-of-Stack label and the outgoing label is not implicit-null, Ethertype is set to MPLS value.
- If the swapped label is the Bottom-of-Stack label and the outgoing label is implicit-null, Ethertype is set to IPv4 or IPv6 value when the first nibble of the exposed IP packet is 4 or 6 respectively. If the first nibble value is neither 4 nor 6, the packet is dropped.

The router sets the TTL of the outgoing packet as per the behavior of a PHP LSR:

- The TTL of a forwarded IP packet is set to MIN (MPLS_TTL-1, IP_TTL), where MPLS_TTL refers to the TTL in the outermost label in the popped stack and IP_TTL refers to the TTL in the exposed IP header.
- The TTL of a forwarded MPLS packet is set to MIN(MPLS_TTL-1, INNER_MPLS_TTL), where MPLS_TTL refers to the TTL in the outermost label in the popped stack and INNER_MPLS_TTL refers to the TTL in the exposed label.

2.6.4 Ethertype Setting and TTL Handling in IP-over-GRE Termination

The router sets the Ethertype field value of the outgoing packet to IPv4 or IPv6 value when the GRE protocol field value in the incoming packet is IPv4 or IPv6 respectively.

The router checks and decrements the TTL field of the inner IPv4 or IPv6 header and ignores the TTL of the outer IPv4 header.

2.6.5 LER and LSR Hashing Support

When the router removes the GRE encapsulation, pops one or more labels including the Bottom-of-Stack (BoS) label, it acts as a LER. The exposed packet will be forwarded in the global routing table or in a service context. The LAG/ECMP hashing of the packet when forwarded follow the procedures of that specific forwarding context. Refer to *LAG and ECMP Hashing* in the *7450 ESS*, *7750 SR*, *7950 XRS*, and *VSR Interface Configuration Guide*.

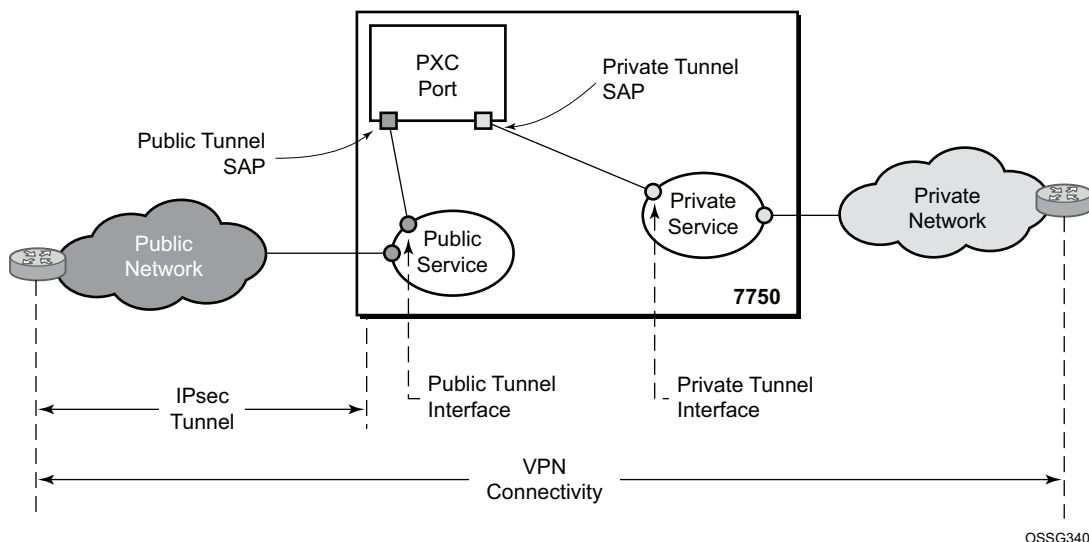
When the router removes the GRE encapsulation, pops one or more labels and then swaps a label, it acts as an LSR. The LSR hashing for packets of a MPLS-over-GRE SDP or tunnel terminating on the GRE subnet follows a new procedure which is enabled automatically and overrides the LSR hashing option enabled on the incoming network IP interface (**l3r-load-balancing {l3l-only | l3l-ip | ip-only | eth-encap-ip | l3l-ip-l4-teid}**). For more details, refer to *LSR Hashing of MPLS-over-GRE Encapsulated Packet* in section *Changing Default Per Flow Hashing Inputs* of the *7450 ESS*, *7750 SR*, *7950 XRS*, and *VSR Interface Configuration Guide*.

2.7 GRE Tunnel Overview

This section describes the GRE tunneling feature supported through the use of a Port Cross Connect (PXC) port. In this application, the PXC port functions as a resource module for the system, providing the necessary resources for the GRE encapsulation function. The GRE encapsulation function described here is similar to the GRE tunnel functionality supported through the use of the MS-ISA. In this use case, the MS-ISA is not required.

Figure 14 shows an example of a GRE deployment supported inside a 7750 SR router using the PXC element.

Figure 14 Sample GRE Deployment Using a PXC Port



In Figure 14, the public network is typically an unsecured network, such as public Internet, over which packets belonging to the private network in the diagram cannot be transmitted natively. Inside the 7750 SR, a public service instance (IES or VRPN) connects to the public network, and a private service instance (typically a VRPN) connects to the private network.

For GRE tunnels using PXC ports, the public and private services must be two different services, and the PXC is the connection between the two services. Traffic from the public network may require authentication and encryption inside an IPsec tunnel to reach the private network. In this way, the authenticity, confidentiality, and integrity of private network access can be enforced. If authentication and confidentiality are not required, then access to the private network may be provided through GRE or IP-IP tunnels.

Traffic flows through PXC-based tunnels in the following ways:

- In the upstream direction (public to private), the encapsulated traffic is forwarded to a public tunnel interface if the destination address matches the local or gateway address of a GRE tunnel. As the traffic passes through the PXC port, the tunnel header is removed, the payload IP packet is delivered to the private service, and from there, the traffic is forwarded again based on the destination address of the payload IP packet.
- In the downstream direction (private to public), unencapsulated traffic belonging to the private service is forwarded into the tunnel by matching a route with the GRE tunnel as next-hop. The route can be configured statically, learned by running OSPF on the private tunnel interface or by running BGP over the tunnel. After clear traffic is forwarded to the PXC port, it is encapsulated in the GRE header and passed to the public service, and from there, the traffic is forwarded again based on the destination address of the GRE header.

2.7.1 Sample GRE Tunnel Configurations

Public interface example:

```
config > service > ies 100
  interface "int-gre-tunnel-public" create
    address 192.110.1.1/30
    sap pxc-1.b:100 create //Public interface
    description "Public Tunnel PXC SAP"
    exit
  exit
no shutdown
```

Private interface example:

```
config > service > vprn 200 customer 200 create
  route-distinguisher 64496:1
  vrf-target target:64496:1
  interface "int-gre-tunnel-private" tunnel create // Private if
    address 10.1.1.1/30
    ip-mtu 1476
    sap pxc-1.a:200 create
      ip-tunnel "gre-tunnel-1" create
        source 192.110.1.2
        remote-ip 192.120.1.1
        backup-remote-ip 192.120.1.2
        delivery-service 100
        gre-header send-key 123 receive-key 123
        no shutdown
      exit
    exit
  static-route 172.16.1.1/24 next-hop 10.1.1.2
... [additional SAPs and or SDP configuration]
```

2.8 Router Interface Encryption with NGE

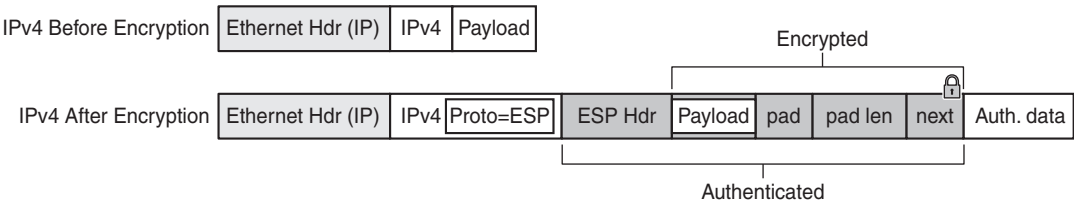
NGE nodes support Layer 3 encryption on router interfaces for IPv4 traffic. NGE is not supported on dual-stack IPv4/IPv6 or IPv6-only interfaces. Refer to the *7450 ESS, 7750 SR, 7950 XRS, and VSR Services Overview Guide* for more information about platforms that support NGE.

NGE is enabled on a router interface by configuring the **group-encryption** command on the router interface. The interface is considered part of the NGE domain, and any received packets that are NGE-encrypted are decrypted if the key group is configured on the node. To encrypt packets egressing the interface, the outbound key group must be configured on the interface. All IP packets, such as self-generated traffic or packets forwarded from router interfaces that are not inside the NGE domain, are encrypted when egressing the interface. There are some exceptions to this general behavior, as described in the sections below; for example, GRE-MPLS and MPLSoUDP packets are not encrypted when router interface encryption is enabled.

The outbound and inbound key groups configured on the router interface determine which keys are used to encrypt and decrypt traffic. Refer to the *7450 ESS, 7750 SR, 7950 XRS, and VSR Services Overview Guide* for more information about configuring key groups.

To perform encryption, router interface encryption reuses the IPsec transport mode packet format as shown in [Figure 15](#).

Figure 15 Router Interface Encryption Packet Format (IPsec Transport Mode)



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The protocol field in the IP header of an NGE packet is always set to “ESP”. Within an NGE domain, the SPI that is included in the ESP header is always an SPI for the key group configured on the router interface. Other fields in the IP header, such as the source and destination addresses, are not altered by NGE router interface encryption. Packets are routed through the NGE domain and decrypted when the packet leaves the NGE domain.

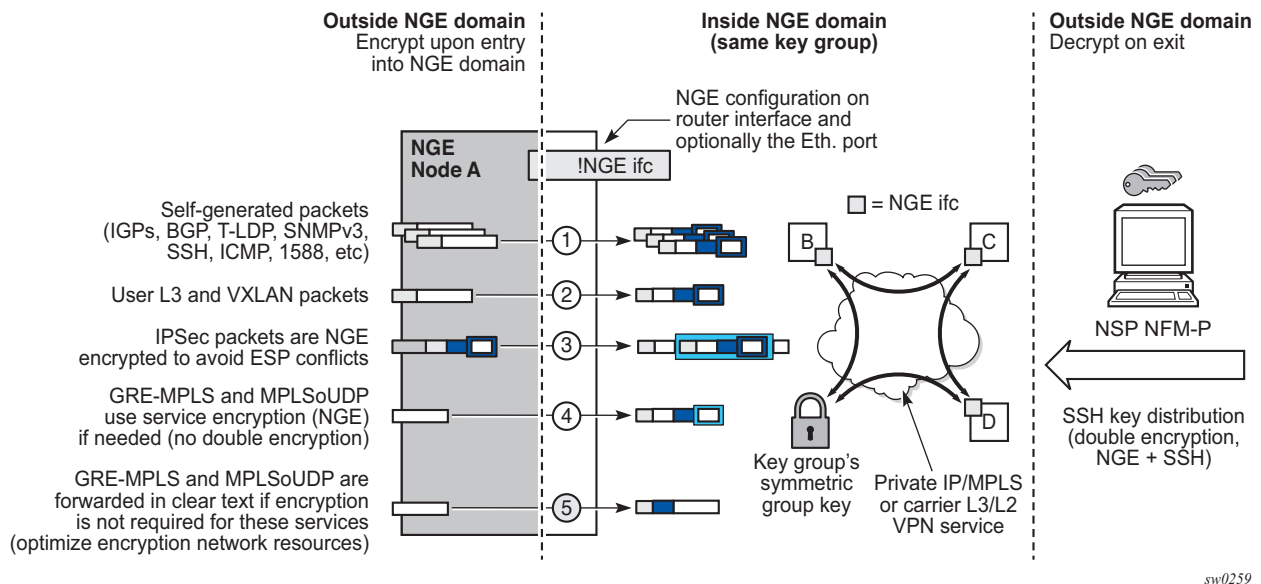
The group keys used on an NGE-enabled router interface provide encryption of broadcast and multicast packets within the GRT. For example, OSPF uses a broadcast address to establish adjacencies, which can be encrypted by NGE without the need to establish point-to-point encryption tunnels. Similarly, multicast packets are also encrypted without point-to-point encryption tunnels.

2.8.1 NGE Domains

An NGE domain is a group of nodes and router interfaces forming a network that uses a single key group to create a security domain. NGE domains are created when router interface encryption is enabled on router interfaces that need to participate in the NGE domain. The NSP NFM-P assists operators in managing the nodes and interfaces that participate in the NGE domain. See the *NSP NFM-P User Guide* for more information.

Figure 16 shows various traffic types crossing an NGE domain.

Figure 16 NGE Domain Transit



In Figure 16, nodes A, B, C, and D have router interfaces configured with router interface encryption enabled. Traffic is encrypted when entering the NGE domain using the key group configured on the router interface and is decrypted when exiting the NGE domain. Traffic may traverse multiple hops before exiting the NGE domain, yet decryption only occurs on the final node when the traffic exits the NGE domain.

Various traffic types are supported and encrypted when entering the NGE domain, as illustrated by the following items on node A in [Figure 16](#):

- item 1: self-generated packets — these packets, which include all types of control plane and management packets such as OSPF, BGP, LDP, SNMPv3, SSH, ICMP, RSVP-TE, and 1588, are encrypted
- item 2: user Layer 3 and VXLAN packets — any Layer 3 user packets that are routed into the NGE domain from an interface outside the NGE domain are encrypted. Any VXLAN packets that are routed into the NGE domain from this NGE node are encrypted.
- item 3: IPSec packets — IPSec packets are NGE-encrypted when entering the NGE domain to ensure that the IPSec packets' security association information does not conflict with the NGE domain

GRE-MPLS- or MPLSoUDP-based service traffic consists of Layer 3 packets, and router interface NGE is not applied to these types of packets. Instead, service-level NGE is used for encryption to avoid double-encrypting these packets and impacting throughput and latencies. The two types of GRE-MPLS or MPLSoUDP packets that can enter the NGE domain are illustrated by items 4 and 5 in [Figure 16](#).

- item 4: GRE-MPLS and MPLSoUDP packets (SDP or VPRN) with service-level NGE enabled — these encrypted packets use the key group that is configured on the service. The services key group may be different from the key group configured on the router interface where the GRE-MPLS or MPLSoUDP packet enters the NGE domain.
- item 5: GRE-MPLS and MPLSoUDP packets (SDP or VPRN) with NGE disabled — these packets are not encrypted and can traverse the NGE domain in clear text. If these packets require encryption, SDP or VPRN encryption must be enabled.

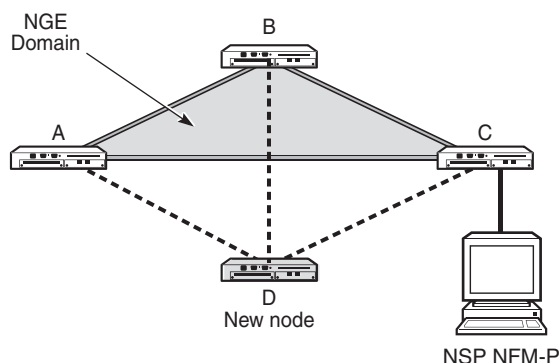
Creating an NGE domain from the NSP NFM-P requires the operator to determine the type of NGE domain being managed. This will indicate whether NGE gateway nodes are required to manage the NGE domain, and other operational considerations. The two types of NGE domains are:

- [Private IP/MPLS Network NGE Domain](#)
- [Private Over Intermediary Network NGE Domain](#)

2.8.1.1 Private IP/MPLS Network NGE Domain

One type of NGE domain is a private IP/MPLS network, as shown in [Figure 17](#).

Figure 17 Private IP/MPLS Network NGE Domain



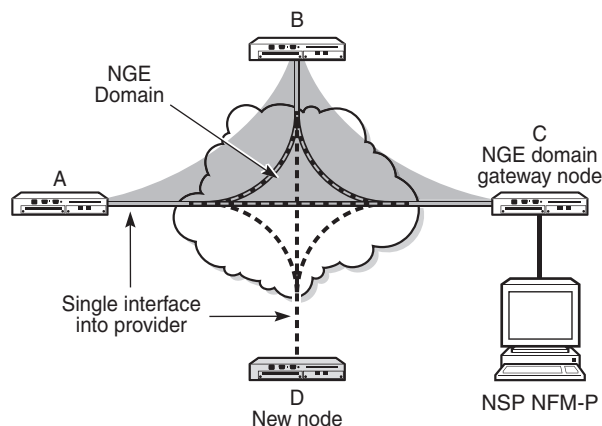
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In a private IP/MPLS network NGE domain, all interfaces are owned by the operator and there is no intermediary service provider needed to interconnect nodes. Each interface is a point-to-point private link between private nodes. When a new node is added to this type of NGE domain (node D in [Figure 17](#)), the links that connect node D to the existing nodes in the NGE domain (nodes A, B, and C) must be enabled with NGE router interface encryption. Links from the new node to the existing nodes are enabled one at a time. The NSP NFM-P provides tools that simplify adding nodes to the NGE domain and enabling NGE on their associated interfaces. In this type of NGE domain, each interface is a direct link between two nodes and is not used to communicate with multiple nodes over a broadcast medium offered by an intermediary network. Also, there are no NGE gateway nodes required between the NSP NFM-P and new nodes entering the NGE domain.

2.8.1.2 Private Over Intermediary Network NGE Domain

The other type of NGE domain is a private IP/MPLS network that traverses an intermediary network NGE domain; the intermediary network is used to interconnect nodes in the NGE domain using a multipoint-to-multipoint service. The intermediary network is typically a service provider network that provides a private IP VPN service or a private VPLS service used to interconnect a private network that does not mimic point-to-point links as described in the [Private IP/MPLS Network NGE Domain](#) section.

This type of NGE domain is shown in [Figure 18](#).

Figure 18 Private Over Intermediary Network NGE Domain

26214

Private over intermediary network NGE domains have nodes with links that connect to a service provider network where a single link can communicate with multiple nodes over a Layer 3 service such as a VPRN. In [Figure 18](#), node A has NGE enabled on its interface with the service provider and uses that single interface to communicate with nodes B and C, and eventually with node D when node D has been added to the NGE domain. This type of NGE domain requires the recognition of NGE gateway nodes that allow the NSP NFM-P to reach new nodes that enter the domain. Node C is designated as a gateway node.

When node D is added to the NGE domain, it must first have the NGE domain key group downloaded to it from the NSP NFM-P. The NSP NFM-P creates an NGE exception ACL on the gateway node, C, to allow communication with node D using SNMPv3 and SSH through the NGE domain. After the key group is downloaded, the NSP NFM-P enables router interface encryption on node D's interface with the service provider and node D is now able to participate in the NGE domain. The NSP NFM-P automatically removes the IP exception ACL from node C when node D enters the NGE domain.

See [Router Interface NGE Domain Concepts](#) for more information.

2.8.2 Router Interface NGE Domain Concepts

An NGE domain is a group of nodes whose router interfaces in the base routing context (GRT) are enabled for router interface NGE. An interface without router interface NGE enabled is considered to be outside the NGE domain. NGE domains use only one key group when the domain is created; however, two key groups may be active at once if some links within the NGE domain are in transition from one key group to the other.

Figure 19 illustrates the NGE domain concept. Table 6 describes the three configuration scenarios inside the NGE domain.

Figure 19 Inside and Outside NGE Domains

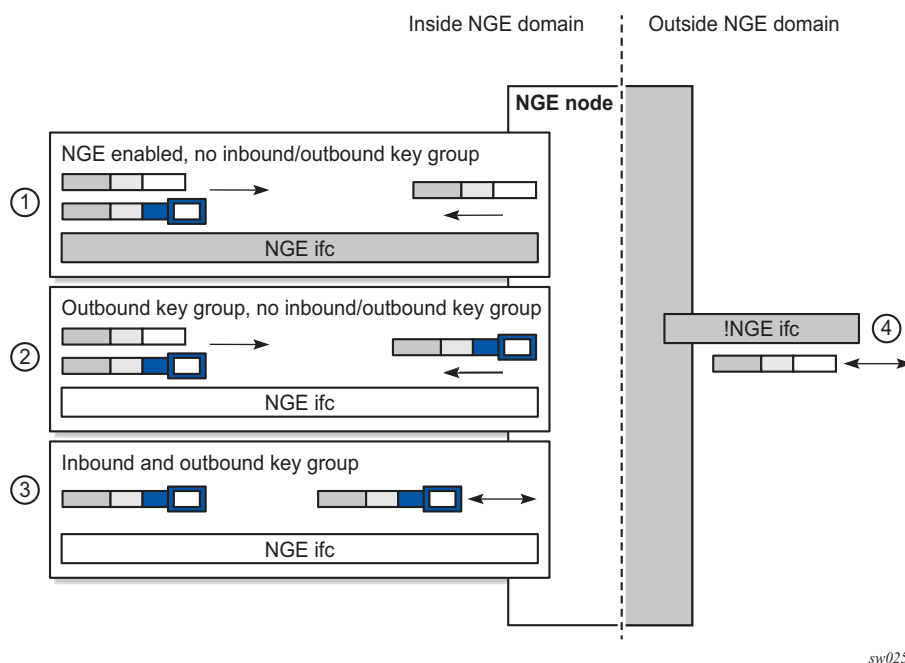


Table 6 Inside and Outside NGE Domains — Configuration Scenarios

Key	Description
1	NGE enabled, no inbound/outbound key group Outbound packets are sent without encrypting. Inbound packets can be NGE-encrypted or clear text.
2	Outbound key group, no inbound key group Outbound packets are encrypted using the interface key group if not already encrypted. Inbound packets can be NGE-encrypted or clear text.

Table 6 **Inside and Outside NGE Domains — Configuration Scenarios**

Key	Description
3	Inbound and outbound key group Outbound packets are encrypted using the interface key group if not already encrypted. Inbound packets must be encrypted using the interface key group keys.
4	Outside the NGE domain, the interface is not configured for NGE. Any ESP packets are IPSec packets.

A router interface is considered to be inside the NGE domain when it has been configured with **group-encryption** on the interface. When **group-encryption** is configured on the interface, the router can receive unencrypted packets or NGE-encrypted packets from any configured key group on the router, but any other type of IPSec-formatted packet is not allowed. If an IPSec-formatted packet is received on an interface that has **group-encryption** enabled, it will not pass NGE authentication and will be dropped. Therefore, IPSec packets cannot exist within the NGE domain without first being converted to NGE packets. This conversion requirement delineates the boundary of the NGE domain and other IPSec services.

When NGE router interface encryption is enabled and only an outbound key group is configured, the interface can receive unencrypted packets or NGE-encrypted packets from any configured key group on the router. All outbound packets are encrypted using the outbound key group if the packet was not already encrypted further upstream in the network.

When NGE router interface encryption has been configured with both an inbound and outbound key group, only NGE packets encrypted with the key group security association can be sent and received over the interface.

When there is no NGE router interface encryption, the interface is considered outside the NGE domain where NGE is not applied.

Refer to the “NGE Packet Overhead and MTU Considerations” section in the *7450 ESS, 7750 SR, 7950 XRS, and VSR Services Overview Guide* for MTU information related to enabling NGE on a router interface.

2.8.3 GRE-MPLS and MPLSoUDP Packets Inside the NGE Domain

NGE router interface encryption is never applied to GRE-MPLS or MPLSoUDP packets, for example:

- GRE with the GRE protocol ID set to MPLS Unicast (0x8847) or Multicast (0x8848)
- UDP packets with destination port = 6635)

GRE-MPLS and MPLSoUDP packets that enter the NGE domain or transit the NGE domain are forwarded as is.

Because these GRE-MPLS and MPLS-oUDP packets provide transport for MPLS-based services, they already use the NGE services-based encryption techniques for MPLS, such as SDP or VPRN-based encryption. To avoid double encryption, the packets are left in clear text when entering an NGE domain or crossing intermediate nodes in the NGE domain, and are forwarded as needed when exiting an NGE domain.

2.8.4 EVPN-VXLAN Tunnels and Services

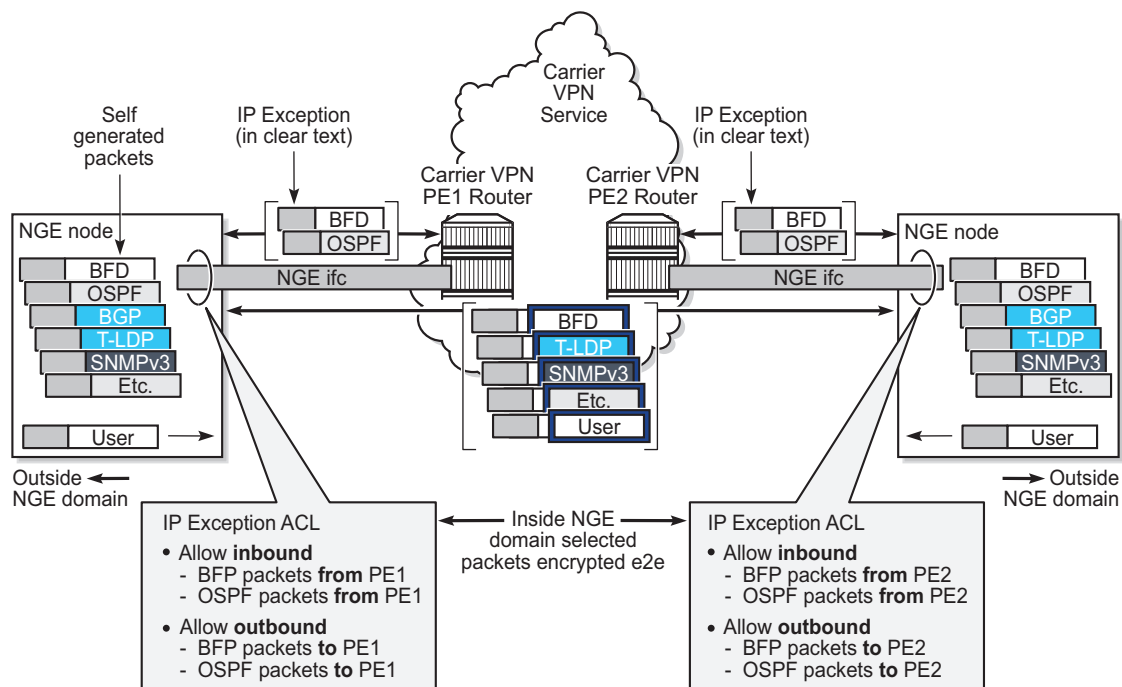
NGE router interface encryption does not differentiate between EVPN-VXLAN tunnels and other L3 traffic, and therefore encrypts all EVPN-VXLAN traffic that egresses the node.

For received encrypted EVPN-VXLAN packets, if the VXLAN tunnel terminates on the node (that is, the destination IP is for a VTEP on this node), then the NGE packet is decrypted and the EVPN-VXLAN traffic is processed as if NGE encryption never took place.

2.8.5 Router Encryption Exceptions using ACLs

In some cases, Layer 3 packets may need to cross the NGE domain in clear text, such as when an NGE-enabled router needs to peer with a non-NGE-capable router to exchange routing information. This can be accomplished by using a router interface NGE exception filter applied on the router interface for the required direction, inbound or outbound.

[Figure 20](#) shows the use of a router interface NGE exception filter.

Figure 20 Router Interface NGE Exception Filter Example

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The inbound or outbound exception filter is used to allow specific packet flows through the NGE domain in clear text, where there is an explicit inbound and outbound key group configured on the interface. The behavior of the exception filter for each router interface configuration is as follows:

- NGE enabled, no inbound/outbound key group — in this scenario, the router does not encrypt outbound traffic, and so the outbound exception filter is not applied. The router can still receive inbound NGE packets, so the exception filter is applied to inbound packets. If the filter detects a match, clear text packets can be received and forwarded by the router.
- outbound key group, no inbound key group — the outbound exception filter is applied to outbound traffic, and packets that match the filter are not encrypted on egress. The router can receive inbound NGE packets without an inbound key group set and applies the exception filter to inbound packets. If the filter detects a match, clear text packets can be received and forwarded by the router.
- inbound and outbound key group — the inbound and outbound exception filters are applied, and any packets that match are passed in clear text.

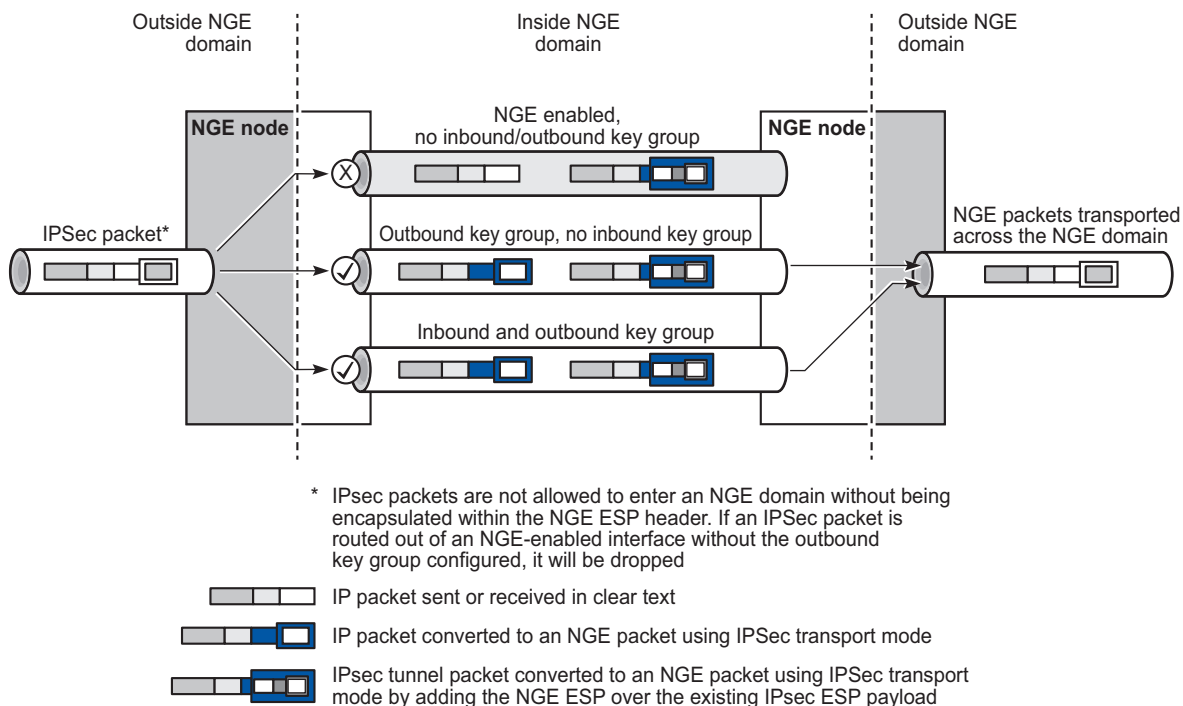
2.8.6 IPSec Packets Crossing an NGE Domain

IPSec packets can cross the NGE domain because they are still considered Layer 3 packets. To avoid confusion between the security association used in an IPSec packet and the one used in a router interface NGE packet, the router will always apply NGE to any IPSec packet that traverses the NGE domain.

IPSec packets that originate from a router within the NGE domain are not allowed to enter the NGE domain. The only exception to this restriction is OSPFv3 packets.

Figure 21 shows how IPSec packets can transit an NGE domain.

Figure 21 IPSec Packets Transiting an NGE Domain



sw0256

An IPSec packet enters the router from outside the NGE domain. When the router determines that the egress interface to route the packet is inside an NGE domain, it will select an NGE router interface with one of the following configurations.

- NGE enabled with no inbound or outbound key group configured — this link cannot forward the IPSec packet without adding the NGE ESP, but since nothing is configured for the outbound key group, the packet must be dropped.

- NGE enabled with outbound key group configured and no inbound key group configured — the packet originates outside the NGE domain, so the router adds an ESP header over the existing ESP and encrypts the payload using the NGE domain keys for the configured outbound key group.
- NGE enabled with both inbound and outbound key groups configured — the packet originates outside the NGE domain, so the router adds an ESP header over the existing ESP and encrypts the payload using the NGE domain keys for the configured outbound key group.

OSPFv3 IPsec support also uses IPsec transport mode packets. These packets originate from the CPM, which is considered outside the NGE domain; however, the above rules for encapsulating the packets with an NGE ESP apply and allow these packets to successfully transit the NGE domain.

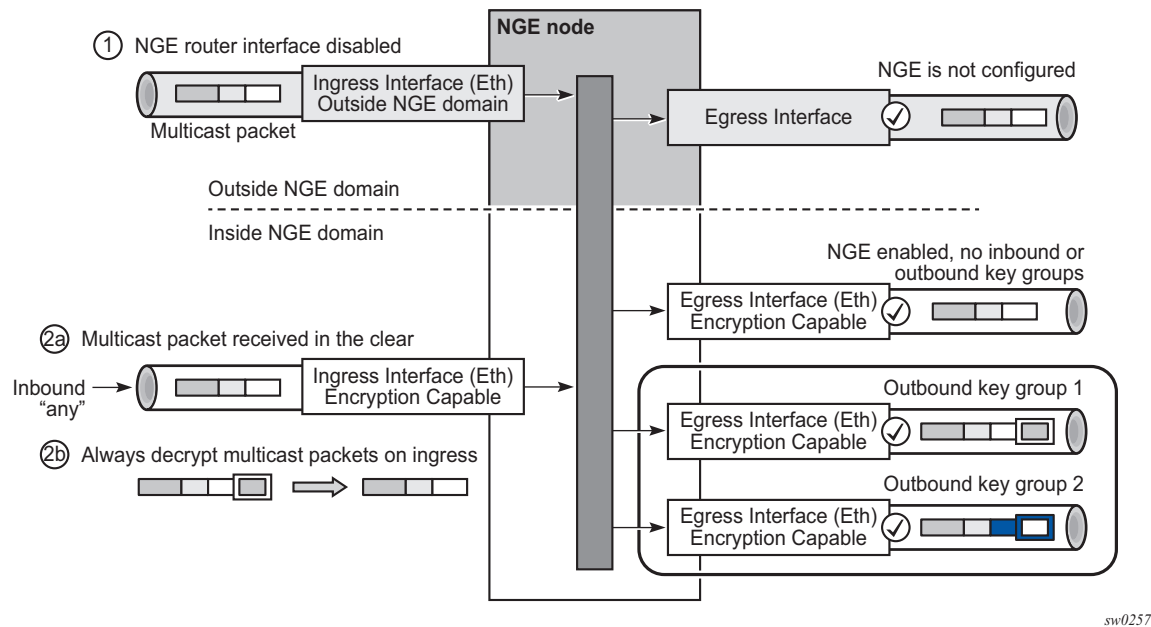
2.8.7 Multicast Packets Traversing the NGE Domain

Multicast packets that traverse an NGE domain can be categorized into two main scenarios:

- Scenario 1 — multicast packets that ingress the router on an interface that is outside the NGE domain. These packets can egress a variety of interfaces that are either inside or outside the NGE domain.
- Scenario 2 — multicast packets that ingress the router on an interface that is inside the NGE domain. These packets can egress a variety of interfaces that are either inside or outside the NGE domain. This scenario has two cases:
 - Scenario 2a — the ingress multicast packet is not yet NGE-encrypted
 - Scenario 2b — the ingress multicast packet is NGE-encrypted

[Figure 22](#) shows these scenarios.

Figure 22 Processing Multicast Packets



Multicast packets received from outside the NGE domain (Scenario 1) are processed similarly to multicast packets received from inside the NGE domain (Scenarios 2a and 2b).

The processing rule is that multicast packets are always forwarded as clear text over the fabric. This means that for Scenario 2b, when a multicast packet is received on an encryption-capable interface and is NGE-encrypted, the packet is always decrypted first so that it can be processed in the same way as packets in Scenarios 1 and 2a.

On egress, the following scenarios apply:

- egressing an interface outside the NGE domain — packets are processed in the same way as any multicast packets forwarded out a non-NGE interface
- egressing an NGE router interface and no inbound or outbound key group is configured — the router forwards these packets out from the egress interface without encrypting them since there is no outbound key group configured. This behavior also applies to unicast packets in the same scenario.
- egressing an NGE router interface with the outbound key group configured — the router encrypts the multicast packet using the SPI keys of the outgoing SA configured in the key group. This behavior also applies to unicast packets in the same scenario.

2.8.8 Assigning Key Groups to Router Interfaces

Assigning key groups to router interfaces involves the following three steps:

Step 1. Enable NGE with the **group-encryption** command.

Step 2. Configure the outbound key group.

Step 3. Configure the inbound key group.

Step 1 is required so that the router can initialize and differentiate the interface for NGE traffic before accepting or sending NGE packets. This assigns the interface to an NGE domain.

Assigning key groups to a router interface in steps 2 and 3 is similar to assigning key groups to SDPs or VPRN-based services. An outbound key group cannot be configured for a router interface without first enabling **group-encryption**.

When group-encryption is enabled and no inbound key group is configured, the router will accept NGE Layer 3 packets that were encrypted using keys from any security association configured in any key group on the system. If the packet specifies a security association that is not configured in any key group on the node, the packet is dropped.

The outbound key group references the key group to use when traffic egresses the router on the router interface. The inbound key group is used to make sure ingress traffic is using the correct key group on the router interface. If ingress traffic is not using the correct key group, the router counts these packets as errors.

2.8.9 NGE and BFD Support

When NGE is enabled on a router interface, BFD packets that originate from the network processor on the adapter card or from the system are encrypted in the same way as BFD packets that are generated by the CPM.

2.8.10 NGE and ACL Interactions

When NGE is enabled on a router interface, the ACL function is applied as follows:

- on ingress — Normal ACLs are applied to traffic received on the interface that could be either NGE-encrypted or clear text. For NGE-encrypted packets, this implies that only the source, destination, and IP options are available to filter on ingress, as the protocol is ESP and the packet is encrypted. If an IP exception ACL is also configured on the interface, the IP exception ACL is applied first to allow any clear text packets to ingress as needed. After the IP exception ACL is applied and if another filter or ACL is configured on the interface, the other filter will process the remaining packet stream (NGE-encrypted and IP exception ACL packets), and other ACL functions such as PBR or Layer 4 information filtering could be applied to any clear text packets that passed the exception ACL.
- on egress — ACLs are applied to packets before they are NGE-encrypted as per normal operation without NGE enabled.

2.8.11 Router Interface NGE and ICMP Interactions Over the NGE Domain

Typically, ICMP works as expected over an NGE domain when all routers participating in the NGE domain are NGE-capable; this includes running an NGE domain over a private IP/MPLS network. When an ICMP message is required, the NGE packet is decrypted first and the original packet is restored to create a detailed ICMP message using the original packet's header information.

When the NGE domain crosses a Layer 3 service provider, or crosses over routers that are not NGE-aware, it is not possible to create a detailed ICMP message using the original packet's information, as the NGE packet protocol is always set to ESP. Furthermore, the NGE router that receives these ICMP messages will drop them because the messages are not NGE-encrypted.

The combination of dropping ICMP messages at the NGE border node and the missing unencrypted packet details in the ICMP information can cause problems with diagnosing network issues.

To help with diagnosing network issues, additional statistics are available on the interface to show whether ICMP messages are being returned from a foreign node. The following statistics are included in the group encryption NGE statistics for an interface:

- Group Enc Rx ICMP DestUnRch Pkts
- Group Enc Rx ICMP TimeExc Pkts
- Group Enc Rx ICMP Other Pkts

These statistics are used when clear text ICMP messages are received on an NGE router interface. The Invalid ESP statistics are not used in this situation even though the packet does not have a correct NGE ESP header. If there is no ingress exception ACL configured on the interface to allow the ICMP messages to be forwarded, the messages are counted and dropped.

If more information is required for these ICMP messages, such as source or destination address information, a second ICMP filter can be configured on the interface to allow logging of the ICMP messages. If the original packet information is also required, an egress exception ACL can be configured with the respective source or destination address information, or other criteria, to allow the original packet to enter the NGE domain in clear text and determine which flows are causing the ICMP failures.

2.8.12 1588v2 Encryption With NGE

If a router interface is enabled for encryption and Layer 3 1588v2 packets are sent, they will be encrypted using NGE. This means that if port timestamping is enabled on a router interface with NGE, the port timestamp is applied to the Layer 3 1588v2 packet using software-based timestamping instead of hardware-based timestamping, and consequently, timing accuracy may degrade. The exact level of timing or synchronization degradation is dependent on many factors, and testing is recommended to measure any impact.

If there is a need to support Layer 3 1588v2 with better accuracy for frequency or better time using port timestamping, an NGE exception ACL is required to keep the Layer 3 1588v2 packets in clear text. The exception ACL must enable UDP packets with destination port 319 to be sent in clear text.

2.9 Process Overview

The following items are components to configure basic router parameters:

- **Interface** — A logical IP routing interface. When created, attributes like an IP address, port, link aggregation group, or the system can be associated with the IP interface.
- **Address** — The address associates the device's system name with the IP system address. An IP address must be assigned to each IP interface.
- **System interface** — This creates an association between the logical IP interface and the system (loopback) address. The system interface address is the circuitless address (loopback) and is used by default as the router ID for protocols such as OSPF and BGP.
- **Router ID** — (Optional) The router ID specifies the router's IP address.
- **Autonomous system** — (Optional) An autonomous system (AS) is a collection of networks that are subdivided into smaller, more manageable areas.
- **Confederation** — (Optional) Creates confederation-autonomous systems within an AS to reduce the number of IBGP sessions required within an AS.

2.10 Configuration Notes

The following information describes router configuration requirements:

- A system interface and associated IP address must be specified.
- Boot options file (BOF) parameters must be configured before configuring router parameters.
- Confederations can be configured before protocol connections (such as BGP) and peering parameters are configured.
- IPv6 interfaces and associated routing protocols may only be configured on the following systems:
 - 7950 XRS systems
 - 7750 SR chassis systems
 - 7750 SR-a chassis systems
 - 7750 SR-e chassis systems
 - 7450 ESS systems running in mixed-mode with IPv6 functionality limited to those interfaces on slots with 7750 IOM3-XP/IMMs (or later) line cards.

2.11 Configuring an IP Router with CLI

This section provides information to configure an IP router using CLI.

2.11.1 Router Configuration Overview

In a Nokia router, an interface is a logical named entity. An interface is created by specifying an interface name under the **config>router** context. This is the global router configuration context where objects like static routes are defined. An IP interface name can be up to 32 alphanumeric characters, must start with a letter, and is case-sensitive; for example, the interface name “1.1.1.1” is not allowed, but “int-1.1.1.1” is allowed.

To create an interface, the following basic configuration tasks must be performed.

- Assign a name to the interface.
- Associate an IP address with the interface.
- Associate the interface with a network interface or the system interface.
- Configure appropriate routing protocols.

A system interface and network interface must be configured.

2.11.1.1 System Interface

The system interface is associated with a network entity (such as a specific Nokia router), not a specific interface. The system interface is also referred to as the loopback address. The system interface is associated during the configuration of the following entities:

- Termination point of service tunnels
- Hops when configuring MPLS paths and LSPs
- Addresses on a target router for BGP and LDP peering

The system interface is used to preserve connectivity (when routing reconvergence is possible) when an interface fails or is removed. The system interface is used as the router identifier. A system interface must have an IP address with a 32-bit subnet mask.

2.11.1.2 Network Interface

A network interface can be configured on one of the following entities:

- Physical or logical port
- SONET/SDH channel

For the 7950 XRS, a network interface can be configured on either a physical port or Ethernet LAG interface.

2.11.2 Basic Configuration

Refer to each specific chapter for specific routing protocol information and command syntax to configure protocols such as OSPF and BGP.

The most basic router configuration must have the following:

- System name
- System address

The following example shows a router configuration for the 7750 SR and 7450 ESS:

```
A:ALA-A> config# info
. . .
#-----
# Router Configuration
#-----
    router
        interface "system"
            address 10.10.10.103/32
        exit
        interface "to-104"
            address 10.0.0.103/24
            port 1/1/1
        exit
        exit
        autonomous-system 100
        confederation 1000 members 100 200 300
        router-id 10.10.10.103
    ...
        exit
        isis
        exit
    ...
#-----
A:ALA-A> config#
```


2.11.3 Common Configuration Tasks

The following sections describe basic system tasks.

2.11.3.1 Configuring a System Name

Use the system command to configure a name for the device. The name is used in the prompt string. Only one system name can be configured. If multiple system names are configured, the last one configured will overwrite the previous entry.

If special characters are included in the system name string, such as spaces, #, or ?, the entire string must be enclosed in double quotes. To configure the system name:

CLI Syntax: config# system
 name *system-name*

Example: config# system
 config>system# name ALA-A
 ALA-A>config>system# exit all
 ALA-A#

The following example shows the system name output:

```
A:ALA-A>config>system# info
#-----
# System Configuration
#-----
      name "ALA-A"
      location "Mt.View, CA, NE corner of FERG 1 Building"
      coordinates "37.390, -122.05500 degrees lat."
      snmp
      exit
```

2.11.3.2 Configuring Interfaces

The following command sequences create a system and a logical IP interface. The system interface assigns an IP address to the interface, then associates the IP interface with a physical port. The logical interface can associate attributes like an IP address or port.

The system interface cannot be deleted.

2.11.3.2.1 Configuring a System Interface

To configure a system interface:

CLI Syntax:

```
config>router
      interface interface-name
        address {ip-address/mask | ip-address
                  [netmask] } [broadcast {all-ones | host-ones}]
        secondary { [address/mask | ip-address]
                    [netmask] } [broadcast {all-ones | host-
                    ones}] [igp-inhibit]
```

2.11.3.2.2 Configuring a Network Interface

To configure a network interface for the 7450 ESS:

CLI Syntax:

```
config>router
      interface interface-name
        address ip-addr{/mask-length | mask}
          [broadcast {all-ones | host-ones}]
        cflowd {acl | interface}
        egress
          filter ip ip-filter-id
        ingress
          filter ip ip-filter-id
        port port-name
```

To configure a network interface for the 7750 SR:

CLI Syntax:

```
config>router
      interface interface-name
        address ip-addr{/mask-length | mask}
          [broadcast {all-ones | host-ones}]
        cflowd {acl | interface}
        egress
          filter ip ip-filter-id
          filter ipv6 ipv6-filter-id
        ingress
          filter ip ip-filter-id
          filter ipv6 ipv6-filter-id
        port port-name
```

To configure a network interface on the 7950 XRS:

CLI Syntax:

```
config>router
      interface interface-name
```

```

address ip-addr{/mask-length | mask}
    [broadcast {all-ones | host-ones}]
egress
    filter ip ip-filter-id
    filter ipv6 ipv6-filter-id
ingress
    filter ip ip-filter-id
    filter ipv6 ipv6-filter-id
port port-name

```

The following shows interface information about an IP configuration:

```

A:ALA-A>config>router# info
#-----
# IP Configuration
#-----
    interface "system"
        address 10.10.0.4/32
    exit
    interface "to-ALA-2"
        address 10.10.24.4/24
        port 1/1/1
        egress
            filter ip 10
        exit
    exit
...
#-----
A:ALA-A>config>router#

```

To enable CPU protection:

CLI Syntax: config>router
 interface interface-name
 cpu-protection policy-id

CPU protection policies are configured in the **config>sys>security>cpu-protection** context. Refer to the *7450 ESS, 7750 SR, 7950 XRS, and VSR System Management Guide*.

2.11.3.2.3 Assigning a Key Group to a Router Interface

Use the following CLI syntax to assign a key group to a router interface:

CLI Syntax: config>router# interface ip-int-name [create]
 group-encryption
 encryption-keygroup keygroup-id direction
 {inbound | outbound}

The following example displays a key group assigned to a router interface:

Example:

```
config>router# interface demo
config>router>if# group-encryption
config>router>if>group-encryp# encryption-keygroup 6
direction inbound
config>router>if>group-encryp# encryption-keygroup 6
direction outbound
```

The following example displays key group configuration for a router interface.

```
domain1>config>router# info
-----
...
    interface demo
        group-encryption
            encryption-keygroup 6 direction inbound
            encryption-keygroup 6 direction outbound
        exit
        no shutdown
        exit
    exit
...
-----
```

2.11.3.2.4 Configuring IPv6 Parameters

IPv6 interfaces and associated routing protocols may only be configured on the following systems:

- 7950 XRS systems.
- 7750 SR chassis systems.
- 7750 SR-a chassis systems.
- 7750 SR-e chassis systems.
- 7450 ESS chassis running in mixed-mode, with IPv6 functionality limited to those interfaces on slots with 7750 IOM3-XP/IMMs (or later) line card.

The following displays the interface configuration showing the IPv6 default configuration when IPv6 is enabled on the interface:

```
A:ALA-49>config>router>if>ipv6# info detail
-----
' port 1/2/37
  ipv6
    packet-too-big 100 10
    param-problem 100 10
    redirects 100 10
    time-exceeded 100 10
    unreachablees 100 10
```

```

exit
-----
A:ALA-49>config>router>if>ipv6# exit all

```

To configure IPv6 parameters on a router interface:

CLI Syntax:

```

config>router# interface interface-name
port port-name
ipv6
    address {ipv6-address/prefix-length} [eui-64]
    icmp6
        packet-too-big [number seconds]
        param-problem [number seconds]
        redirects [number seconds]
        time-exceeded [number seconds]
        unreachable [number seconds]
    neighbor ipv6-address mac-address

```

The following displays a configuration example showing interface information:

```

A:ALA-49>config>router>if# info
-----
    address 10.11.10.1/24
    port 1/2/37
    ipv6
        address 2001:db8::1/24
    exit
-----
A:ALA-49>config>router>if#

```

2.11.3.2.5 Configuring IPv6 Over IPv4 Parameters

The following sections provide several examples of the features that must be configured (tunnel ingress and egress node) to implement IPv6 over IPv4 relay services for the 7750 SR OS.

2.11.3.2.6 Tunnel Ingress Node

The following example shows the configuration of the interface through which the IPv6 over IPv4 traffic leaves the node. This must be configured on a network interface.

CLI Syntax:

```

config>router
    static-route-entry 3ffe::c8c8:c802/128
        indirect 10.200.200.2
    interface ip-int-name

```

```
address {ip-address/mask | ip-address  
        netmask} [broadcast {all-ones |  
        host-ones}]  
port port-name
```

The following example shows an interface configuration:

```
A:ALA-49>config>router# info  
-----  
...  
    interface "ip-1.1.1.1"  
        address 10.1.1.1/30  
        port 1/1/1  
    exit  
...  
-----  
A:ALA-49>config>router#
```

Both the IPv4 and IPv6 system addresses must be configured:

CLI Syntax:

```
config>router  
    interface ip-int-name  
        address {ip-address/mask | ip-address netmask}  
        [broadcast {all-ones | host-ones}]  
    ipv6  
        address ipv6-address/prefix-length [eui-  
        64]
```

The following example shows the configuration of interface information:

```
A:ALA-49>config>router# info  
-----  
...  
    interface "system"  
        address 10.0.113.1/32  
        ipv6  
            address 3ffe::c8c8:c801/128  
        exit  
    exit  
...  
-----  
A:ALA-49>config>router#
```

Learning the Tunnel Endpoint IPv4 System Address

The following example shows the OSPF configuration to learn the IPv4 system address of the tunnel endpoint:

CLI Syntax:

```
config>router
```

```
ospf
  area area-id
    interface ip-int-name
```

The following example shows the configuration of OSPF output:

```
A:ALA-49>config>router# info
-----
...
    ospf
      area 0.0.0.0
        interface "system"
        exit
        interface "ip-1.1.1.1"
        exit
      exit
    exit
-----
A:ALA-49>config>router#
```

Configuring an IPv4 BGP Peer

The following example shows the configuration of an IPv4 BGP peer with (IPv4 and) IPv6 protocol families:

CLI Syntax:

```
config>router
bgp
  export policy-name [policy-name...(upto 5 max)]
  router-id ip-address
  group name
    family [ipv4] [vpn-ipv4] [ipv6] [mcast-ipv4]
    type {internal | external}
    neighbor ip-address
      local-as as-number [private]
      peer-as as-number
```

The following example shows the configuration of BGP output:

```
A:ALA-49>config>router# info
-----
...
    bgp
      export "ospf3"
      router-id 203.0.113.1
      group "main"
        family ipv4 ipv6
        type internal
        neighbor 203.0.113.2
          local-as 1
          peer-as 1
        exit
    exit
```

```

        exit
    exit
...
-----
A:ALA-49>config>router#

```

An Example of an IPv6 Over IPv4 Tunnel Configuration

The IPv6 address is the next-hop as it is received through BGP. The IPv4 address is the system address of the tunnel's endpoint.

The following example shows the configuration of a policy to export IPv6 routes into BGP:

CLI Syntax:

```

config>router
  bgp
    export policy-name [policy-name...(upto 5 max)]
    router-id ip-address
    group name
      family [ipv4] [vpn-ipv4] [ipv6] [mcast-ipv4]
      type {internal | external}
      neighbor ip-address
        local-as as-number [private]
        peer-as as-number

```

The following example shows the configuration output:

```

A:ALA-49>config>router# info
-----
...
  policy-options
    policy-statement "ospf3"
      description "Plcy Stmt For 'From ospf3 To bgp'"
      entry 10
        description "Entry From Protocol ospf3 To bgp"
        from
          protocol ospf3
        exit
        to
          protocol bgp
        exit
        action accept
        exit
      exit
    exit
  exit
...
-----
A:ALA-49>config>router#

```


2.11.3.2.7 Tunnel Egress Node

The following example shows the configuration of the interface through which the IPv6 over IPv4 traffic leaves the node. It must be configured on a network interface. Both the IPv4 and IPv6 system addresses must be configured.

CLI Syntax:

```
config>router
    static-route 3ffe::c8c8:c801/128
        indirect 10.0.113.1
            interface ip-int-name
                address {ip-address/mask> | ip-
                    address netmask} [broadcast
                        {all-ones | host-ones}]
                ipv6
                address ipv6-address/prefix-length
                    [eui-64]
                port port-name
```

The following example shows the interface configuration:

```
A:ALA-49>config>router# info
-----
...
    interface "ip-1.1.1.2"
        address 10.1.1.2/30
        port 1/1/1
    exit
    interface "system"
        address 10.0.113.2/32
        ipv6
            address 3ffe::c8c8:c802/128
        exit
    exit
-----
```

Learning the Tunnel Endpoint IPv4 System Address

The following example shows the configuration of the OSPF configuration to learn the IPv4 system address of the tunnel endpoint:

CLI Syntax:

```
config>router
    ospf
        area area-id
            interface ip-int-name
```

The following example shows the configuration of OSPF information:

```
A:ALA-49>config>router# info
-----
```

```

...
    ospf
      area 0.0.0.0
        interface "system"
        exit
        interface "ip-1.1.1.2"
        exit
      exit
    exit
  -----
A:ALA-49>config>router#

```

Configuring an IPv4 BGP Peer

The following example shows the configuration an IPv4 BGP peer with (IPv4 and) IPv6 protocol families:

CLI Syntax:

```

config>router
bgp
  export policy-name [policy-name...(upto 5 max)]
  router-id ip-address
  group name
    family [ipv4] [vpn-ipv4] [ipv6] [mcast-ipv4]
    type {internal | external}
    neighbor ip-address
      local-as as-number [private]
      peer-as as-number

```

The following example shows the IPv4 BGP peer configuration:

```

A:ALA-49>config>router# info
-----
...
    bgp
      export "ospf3"
      router-id 203.0.113.2
      group "main"
        family ipv4 ipv6
        type internal
        neighbor 203.0.113.1
          local-as 1
          peer-as 1
        exit
      exit
    exit
  -----
A:ALA-49>config>router#

```

An Example of an IPv6 Over IPv4 Tunnel Configuration

The IPv6 address is the next-hop as it is received through BGP. The IPv4 address is the system address of the tunnel's endpoint.

The following example shows the configuration of a policy to export IPv6 routes into BGP:

```
CLI Syntax:  config>router
             bgp
               export policy-name [policy-name...(upto 5 max)]
               router-id ip-address
               group name
                 family [ipv4] [vpn-ipv4] [ipv6] [mcast-ipv4]
                 type {internal | external}
                 neighbor ip-address
                     local-as as-number [private]
                     peer-as as-number
```

The following example shows an IPv6 over IPv4 tunnel configuration:

```
A:ALA-49>config>router# info
-----
...
    policy-options
      policy-statement "ospf3"
        description "Plcy Stmt For 'From ospf3 To bgp'"
        entry 10
          description "Entry From Protocol ospf3 To bgp"
          from
            protocol ospf3
          exit
          to
            protocol bgp
          exit
          action accept
          exit
        exit
      exit
    exit
  exit
-----
A:ALA-49>config>router#
```

2.11.3.2.8 Router Advertisement

To configure the router to originate router advertisement messages on an interface, the interface must be configured under the **router-advertisement** context and be enabled (no shutdown). All other router advertisement configuration parameters are optional.

Router advertisement can be configured under the **config>router>router-advertisement** context or under the **config>service>vprn>router-advertisement** context. Use the following examples of CLI syntax to enable router advertisement and configure router advertisement parameters.

To configure router advertisement on the 7750 SR:

CLI Syntax:

```
config>router# router-advertisement
dns-options
    rdns-lifetime seconds
    dns-servers ipv6-address
interface ip-int-name
    current-hop-limit number
    dns-options
        rdns-lifetime {seconds | infinite}
        dns-servers ipv6-address
    include-dns
    managed-configuration
    max-advertisement-interval seconds
    min-advertisement-interval seconds
    mtu mtu-bytes
    other-stateful-configuration
    prefix ipv6-prefix/prefix-length
        autonomous
        on-link
        preferred-lifetime {seconds | infinite}
        valid-lifetime {seconds | infinite}
    reachable-time milliseconds
    retransmit-time milliseconds
    router-lifetime seconds
    no shutdown
    use-virtual-mac
```

To configure router advertisement for the 7450 ESS:

CLI Syntax:

```
config>router# router-advertisement
dns-options
    rdns-lifetime seconds
interface ip-int-name
    current-hop-limit number
    dns-options
        rdns-lifetime {seconds | infinite}
    include-dns
    managed-configuration
    max-advertisement-interval seconds
    min-advertisement-interval seconds
    mtu mtu-bytes
    other-stateful-configuration
        autonomous
```

```

on-link
preferred-lifetime {seconds | infinite}
valid-lifetime {seconds | infinite}
reachable-time milliseconds
retransmit-time milliseconds
router-lifetime seconds
no shutdown
use-virtual-mac

```

The following example shows a router advertisement configuration:

```

*A:sim131>config>router>router-advert# info
-----
        interface "n1"
            prefix 2001:db8:3::/64
            exit
            use-virtual-mac
            no shutdown
        exit
-----
*A:sim131>config>router>router-advert# interface n1
*A:sim131>config>router>router-advert>if# prefix 2001:db8:3::/64
-----
            autonomous
            on-link
            preferred-lifetime 604800
            valid-lifetime 2592000
-----
*A:tahi>config>router>router-advert>if>prefix#

```

2.11.3.2.9 Configuring IPv6 Parameters

The following example shows the IPv6 default configuration when IPv6 is enabled on the interface:

```

A:ALA-49>config>router>if>ipv6# info detail
-----
port 1/3/37
ipv6
    packet-too-big 100 10
    param-problem 100 10
    redirects 100 10
    time-exceeded 100 10
    unreachablees 100 10
exit
-----
A:ALA-49>config>router>if>ipv6# exit all

```

The following example shows an IPv6 configuration:

```

A:ALA-49>config>router>if# info

```

```

-----
        address 10.11.10.1/24
        port 1/3/37
        ipv6
            address 2001:db8::1/24
        exit
-----
A:ALA-49>config>router>if#

```

An Example of an IPv6 Over IPv4 Tunnel Configuration

The IPv6 address is the next-hop as it is received through BGP. The IPv4 address is the system address of the tunnel's endpoint.

The following example shows the configuration of a policy to export IPv6 routes into BGP:

CLI Syntax:

```

config>router
bgp
    export policy-name [policy-name...(upto 5 max)]
    router-id ip-address
    group name
        family [ipv4] [vpn-ipv4] [ipv6] [mcast-ipv4]
        type {internal | external}
        neighbor ip-address
            local-as as-number [private]
            peer-as as-number

```

The following example shows the configuration of the policy output:

```

A:ALA-49>config>router# info
-----
...
    policy-options
        policy-statement "ospf3"
            description "Plcy Stmtnt For 'From ospf3 To bgp'"
            entry 10
                description "Entry From Protocol ospf3 To bgp"
                from
                    protocol ospf3
                exit
                to
                    protocol bgp
                exit
                action accept
                exit
            exit
        exit
    exit
-----
A:ALA-49>config>router#

```

2.11.3.2.10 Configuring Proxy ARP

To configure proxy ARP, you can configure:

- A prefix list in the **config>router>policy-options>prefix-list** context.
- A route policy statement in the **config>router>policy-options>policy-statement** context and apply the specified prefix list.
 - In the policy statement **entry>to** context, specify the host source address(es) for which ARP requests can or cannot be forwarded to non-local networks, depending on the specified action.
 - In the policy statement **entry>from** context, specify network prefixes that ARP requests will or will not be forwarded to depending on the action if a match is found. For more information about route policies, refer to the *7450 ESS, 7750 SR, 7950 XRS, and VSR Unicast Routing Protocols Guide*.
- Apply the policy statement to the **proxy-arp** configuration in the **config>router>interface** context.

CLI Syntax:

```
config>router# policy-options
begin
commit
prefix-list name
        prefix ip-prefix/mask [exact | longer | through
        length | prefix-length-range length1-length2]
```

To configure the policy statement specified in the **proxy-arp-policy policy-statement** command:

CLI Syntax:

```
config>router# policy-options
begin
commit
policy-statement name
        default-action {accept | next-entry | next-policy |
        reject}
        entry entry-id
                action {accept | next-entry | next-policy |
                drop | reject}
        to
                prefix-list name [name...(upto 5 max)]
        from
                prefix-list name [name...(upto 5 max)]
```

The following example shows the prefix list and policy statement configuration:

```
A:ALA-49>config>router>policy-options# info
-----
        prefix-list "prefixlist1"
```

```

        prefix 10.20.30.0/24 through 32
    exit
    prefix-list "prefixlist2"
        prefix 10.10.10.0/24 through 32
    exit
...
    policy-statement "ProxyARPolicy"
        entry 10
            from
                prefix-list "prefixlist1"
            exit
            to
                prefix-list "prefixlist2"
            exit
            action reject
        exit
        default-action accept
    exit
exit
...
-----
A:ALA-49>config>router>policy-options#

```

Use the following CLI to configure proxy ARP:

CLI Syntax: config>router>interface *interface-name*
 local-proxy-arp
 proxy-arp-policy *policy-name* [*policy-name...*(upto 5
 max)]
 remote-proxy-arp

The following example shows a proxy ARP configuration:

```

A:ALA-49>config>router>if# info
-----
        address 192.0.2.59/24
        local-proxy-arp
        proxy-arp
            policy-statement "ProxyARPolicy"
        exit
-----
A:ALA-49>config>router>if#

```

2.11.3.2.11 Creating an IP Address Range

An IP address range can be reserved for exclusive use for services by defining the **config>router>service-prefix** command. When the service is configured, the IP address must be in the range specified as a service prefix. If no service prefix command is configured, no limitation exists.

The **no service-prefix** *ip-prefix/mask* command removes all address reservations. A service prefix cannot be removed while one or more services use address(es) in the range to be removed.

CLI Syntax:

```
config>router
service-prefix ip-prefix/mask [exclusive]
```

2.11.3.3 Deriving the Router ID

The router ID defaults to the address specified in the system interface command. If the system interface is not configured with an IP address, the router ID inherits the last four bytes of the MAC address. The router ID can also be manually configured in the **config>router** *router-id* context. On the BGP protocol level, a BGP router ID can be defined in the **config>router>bgp** *router-id* context and is only used within BGP.

If a new router ID is configured, protocols are not automatically restarted with the new router ID. The next time a protocol is initialized, the new router ID is used. An interim period of time can occur when different protocols use different router IDs. To force the new router ID, issue the shutdown and no shutdown commands for each protocol that uses the router ID, or restart the entire router.

It is possible to configure SR OS to operate with an IPv6 only BOF and no IPv4 system interface address. When configured in this manner, the operator must explicitly define IPv4 router IDs for protocols such as OSPF and BGP because there is no mechanism to derive the router ID from an IPv6 system interface address.

To configure the router ID:

CLI Syntax:

```
config>router
router-id router-id
interface ip-int-name
    address {ip-address/mask | ip-address netmask}
    [broadcast {all-ones | host-ones}]
```

The following example shows a router ID configuration:

```
A:ALA-4>config>router# info
#-----
# IP Configuration
#-----
    interface "system"
        address 10.10.0.4/32
    exit
    . . .
    router-id 10.10.0.4
#-----
```

```
A:ALA-4>config>router#
```

2.11.3.4 Configuring a Confederation

Configuring a confederation is optional. The AS and confederation topology design should be carefully planned. Autonomous system (AS), confederation, and BGP connection and peering parameters must be explicitly created on each participating router. Identify AS numbers, confederation numbers, and members participating in the confederation.

See the BGP section for CLI syntax and command descriptions.

To configure a confederation:

CLI Syntax: `config>router`
 `confederation confed-as-num members member-as-num`

The following example shows the configuration of the confederation topology in [Figure 2](#).



Note:

- Confederations can be preconfigured prior to configuring BGP connections and peering.
- Each confederation can have up to 15 members.

The following example shows a confederation configuration:

```
A:ALA-B>config>router# info
#-----
# IP Configuration
#-----
      interface "system"
        address 10.10.10.103/32
      exit
      interface "to-104"
        shutdown
        address 10.0.0.103/24
        port 1/1/1
      exit
      autonomous-system 100
      confederation 2002 members 200 300 400
      router-id 10.10.10.103

#-----
A:ALA-B>config>router#
```

2.11.3.5 Configuring an Autonomous System

Configuring an autonomous system is optional. To configure an autonomous system:

CLI Syntax: `config>router`
 `autonomous-system as-number`

The following example shows an autonomous system configuration:

```
A:ALA-A>config>router# info
#-----
# IP Configuration
#-----
        interface "system"
            address 10.10.10.103/32
        exit
    interface "to-104"
        address 10.0.0.103/24
        port 1/1/1
        exit
    exit
        autonomous-system 100
        router-id 10.10.10.103
#-----
A:ALA-A>config>router#
```

2.11.3.6 Configuring Overload State on a Single SFM

When a router has fewer than the full set of SFMs functioning, the forwarding capacity can be reduced. Some scenarios include:

- fewer than the maximum number of SFMs installed in the system
- one or more SFMs have failed
- the system is in the ISSU process and the SFM is co-located on the CPM

An overload condition can be set for IS-IS and OSPF to enable the router to still participate in exchanging routing information, but route all traffic away from it when insufficient SFMs are active. This is achieved using the following CLI commands:

CLI Syntax: `config>router>single-sfm-overload [holdoff-time hold-off-time]`
 `config>service>vprn>single-sfm-overload [holdoff-time hold-off-time]`
 `tools>perform>redundancy>forced-single-sfm-overload`

These cause an overload state in the IGP to trigger the traffic reroute by setting the overload bit in IS-IS or setting the metric to maximum in OSPF. When PIM uses IS-IS or OSPF to find out the upstream router, a next-hop change in the IS-IS or OSPF will cause PIM to join the new path and prune the old path, which effectively also reroutes the multicast traffic downstream as well as the unicast traffic.

When the problem is resolved, and the required compliment of SFMs become active in the router, the overload condition is cleared, which will cause the traffic to be routed back to the router.

The conditions to set overload are:

- 7750 SR-12/SR-7 and 7450 ESS-12/ESS-7 platforms: protocol sets overload if one of the SF/CPMs fails
- 7750 SR-12e and 7950 XRS platforms: protocol sets overload if two SFMs fail (two SFMs belonging to different SFM pairs on the XRS-40)

2.12 Service Management Tasks

This section describes IP router service management tasks:

2.12.1 Changing the System Name

The system command sets the name of the device and is used in the prompt string. Only one system name can be configured. If multiple system names are configured, the last one configured will overwrite the previous entry.

To change the system name:

CLI Syntax: config# system
 name *system-name*

The following example shows the configuration to change the system name:

Example: A:ALA-A>config>system# name tgif
 A:TGIF>config>system#

The following example shows the system name change:

```
A:ALA-A>config>system# name TGIF
A:TGIF>config>system# info
#-----
# System Configuration
#-----
      name "TGIF"
      location "Mt.View, CA, NE corner of FERG 1 Building"
      coordinates "37.390, -122.05500 degrees lat."
      synchronize
      snmp
          exit
          security
              snmp
                  community "private" rwa version both
              exit
          exit
          . . .
#-----
A:TGIF>config>system#
```

2.12.2 Modifying Interface Parameters

Starting at the **config>router** level, navigate down to the **router interface** context.

To modify an IP address:

CLI Syntax:

```
A:ALA-A>config>router# interface "to-sr1"
A:ALA-A>config>router>if# shutdown
A:ALA-A>config>router>if# no address
A:ALA-A>config>router>if# address 10.0.0.25/24
A:ALA-A>config>router>if# no shutdown
```

To modify a port:

CLI Syntax:

```
A:ALA-A>config>router# interface "to-sr1"
A:ALA-A>config>router>if# shutdown
A:ALA-A>config>router>if# no port
A:ALA-A>config>router>if# port 1/1/2
A:ALA-A>config>router>if# no shutdown
```

The following example shows the interface configuration:

```
A:ALA-A>config>router# info
#-----
# IP Configuration
#-----
      interface "system"
        address 10.0.0.103/32
      exit
      interface "to-sr1"
        address 10.0.0.25/24
        port 1/1/2
      exit
      router-id 10.10.0.3
#-----
A:ALA-A>config>router#
```

2.12.3 Removing a Key Group from a Router Interface

Use the following CLI syntax to remove a key group from a router interface:

CLI Syntax:

```
config>router# interface ip-int-name
group-encryption
no encryption-keygroup keygroup-id direction
{inbound | outbound}
```

The following example displays a key group removed from a router interface:

Example:

```
config>router# interface demo
config>router>if# group-encryption
config>router>if>group-encryp# no encryption-keygroup 6
direction inbound
```

```
config>router>if>group-encryp# no encryption-keygroup 6
direction outbound
```

The following example shows that the key group configuration has been removed from a router interface.

```
domain1>config>router# info
-----
...
    interface demo
        group-encryption
        exit
        no shutdown
        exit
    exit
...
-----
```

2.12.4 Changing the Key Group for a Router Interface

The following CLI syntax changes the key group on a router interface. In the example below, the inbound and outbound key groups are changed from key group 6 to key group 8.

CLI Syntax:

```
config>router# interface ip-int-name
group-encryption
    no encryption-keygroup keygroup-id direction
    {inbound | outbound}
```

Example:

```
config>router# interface demo
config>router>if# group-encryption
config>router>if>group-encryp# no encryption-keygroup 6
direction inbound
config>router>if>group-encryp# encryption-keygroup 8
direction outbound
config>router>if>group-encryp# encryption-keygroup 8
direction inbound
```

The following example shows that the key group configuration has been changed for the router interface.

```
domain1>config>router# info
-----
...
    interface demo
        group-encryption
            encryption-keygroup 8 direction inbound
            encryption-keygroup 8 direction outbound
    exit
...
-----
```

```
        exit
    no shutdown
    exit
exit
...
-----
```

2.12.5 Deleting a Logical IP Interface

The **no** form of the **interface** command typically removes the entry, but all entity associations must be shut down and/or deleted before an interface can be deleted.

- Step 1.** Before an IP interface can be deleted, it must first be administratively disabled with the shutdown command.
- Step 2.** After the interface has been shut down, it can then be deleted with the **no interface** command.

CLI Syntax:

```
config>router
no interface ip-int-name
```

Example:

```
config>router# interface test-interface
config>router>if# shutdown
config>router>if# exit
config>router# no interface test-interface
config>router#
```


2.13 IP Router Configuration Command Reference

- [Command Hierarchies](#)
- [Command Descriptions](#)

2.13.1 Command Hierarchies

- [Router Commands](#)
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- [Router Interface Commands](#)
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2.13.1.1 Router Commands

```
config
— router [router-instance] [create]
— no router [router-instance]
  — admin-tags
    — [no] admin-tag tag
    — [no] route-admin-tag-policy policy-name
      — [no] exclude tag
      — [no] include tag
  — aggregate ip-prefix/ip-prefix-length [summary-only] [as-set] [aggregator as-number:ip-address] [black-hole [generate-icmp]] [community comm-id [comm-id]] [description description] [local-preference local-preference]
  — aggregate ip-prefix/ip-prefix-length [summary-only] [as-set] [aggregator as-number:ip-address] [community comm-id [comm-id]] [indirect ip-address] [description description] [local-preference local-preference]
  — no aggregate ip-prefix/ip-prefix-length
  — autonomous-system autonomous-system
  — no autonomous-system
  — [no] class-forwarding
  — confederation confed-as-num [members as-number [as-number]]
  — no confederation confed-as-num members as-number [as-number]
  — no confederation
  — ecmp max-ecmp-routes
  — no ecmp
  — [no] entropy-label
  — fib-priority {high | standard}
  — [no] fib-telemetry
```

-
- **flowspec**
 - **ip-filter-max-size** {*value* | **default**}
 - **ipv6-filter-max-size** {*value* | **default**}
 - [no] **icmp-tunneling**
 - [no] **ip-fast-reroute**
 - **ldp-shortcut** [ipv4] [ipv6]
 - no **ldp-shortcut**
 - **leak-export** *plcy-or-long-expr* [*plcy-or-expr* [*plcy-or-expr*]]
 - no **leak-export**
 - [no] **leak-export-limit** [*value*]
 - **mc-maximum-routes** *number* [**log-only**] [**threshold** *threshold*]
 - no **mc-maximum-routes**
 - **mss-adjust-group** *bb-group-id* **segment-size** *segment-size*
 - no **mss-adjust-group**
 - **mtrace2**
 - [no] **shutdown**
 - **udp-port** *udp-port-number*
 - **multicast-info-policy** *policy-name*
 - no **multicast-info-policy**
 - **network-domains**
 - [no] **network-domain** *network-domain-name*
 - **description** *description-string*
 - no **description**
 - **origin-validation**
 - [no] **rpki-session** *ip-address*
 - **connect-retry** *seconds*
 - no **connect-retry**
 - **description** *description-string*
 - no **description**
 - **local-address** *ip-address*
 - no **local-address**
 - **port** *port-id*
 - no **port**
 - **refresh-time** *seconds* **hold-time** *seconds*
 - no **refresh-time**
 - [no] **shutdown**
 - **stale-time** *seconds*
 - no **stale-time**
 - **static-entry** *ip-prefix/ip-prefix-length upto prefix-length2 origin-as as-number* [{**valid** | **invalid**}]
 - no **static-entry** *ip-prefix/ip-prefix-length upto prefix-length2 origin-as as-number*
 - **router-id** *ip-address*
 - no **router-id**
 - **service-prefix** {*ip-prefix/ip-prefix-length* | *ip-prefix netmask*} [**exclusive**]
 - no **service-prefix** {*ip-prefix/ip-prefix-length* | *ip-prefix netmask*}
 - **sgt-qos**
 - **application** *dscp-app-name* **dscp** {*dscp-value* | *dscp-name*}
 - **application** *dot1p-app-name* **dot1p** *dot1p-priority*
 - no **application** {*dscp-app-name* | *dot1p-app-name*}
 - **dscp** *dscp-name* **fc** *fc-name*
 - no **dscp** *dscp-name*
 - **single-sfm-overload** [**holdoff-time** *holdoff-time*]
 - no **single-sfm-overload**

- [no] **static-route-entry** *ip-prefix/prefix-length* [*mcast*]
 - [no] **black-hole**
 - **community** *comm-id*
 - **no community** [*comm-id*]
 - **description** *description-string*
 - **no description** [*description-string*]
 - [no] **dynamic-bgp**
 - [no] **generate-icmp**
 - **metric** *metric*
 - **no metric** [*metric*]
 - **preference** *preference*
 - **no preference**
 - **prefix-list** *prefix-list-name* [{**all** | **none**}]
 - **no prefix-list** [*prefix-list-name*] [{**all** | **none**}]
 - [no] **shutdown**
 - **tag** *tag*
 - **no tag** [*tag*]
 - **community** *comm-id* [*comm-id*]
 - **no community** [*comm-id* [*comm-id*]]
 - [no] **indirect** *ip-address*
 - **community** *comm-id*
 - **no community** [*comm-id*]
 - **cpe-check** *cpe-ip-address*
 - **no cpe-check** [*cpe-ip-address*]
 - **drop-count** *count*
 - **no drop-count**
 - **interval** *seconds*
 - **no interval**
 - [no] **log**
 - **padding-size** *padding-size*
 - **no padding-size**
 - **description** *description-string*
 - **no description** [*description-string*]
 - **destination-class** *dest-index*
 - **no destination-class** [*dest-index*]
 - **forwarding-class** {**be** | **l2** | **af** | **l1** | **h2** | **ef** | **h1** | **nc**}
 - **no forwarding-class** [{**be** | **l2** | **af** | **l1** | **h2** | **ef** | **h1** | **nc**}]
 - **priority** {**low** | **high**}
 - **no priority** [{**low** | **high**}]
 - **metric** *metric*
 - **no metric** [*metric*]
 - **preference** *preference*
 - **no preference**
 - **prefix-list** *prefix-list-name* [{**all** | **none**}]
 - **no prefix-list** [*prefix-list-name*] [{**all** | **none**}]
 - [no] **shutdown**
 - **source-class** *source-index*
 - **no source-class** [*source-index*]
 - **tag** *tag*
 - **no tag** [*tag*]
 - **tunnel-next-hop**
 - [no] **disallow-igp**
 - **resolution** {**any** | **disabled** | **filter**}
 - **resolution-filter**

```

    — [no] ldp
    — [no] mpls-fwd-policy
    — [no] rib-api
    — [no] rsvp-te
      — [no] lsp lsp-name
    — [no] sr-isis
    — [no] sr-ospf
    — [no] sr-te
      — [no] lsp lsp-name
— [no] next-hop {ip-int-name | ip-address | ipv6-address}
  — [no] bfd-enable
  — community comm-id
  — no community [comm-id]
  — cpe-check cpe-ip-address
  — no cpe-check [cpe-ip-address]
    — drop-count count
    — no drop-count
    — interval seconds
    — no interval
    — [no] log
    — padding-size padding-size
    — no padding-size
  — description description-string
  — no description [description-string]
  — destination-class dest-index
  — no destination-class [dest-index]
  — forwarding-class {be | l2 | af | l1 | h2 | ef | h1 | nc}
  — no forwarding-class [{be | l2 | af | l1 | h2 | ef | h1 | nc}]
    — priority {low | high}
    — no priority [{low | high}]
  — [no] ldp-sync
  — load-balancing-weight value
  — no load-balancing-weight [value]
  — metric metric
  — no metric [metric]
  — preference preference
  — no preference
  — prefix-list prefix-list-name [{all | none}]
  — no prefix-list [prefix-list-name] [{all | none}]
  — [no] shutdown
  — source-class source-index
  — no source-class [source-index]
  — tag tag
  — no tag [tag]
  — [no] validate-next-hop
— tag tag
— no tag [tag]
— [no] triggered-policy
— ttl-propagate
  — label-route-local [{none | all}]
  — label-route-transit [{none | all}]
  — lsr-label-route [{none | all}]
  — vprn-local [{none | all | vc-only}]
  — vprn-transit [{none | all | vc-only}]

```

- **weighted-ecmp**

2.13.1.2 Router BFD Commands

```

config
  — router
    — bfd
      — [no] bfd-template name
        — echo-receive echo-interval
        — no echo-receive
        — multiplier multiplier
        — no multiplier
        — receive-interval receive-interval
        — no receive-interval
        — transmit-interval transmit-interval
        — no transmit-interval
        — type {cpm-np}
        — no type

```

2.13.1.3 Router L2TP Commands

The router L2TP commands apply only to the 7750 SR and 7450 ESS.

```

config
  — router [router-instance] [create]
  — no router [router-instance]
    — l2tp
      — calling-number-format ascii-spec
      — no calling-number-format
      — challenge {always}
      — no challenge
      — destruct-timeout destruct-timeout
      — no destruct-timeout
      — df-bit-lac {always | never}
      — no df-bit-lac
      — eth-tunnel
        — reconnect-timeout reconnect-timeout
        — no reconnect-timeout
      — exclude-avps [calling-number] [initial-rx-lcp-conf-req]
      — no exclude-avps
      — group tunnel-group-name [create]
      — group tunnel-group-name [create] [protocol protocol]
      — no group tunnel-group-name
        — avp-hiding {sensitive | always | never}
        — no avp-hiding
        — challenge {always | never}
        — no challenge
        — description description-string

```

-
- **no description**
 - **destruct-timeout** *destruct-timeout*
 - **no destruct-timeout**
 - **df-bit-lac** {*always* | *never* | **default**}
 - **no df-bit-lac**
 - **hello-interval** *hello-interval*
 - **hello-interval** **infinite**
 - **no hello-interval**
 - **idle-timeout** *idle-timeout*
 - **idle-timeout** **infinite**
 - **no idle-timeout**
 - **l2tpv3**
 - **cookie-length** *cookie-length*
 - **cookie-length** **default**
 - **no cookie-length**
 - **digest-type** {*default* | *none* | *md5* | *sha1*}
 - **no digest-type**
 - **nonce-length** *length*
 - **nonce-length** **default**
 - **no nonce-length**
 - **password** *password* [{*hash* | *hash2*}]
 - **no password**
 - **private-tcp-mss-adjust** *octets*
 - **private-tcp-mss-adjust** **default**
 - **no private-tcp-mss-adjust**
 - **public-tcp-mss-adjust** *octets*
 - **public-tcp-mss-adjust** **default**
 - **no public-tcp-mss-adjust**
 - **pw-cap-list** {*ethernet* | *ethernet-vlan*} [{*ethernet* | *ethernet-vlan*}]
 - **no pw-cap-list**
 - **rem-router-id** *ip-address*
 - **no rem-router-id**
 - [no] **track-password-change**
 - **lns-group** *lns-group-id*
 - **no lns-group**
 - **load-balance-method** {*per-session* | *per-tunnel*}
 - **no load-balance-method**
 - **local-address** *ip-address*
 - **no local-address**
 - **local-name** *host-name*
 - **no local-name**
 - **max-retries-estab** *max-retries*
 - **no max-retries-estab**
 - **max-retries-not-estab** *max-retries*
 - **no max-retries-not-estab**
 - **password** *password* [{*hash* | *hash2*}]
 - **no password**
 - **ppp**
 - **authentication** {*chap* | *pap* | *pref-chap* | *pref-pap*}
 - **authentication-policy** *auth-policy-name*
 - **no authentication-policy**
 - **default-group-interface** *ip-int-name* **service-id** *service-id*
 - **default-group-interface** *ip-int-name* **service-name** *svc-name*

-
- **no default-group-interface**
 - **keepalive** *seconds* [**hold-up-multiplier** *multiplier*]
 - **no keepalive**
 - **[no] lcp-force-ack-accm**
 - **mtu** *mtu-bytes*
 - **no mtu**
 - **[no] proxy-authentication**
 - **[no] proxy-lcp**
 - **[no] reject-disabled-ncp**
 - **user-db** *local-user-db-name*
 - **no user-db**
 - **session-assign-method** {**existing-first** | **weighted** | **weighted-random**}
 - **no session-assign-method**
 - **session-limit** *session-limit*
 - **session-limit** **unlimited**
 - **no session-limit**
 - **tunnel** *tunnel-name* [**create**]
 - **no tunnel** *tunnel-name*
 - **[no] auto-establish**
 - **avp-hiding** {**never** | **sensitive** | **always**}
 - **no avp-hiding**
 - **challenge** {**always** | **never**}
 - **no challenge**
 - **description** *description-string*
 - **no description**
 - **destruct-timeout** *destruct-timeout*
 - **no destruct-timeout**
 - **df-bit-lac** {**always** | **never** | **default**}
 - **no df-bit-lac**
 - **hello-interval** *hello-interval*
 - **hello-interval** **infinite**
 - **no hello-interval**
 - **idle-timeout** *idle-timeout*
 - **idle-timeout** **infinite**
 - **no idle-timeout**
 - **load-balance-method** {**per-session** | **per-tunnel**}
 - **no load-balance-method**
 - **local-address** *ip-address*
 - **no local-address**
 - **local-name** *host-name*
 - **no local-name**
 - **max-retries-estab** *max-retries*
 - **no max-retries-estab**
 - **max-retries-not-estab** *max-retries*
 - **no max-retries-not-estab**
 - **password** *password* [{**hash** | **hash2**}]
 - **no password**
 - **peer** *ip-address*
 - **no peer**
 - **ppp**
 - **lcp-force-ack-accm** {**always** | **never**}
 - **no lcp-force-ack-accm**
 - **preference** *preference*

-
- **no preference**
 - **remote-name** *host-name*
 - **no remote-name**
 - **session-limit** *session-limit*
 - **session-limit unlimited**
 - **no session-limit**
 - **[no] shutdown**
 - **group-session-limit** *session-limit*
 - **group-session-limit unlimited**
 - **no group-session-limit**
 - **l2tpv3**
 - **cookie-length** *cookie-length*
 - **no cookie-length**
 - **digest-type** {none | md5 | sha1}
 - **no digest-type**
 - **nonce-length** *length*
 - **no nonce-length**
 - **password** *password* [{hash | hash2}]
 - **no password**
 - **private-tcp-mss-adjust** *octets*
 - **no private-tcp-mss-adjust**
 - **public-tcp-mss-adjust** *octets*
 - **no public-tcp-mss-adjust**
 - **transport-type** {ip}
 - **no transport-type**
 - **next-attempt** {same-preference-level | next-preference-level}
 - **no next-attempt**
 - **peer-address-change-policy** {accept | ignore | reject}
 - **receive-window-size** *window-size*
 - **no receive-window-size**
 - **replace-result-code** *code* [*code*]
 - **no replace-result-code**
 - **rtm-debounce-time** *debounce-time*
 - **no rtm-debounce-time**
 - **session-limit** *session-limit*
 - **session-limit unlimited**
 - **no session-limit**
 - **[no] shutdown**
 - **tunnel-selection-blacklist**
 - **add-tunnel never**
 - **add-tunnel on** *reason* [*reason*]
 - **no add-tunnel**
 - **max-list-length unlimited**
 - **max-list-length** *count*
 - **no max-list-length**
 - **max-time** *minutes*
 - **no max-time**
 - **timeout-action** *action*
 - **no timeout-action**

2.13.1.4 Router Interface Commands

```

config
  — router [router-instance] [create]
  — [no] router [router-instance]
    — if-attribute
      — admin-group group-name value group-value
      — no admin-group group-name
      — srlg-group group-name value group-value [penalty-weight penalty-weight]
      — no srlg-group group-name
    — interface interface-name [unnumbered-mpls-tp]
    — interface interface-name control-tunnel
    — interface interface-name gmpls-loopback
    — interface interface-name pdn
    — no interface interface-name
      — address {ip-address/mask | ip-address netmask} [broadcast {all-ones | host-ones}] [track-srrp srrp-instance]
      — no address
      — [no] allow-directed-broadcasts
      — [no] arp-learn-unsolicited
      — arp-limit limit [log-only] [threshold percent]
      — no arp-limit
      — [no] arp-proactive-refresh
      — arp-retry-timer timer-multiple
      — no arp-retry-timer
      — arp-timeout seconds
      — no arp-timeout
      — bfd transmit-interval [receive receive-interval] [multiplier multiplier] [echo-receive echo-interval] [type cpm-np]
      — no bfd
      — cflowd-parameters
        — sampling {unicast | multicast} type {acl | interface} [direction {ingress-only | egress-only | both}]
        — no sampling {unicast | multicast}
      — cpu-protection policy-id
      — no cpu-protection
      — description long-description-string
      — no description
      — dhcp
        — description description-string
        — no description
        — gi-address ip-address [src-ip-addr]
        — no gi-address
        — [no] option
          — action {replace | drop | keep}
          — no action
          — circuit-id {ascii-tuple | ifindex | if-name | port-id | vlan-ascii-tuple | none}
          — no circuit-id
          — remote-id [{mac | string string}]
          — no remote-id
          — [no] vendor-specific-option
            — [no] client-mac-address

```

```

— [no] pool-name
— [no] port-id
— [no] service-id
— string text
— no string
— [no] system-id
— python-policy python-policy-name
— no python-policy
— [no] relay-plain-bootp
— server server [server]
— no server
— [no] shutdown
— [no] trusted
— dist-cpu-protection policy-name
— no dist-cpu-protection
— egress
— filter ip ip-filter-id
— filter ipv6 ipv6-filter-id
— no filter [ip ip-filter-id] [ipv6 ipv6-filter-id]
— [no] enable-ingress-stats
— [no] enable-mac-accounting
— eth-cfm
— [no] mep mep-id domain md-index association ma-index
— collect-lmm-fc-stats
— fc fc-name [fc-name]
— no fc
— fc-in-profile fc-name [fc-name]
— no fc-in-profile
— grace
— eth-ed
— max-rx-defect-window seconds
— no max-rx-defect-window
— priority priority
— no priority
— [no] rx-eth-ed
— [no] tx-eth-ed
— eth-vsm-grace
— [no] rx-eth-vsm-grace
— [no] tx-eth-vsm-grace
— [no] lbm-svc-act-responder
— [no] gre-termination
— hold-time
— down ip seconds [init-only]
— no down ip
— down ipv6 seconds [init-only]
— no down ipv6
— up ip seconds
— no up ip
— up ipv6 seconds
— no up ipv6
— icmp
— [no] mask-reply
— param-problem [number seconds]
— no param-problem

```

- **redirects** *[number seconds]*
- **no redirects**
- **ttl-expired** *[number seconds]*
- **no ttl-expired**
- **unreachables** *[number seconds]*
- **no unreachables**
- **if-attribute**
 - **[no] admin-group** *group-name [group-name]*
 - **no admin-group**
 - **[no] srlg-group** *group-name [group-name]*
 - **no srlg-group**
- **ingress**
 - **filter ip** *ip-filter-id*
 - **filter ipv6** *ipv6-filter-id*
 - **no filter** *[ip ip-filter-id] [ipv6 ipv6-filter-id]*
- **ip-helper-address** *gateway-address*
- **no ip-helper-address**
- **ip-mtu** *octets*
- **no ip-mtu**
- **ip-tunnel**
 - **remote-ip** *ip-address*
 - **no remote-ip**
- **lag-link-map-profile** *lnk-map-profile-id*
- **no lag-link-map-profile**
- **lag-per-link-hash** **class** *class* **weight** *[weight]*
- **no lag-per-link-hash**
- **ldp-sync-timer** *seconds [end-of-lib]*
- **no ldp-sync-timer**
- **load-balancing**
 - **egr-ip-load-balancing** *{source | destination | inner-ip}*
 - **no egr-ip-load-balancing**
 - **lsr-load-balancing** *{lbl-only | lbl-ip | ip-only | eth-encap-ip | lbl-ip-l4-teid}*
 - **no lsr-load-balancing**
 - **[no] spi-load-balancing**
 - **[no] teid-load-balancing**
- **[no] local-proxy-arp**
- **[no] loopback**
- **mac** *ieee-address*
- **no mac**
- **[no] network-domain** *network-domain-name*
- **port** *port-name*
- **no port**
- **proxy-arp-policy** *policy-name [policy-name]*
- **no proxy-arp-policy**
- **[no] ptp-hw-assist**
- **qos** *network-policy-id*
- **qos** *network-policy-id* **egress-port-redirect-group** *queue-group-name* **egress-instance** *instance-id* **ingress-fp-redirect-group** *queue-group-name* **ingress-instance** *instance-id*
- **qos** *network-policy-id* **egress-port-redirect-group** *queue-group-name* **egress-instance** *instance-id*
- **qos** *network-policy-id* **ingress-fp-redirect-group** *queue-group-name* **ingress-instance** *instance-id*

- **no qos**
- **qos-route-lookup** [{source | destination}]
- **no qos-route-lookup**
- [no] **remote-proxy-arp**
- **secondary** {ip-address/mask | ip-address netmask} [broadcast {all-ones | host-ones}] [igmp-inhibit] [track-srrp srrp-instance]
- **no secondary** {ip-address/mask | ip-address netmask}
- [no] **shutdown**
- **static-arp** ip-address ieee-address
- **no static-arp** ip-address
- **static-arp** ieee-address unnumbered
- **no static-arp** unnumbered
- [no] **strip-label**
- **tcp-mss** mss-value
- **no tcp-mss**
- **tos-marking-state** {trusted | untrusted}
- **no tos-marking-state**
- **unnumbered** [{ip-int-name | ip-address}]
- **no unnumbered**
- **untrusted** [default-forwarding default-forwarding]
- **no untrusted**
- [no] **urpf-check**
 - [no] **ignore-default**
 - **mode** {strict | loose | strict-no-ecmp}
- [no] **urpf-selected-vprns**
- **vas-if-type** {to-from-access | to-from-network | to-from-both}
- **no vas-if-type**
- **route-next-hop-policy**
 - [no] **template** name
 - **description** description-string
 - **no description**
 - [no] **exclude-group** ip-admin-group-name
 - **include-group** ip-admin-group-name [pref preference]
 - **no include-group** ip-admin-group-name
 - **nh-type** {ip | tunnel}
 - **no nh-type**
 - **protection-type** {link | node}
 - **no protection-type**
 - [no] **srlg-enable**

For router interface VRRP commands, refer to the VRRP Configuration Command Reference section.

2.13.1.5 Router Interface IPv6 Commands

- ```
config
— router [router-instance] [create]
— [no] router [router-instance]
 — [no] interface interface-name
 — [no] ipv6
```

- **address** *ipv6-address/prefix-length* [**eui-64**] [**track-srrp** *srrp-instance*]  
[**modifier** *cga-modifier*] [**dad-disable**] [**primary-preference**  
*primary-preference*]
- **no address** *ipv6-address/prefix-length*
- **bfd** *transmit-interval* [**receive** *receive-interval*] [**multiplier** *multiplier*]  
[**echo-receive** *echo-interval*] [**type** *cpm-np*]
- **no bfd**
- [**no**] **dad-disable**
- [**no**] **forward-ipv4-packets**
- **icmp6**
  - **packet-too-big** [*number seconds*]
  - **no packet-too-big**
  - **param-problem** [*number seconds*]
  - **no param-problem**
  - **redirects** [*number seconds*]
  - **no redirects**
  - **time-exceeded** [*number seconds*]
  - **no time-exceeded**
  - **unreachables** [*number seconds*]
  - **no unreachables**
- **link-local-address** *ipv6-address* [**dad-disable**]
- **no link-local-address**
- [**no**] **local-proxy-nd**
- **nd-learn-unsolicited** {*global* | *link-local* | *both*}
- **no nd-learn-unsolicited**
- **nd-proactive-refresh** {*global* | *link-local* | *both*}
- **no nd-proactive-refresh**
- **neighbor** *ipv6-address mac-address*
- **no neighbor** *ipv6-address*
- **neighbor-limit** *limit* [**log-only**] [**threshold** *percent*]
- **no neighbor-limit**
- **proxy-nd-policy** *policy-name* [*policy-name*]
- **no proxy-nd-policy**
- **qos-route-lookup** [{*source* | *destination*}]
- **no qos-route-lookup**
- [**no**] **secure-nd**
  - [**no**] **allow-unsecured-msgs**
  - **link-local-modifier** *modifier*
  - **no link-local-modifier**
  - **public-key-min-bits** *bits*
  - **no public-key-min-bits**
  - **security-parameter** *sec*
  - **no security-parameter**
  - [**no**] **shutdown**
- **stale-time** *seconds*
- **no stale-time**
- **tcp-mss** *mss-value*
- **no tcp-mss**
- [**no**] **urpf-check**
  - [**no**] **ignore-default**
  - **mode** {*strict* | *loose* | *strict-no-ecmp*}

## 2.13.1.6 Router Advertisement Commands

```

config
— router [router-instance] [create]
— no router [router-instance]
 — [no] router-advertisement
 — [no] dns-options
 — rdnss-lifetime seconds
 — rdnss-lifetime infinite
 — no rdnss-lifetime
 — server ipv6-address [ipv6-address]
 — no server
 — [no] interface ip-int-name
 — current-hop-limit number
 — no current-hop-limit
 — [no] dns-options
 — [no] include-dns
 — rdnss-lifetime seconds
 — rdnss-lifetime infinite
 — no rdnss-lifetime
 — server ipv6-address [ipv6-address]
 — no server
 — [no] managed-configuration
 — max-advertisement-interval seconds
 — no max-advertisement-interval
 — min-advertisement-interval seconds
 — no min-advertisement-interval
 — mtu mtu-bytes
 — no mtu
 — [no] other-stateful-configuration
 — [no] prefix ipv6-prefix/prefix-length
 — [no] autonomous
 — [no] on-link
 — preferred-lifetime {seconds | infinite}
 — no preferred-lifetime
 — valid-lifetime {seconds | infinite}
 — no valid-lifetime
 — reachable-time milli-seconds
 — no reachable-time
 — retransmit-time milli-seconds
 — no retransmit-time
 — router-lifetime seconds
 — no router-lifetime
 — [no] shutdown
 — [no] use-virtual-mac

```

## 2.13.2 Command Descriptions

### 2.13.2.1 Generic Commands

#### shutdown

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] shutdown</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>router>if<br>config>router>mtrace2<br>config>router>origin-validation>rpki-session<br>config>router>static-route-entry>black-hole<br>config>router>static-route-entry>indirect<br>config>router>static-route-entry>next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>The <b>shutdown</b> command administratively disables the entity. When disabled, an entity does not change, reset, or remove any configuration settings or statistics. Many entities must be explicitly enabled using the <b>no shutdown</b> command.</p> <p>The <b>shutdown</b> command administratively disables an entity. The operational state of the entity is disabled as well as the operational state of any entities contained within. Many objects must be shut down before they may be deleted.</p> <p>Unlike other commands and parameters where the default state is not indicated in the configuration file, <b>shutdown</b> and <b>no shutdown</b> are always indicated in system generated configuration files.</p> <p>The <b>no</b> form of the command puts an entity into the administratively enabled state.</p> |
| <b>Default</b>     | no shutdown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

#### description

|                |                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>description</b> <i>description-string</i><br><b>no description</b>                                                                                                                                                                                         |
| <b>Context</b> | config>router>if>dhcp<br>config>router>if>vrrp<br>config>router>l2tp>group<br>config>router>l2tp>group>tunnel<br>config>router>network-domains>network-domain<br>config>router>origin-validation>rpki-session<br>config>router>route-next-hop-policy>template |

---

|                    |                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command creates a text description stored in the configuration file for a configuration context.<br><br>The <b>no</b> form of the command removes the description string from the context.                                                                                                     |
| <b>Default</b>     | no description                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b>  | <i>description-string</i> — The description character string. Allowed values are any string up to 80 characters long, composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes. |

## description

|                    |                                                                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>description</b> <i>description-string</i><br><b>no description</b> [ <i>description-string</i> ]                                                                                                                                                                                                |
| <b>Context</b>     | config>router>static-route-entry>black-hole<br>config>router>static-route-entry>indirect<br>config>router>static-route-entry>next-hop                                                                                                                                                              |
| <b>Description</b> | This command creates a text description stored in the configuration file for a configuration context.<br><br>The <b>no</b> form of the command removes the description string from the context                                                                                                     |
| <b>Default</b>     | no description                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <i>description-string</i> — The description character string. Allowed values are any string up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes. |

## description

|                    |                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>description</b> <i>long-description-string</i><br><b>no description</b>                                                                                                                      |
| <b>Context</b>     | config>router>if                                                                                                                                                                                |
| <b>Description</b> | This command creates a text description stored in the configuration file for a configuration context.<br><br>The <b>no</b> form of the command removes the description string from the context. |
| <b>Default</b>     | no description                                                                                                                                                                                  |



**Parameters**     *long-description-string* — The description character string. Allowed values are any string up to 160 characters long, composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes.

### 2.13.2.2 Router Global Commands

#### router

**Syntax**     **router** [*router-instance*] [**create**]  
              **no router** [*router-instance*]

**Context**     config

**Description**     This command enables the context to configure router parameters including interfaces, route policies and protocols. This command is also used to create CPM router instances.

For CPM router instances, this command enters or creates a user-created CPM router instance. A CPM router instance is a not a VPRN router instance. VPRN router instances are configured under **configure service vprn**. CPM router instances are the only type of non-VPRN router instances that can be created by a user, and they have a user-defined name. CPM router instances only use CPM/CCM ethernet ports as interfaces.

**Parameters**     *router-instance* — Specifies the router name or CPM router instance.

**Values**

*router-instance* : *router name*

|                    |                                        |
|--------------------|----------------------------------------|
| <i>router-name</i> | Base   management   <i>cpm-vr-name</i> |
| <i>cpm-vr-name</i> | [32 characters maximum]                |

**Default**     Base

**create** — Mandatory keyword when creating a router instance. The create keyword requirement can be enabled or disabled in the **environment>create** context.

#### admin-tags

**Syntax**     **admin-tags**

**Context**     config>router

---

|                    |                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command enables the context for the configuration of admin tags and router admin tag policy templates used for route resolution to LSPs. |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|

## admin-tag

|                    |                                                                                                                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] admin-tag</b> <i>tag</i>                                                                                                                                                                       |
| <b>Context</b>     | config>router>admin-tags                                                                                                                                                                               |
| <b>Description</b> | This command configures an admin tag value in the nodal LSP administrative tag database.<br><br>Up to 64 admin tags can be configured.<br><br>The <b>no</b> form of the command removes the admin tag. |
| <b>Parameters</b>  | <i>tag</i> — The value of the administrative tag, up to 32 characters.                                                                                                                                 |

## route-admin-tag-policy

|                    |                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] route-admin-tag-policy</b> <i>policy-name</i>                                                                                                                                    |
| <b>Context</b>     | config>router>admin-tags                                                                                                                                                                 |
| <b>Description</b> | This command configures a route admin tag policy.<br><br>Up to 2,000 policies can be configured per system.<br><br>The <b>no</b> form of the command removes the route admin tag policy. |
| <b>Parameters</b>  | <i>policy-name</i> — The name of the route admin tag policy, up to 32 characters.                                                                                                        |

## exclude

|                    |                                                                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] exclude</b> <i>tag</i>                                                                                                                                                                                                                 |
| <b>Context</b>     | config>router>admin-tags>route-admin-tag-policy                                                                                                                                                                                                |
| <b>Description</b> | This configures an admin tag to be excluded when matching a route against an LSP.<br><br>Up to eight exclusion statements are supported per policy.<br><br>The <b>no</b> form of the command removes the admin tag from the exclude statement. |
| <b>Parameters</b>  | <i>tag</i> — The value of the admin tag, up to 32 characters.                                                                                                                                                                                  |

## include

|                    |                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] include tag</b>                                                                                                                                                                                                                               |
| <b>Context</b>     | config>router>admin-tags>route-admin-tag-policy                                                                                                                                                                                                       |
| <b>Description</b> | <p>This configures an admin tag to be included when matching a route against an LSP.</p> <p>Up to eight inclusion statements are supported per policy.</p> <p>The <b>no</b> form of the command removes the admin tag from the include statement.</p> |
| <b>Parameters</b>  | <i>tag</i> — The value of the admin tag, up to 32 characters.                                                                                                                                                                                         |

## aggregate

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>aggregate</b> <i>ip-prefix/ip-prefix-length</i> [<b>summary-only</b>] [<b>as-set</b>] [<b>aggregator</b> <i>as-number:ip-address</i>] [<b>black-hole</b> [<b>generate-icmp</b>]] [<b>community</b> <i>comm-id</i> [<i>comm-id</i>]] [<b>description</b> <i>description</i>] [<b>local-preference</b> <i>local-preference</i>]</p> <p><b>aggregate</b> <i>ip-prefix/ip-prefix-length</i> [<b>summary-only</b>] [<b>as-set</b>] [<b>aggregator</b> <i>as-number:ip-address</i>] [<b>community</b> <i>comm-id</i> [<i>comm-id</i>]] [<b>indirect</b> <i>ip-address</i>] [<b>description</b> <i>description</i>] [<b>local-preference</b> <i>local-preference</i>]</p> <p><b>no aggregate</b> <i>ip-prefix/ip-prefix-length</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>This command creates an aggregate route.</p> <p>Use this command to automatically install an aggregate route in the routing table when there are one or more component routes. A component route is any route used for forwarding that is a more-specific match of the aggregate.</p> <p>The use of aggregate routes can reduce the number of routes that need to be advertised to neighbor routers, leading to smaller routing table sizes.</p> <p>Overlapping aggregate routes may be configured; in this case a route becomes a component of only the one aggregate route with the longest prefix match. For example if one aggregate is configured as 10.0.0.0/16 and another as 10.0.0.0/24, then route 10.0.128/17 would be aggregated into 10.0.0.0/16, and route 10.0.0.128/25 would be aggregated into 10.0.0.0/24. If multiple entries are made with the same prefix and the same mask the previous entry is overwritten.</p> <p>A standard 4-byte BGP community may be associated with an aggregate route in order to facilitate route policy matching.</p> <p>By default aggregate routes are not installed in the forwarding table, however there are configuration options that allow an aggregate route to be installed with a black-hole next hop or with an indirect IP address as next hop.</p> <p>The <b>no</b> form of the command removes the aggregate.</p> |

---

|                    |                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------|
| <b>Default</b>     | no aggregate                                                                                  |
| <b>Parameters</b>  | <i>ip-prefix</i> — The destination address of the aggregate route in dotted decimal notation. |
| <b>Values</b>      | The following values apply to the 7750 SR and 7950 XRS:                                       |
| ipv4-prefix        | a.b.c.d (host bits must be 0)                                                                 |
| ipv4-prefix-length | 0 to 32                                                                                       |
| ipv6-prefix        | x:x:x:x:x:x:x (eight 16-bit pieces)                                                           |
|                    | x:x:x:x:x:d.d.d.d                                                                             |
|                    | x: [0 to FFFF]H                                                                               |
|                    | d: [0 to 255]D                                                                                |
| ipv6-prefix-length | 0 to 128                                                                                      |

**Values** The following values apply to the 7450 ESS:

|                    |                               |
|--------------------|-------------------------------|
| ipv4-prefix        | a.b.c.d (host bits must be 0) |
| ipv4-prefix-length | 0 to 32                       |

*ip-prefix-length* — The mask associated with the network address expressed as a mask length.

**Values** 0 to 32

**summary-only** — This optional parameter suppresses advertisement of more specific component routes for the aggregate.

To remove the **summary-only** option, enter the same aggregate command without the **summary-only** parameter.

**as-set** — This optional parameter is only applicable to BGP and creates an aggregate where the path advertised for this route will be an AS\_SET consisting of all elements contained in all paths that are being summarized. Use this feature carefully as it can increase the amount of route churn due to best path changes.

*as-number:ip-address* — This optional parameter specifies the BGP aggregator path attribute to the aggregate route. When configuring the aggregator, a two-octet AS number used to form the aggregate route must be entered, followed by the IP address of the BGP system that created the aggregate route.

**black-hole** — This optional parameter installs the aggregate route, when activated, in the FIB with a black-hole next-hop, where packets matching this route are discarded.

**generate-icmp** — Mandatory keyword to generate an ICMP.

**community** — This configuration option associates a BGP community with the aggregate route. The community can be matched in route policies and is automatically added to BGP routes exported from the aggregate route.

*comm-id* — Specifies a BGP community value, up to 72 characters. A maximum of twelve community IDs can be specified in a single statement.

**Values** *[as-num:comm-val | well-known-comm | ext-comm | large-comm]*

where:

- *as-num* — 0 to 65535
- *comm-val* — 0 to 65535
- *well-known-comm* — **null | no-export | no-export-subconfed | no-advertise | llgr-stale | no-llgr | blackhole**
- *ext-comm* — the extended community, defined as one of the following:

–{*target | origin*}:*ip-address:comm-val*  
–{*target | origin*}:*asnum:ext-comm-val*  
–{*target | origin*}:*ext-asnum:comm-val*  
–**bandwidth**:*asnum:val-in-mbps*  
–**ext:4300**:*ovstate*  
–**ext**:*value1:value2*  
–**color**:*co-bits:color-value*

where:

–*target* — route target  
–*origin* — route origin  
–*ip-address* — a.b.c.d  
–*ext-comm-val* — 0 to 4294967295  
–*ext-asnum* — 0 to 4294967295  
–*val-in-mbps* — 0 to 16777215  
–*ovstate* — 0, 1, or 2 (0 for valid, 1 for not found, 2 for invalid)  
–*value1* — 0000 to FFFF  
–*value2* — 0 to FFFFFFFFFFFFFFFF  
–*co-bits* — 00, 01, 10 or 11  
–*color-value* — 0 to 4294967295

- *large-comm* — *asn-or-ex:val-or-ex:val-or-ex*

**indirect ip-address** — This configuration option specifies that the aggregate route should be installed in the FIB with a next-hop taken from the route used to forward packets to *ip-address*.

**Values** The following values apply to the 7750 SR and 7950 XRS:

|             |                     |
|-------------|---------------------|
| ipv4-prefix | a.b.c.d             |
| ipv6-prefix | x:x:x:x:x:x:x       |
|             | x:x:x:x:x:x:d.d.d.d |
|             | x: [0 to FFFF]H     |
|             | d: [0 to 255]D      |

**Values** The following values apply to the 7450 ESS:  
ipv4-prefix: a.b.c.d

*description* — Specifies a text description stored in the configuration file for a configuration context, up to 80 characters.

*local-preference* — Specifies a BGP local-preference value with the aggregate route. The local-preference overrides the default local preference value of a BGP route originated by exporting the aggregate route.

**Values** 0 to 4294967295

autonomous-system

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>autonomous-system</b> <i>autonomous-system</i><br><b>no autonomous-system</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command configures the autonomous system (AS) number for the router. A router can only belong to one AS. An AS number is a globally unique number with an AS. This number is used to exchange exterior routing information with neighboring ASs and as an identifier of the AS itself.</p> <p>If the AS number is changed on a router with an active BGP instance, the new AS number is not used until the BGP instance is restarted either by administratively disabling/enabling (<b>shutdown/no shutdown</b>) the BGP instance or rebooting the system with the new configuration.</p> |
| <b>Default</b>     | no autonomous-system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <i>autonomous-system</i> — The autonomous system number expressed as a decimal integer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Values</b>      | 1 to 4294967295                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

class-forwarding

|                |                              |
|----------------|------------------------------|
| <b>Syntax</b>  | <b>[no] class-forwarding</b> |
| <b>Context</b> | config>router                |

**Description** This command enables class-based forwarding (CBF) over IGP shortcuts. When the **class-forwarding** command is enabled, the following types of packets are forwarded based on their forwarding class:

- packets of BGP prefixes
- CPM originated packets for the families (IPv4 only, IPv6 only, or both IPv4 and IPv6) which have been enabled over IGP shortcuts using the **igp-shortcut** CLI context in one or more IGP instances

The SR OS CBF implementation supports spraying of packets over a maximum of four forwarding sets of ECMP LSPs. The user must define a class-forwarding policy object in MPLS to configure the mapping of FCs to the forwarding sets. Then, the user assigns the CBF policy name and set ID to each MPLS LSP that is used in IGP shortcuts.

When a BGP IPv4 or IPv6 prefix is resolved, the FC of the packet is used to look up the forwarding set ID. Then, a modulo operation is performed on the tunnel next-hops of this set ID only, to spray packets of this FC. The data path concurrently implements CBF and ECMP within the tunnels of each set ID.

CPM-originated packets on the router, including control plane and OAM packets, are forwarded over a single LSP from the set of LSPs that the packet's FC is mapped to, as per the CBF configuration.



**Note:** Weighted ECMP, at the transport tunnel level of BGP prefixes over IGP shortcuts and the CBF feature on a per BGP next-hop basis are mutually exclusive.

**Default** no class-forwarding

## confederation

**Syntax** **confederation** *confed-as-num* [**members** *as-number* [*as-number*]]  
**no confederation** *confed-as-num* **members** *as-number* [*as-number*]  
**no confederation**

**Context** config>router

**Description** This command creates confederation autonomous systems within an AS.

This technique is used to reduce the number of IBGP sessions required within an AS. Route reflection is another technique that is commonly deployed to reduce the number of IBGP sessions.

The **no** form of the command deletes the specified member AS from the confederation.

When no members are specified in the **no** statement, the entire list is removed and **confederation** is disabled.

When the last member of the list is removed, **confederation** is disabled.

**Default** no confederation - no confederations are defined.

**Parameters** *confed-as-num* — The confederation AS number expressed as a decimal integer.

**Values** 1 to 65535

*as-number* — The AS number of members that are part of the confederation, expressed as a decimal integer. Up to 15 members per *confed-as-num* can be configured.

**Values** 1 to 65535

## ecmp

**Syntax** **ecmp** *max-ecmp-routes*  
**no ecmp**

**Context** config>router

**Description** This command enables ECMP and configures the number of routes for path sharing; for example, the value 2 means two equal cost routes will be used for cost sharing.

ECMP can only be used for routes learned with the same preference and same protocol.

When more ECMP routes are available at the best preference than configured in *max-ecmp-routes*, then the lowest next-hop IP address algorithm is used to select the number of routes configured in *max-ecmp-routes*.

The **no** form of the command disables ECMP path sharing. If ECMP is disabled and multiple routes are available at the best preference and equal cost, then the route with the lowest next-hop IP address is used.

**Default** no ecmp

**Parameters** *max-ecmp-routes* — The maximum number of equal cost routes allowed on this routing table instance, expressed as a decimal integer. Setting ECMP *max-ecmp-routes* to 1 yields the same result as entering **no ecmp**.

**Values** 0 to 64

## entropy-label

**Syntax** [**no**] **entropy-label**

**Context** config>router



**Description** If **entropy-label** is configured, the Entropy label and Entropy Label Indicator is inserted on packets for which at least one LSP in the stack for the far-end of the LDP or RSVP tunnel used by an IGP or BGP shortcut has advertised entropy-label-capability. If the tunnel is of type RSVP, then **entropy-label** must also have been enabled under **config>router>mpls** or **config>router>mpls>lsp**.

This configuration will result in other traffic that is forwarded over an LDP or RSVP LSP for which this router is the LER, and for which there is no explicit service endpoint on this router, to have the EL/ELI enabled, subject to the LSP far-end advertising entropy-label-capability. An example of such traffic includes packets arriving on a stitched LDP LSP forwarded over an RSVP LSP.

**Default** no entropy-label

## fib-priority

**Syntax** **fib-priority** {**high** | **standard**}

**Context** config>router

**Description** This command specifies the FIB priority for VPRN BGP routes.

**Default** fib-priority standard

**Parameters** **high** — Specifies the high FIB priority.  
**standard** — Specifies the standard FIB priority.

## fib-telemetry

**Syntax** [**no**] **fib-telemetry**

**Context** config>router

**Description** This command enables the collection of extra state information related to the forwarding table state of certain IP routes, TTM tunnels, and MPLS LFIB entries. This extra state can be retrieved by gNMI telemetry subscriptions targeted to the following YANG paths:

- /state/router/route-fib
- /state/router/tunnel-fib
- /state/router/label-fib

If this command is not configured, no information is displayed by the following **show** commands:

- **show>router>fib-telemetry>route**
- **show>router>fib-telemetry>tunnel**

The **no** form of the command disables the collection of this extra state.

**Default** no fib-telemetry

## flowspec

**Syntax** flowspec

**Context** config>router

**Description** This command enables the context to configure flowspec-related parameters for the specified routing instance.

## ip-filter-max-size

**Syntax** ip-filter-max-size {*value* | **default**}

**Context** config>router>flowspec

**Description** This command configures the maximum number of flowspec routes or rules that can be embedded into the auto-created embedded filter (fSpec-X). Flowspec filter entries embedded in a filter policy in this routing instance will use filter entries from the range between “embedding offset + 1” and “embedding offset + ip-filter-max-size”.

The sum of the **ip-filter-max-size** *value* parameter and the highest offset in any IPv4 filter that embeds IPv4 flowspec rules from this routing instance (excluding filters that embed at offset 262143) must not exceed 262143.

The **ip-filter-max-size** configuration can be adjusted up or down at any time. If the number of IPv4 flowspec rules that are currently installed is *M*, and the new limit is *N*, where  $N < M$ , then the last set of rules from *N* to *M* (by flowspec order) are immediately removed, but are retained in the BGP RIB. If the limit is increased, new rules are programmed only as they are received again in new BGP updates.

**Default** ip-filter-max-size 512

**Parameters** *value* — The maximum number of flowspec routes or rules that can be embedded into an ingress IP filter policy.

**Values** 0 to 262143

**default** — Keyword to configure the maximum size as 512.

## ipv6-filter-max-size

**Syntax** ipv6-filter-max-size {*value* | **default**}

**Context** config>router>flowspec

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command configures the maximum number of IPv6 flowspec routes or rules that can be embedded into the auto-created embedded filter (fSpec-X). Flowspec filter entries embedded in a filter policy in this routing instance will use filter entries from the range between “embedding offset + 1” and “embedding offset + ip-filter-max-size”.</p> <p>The sum of the <b>ipv6-filter-max-size</b> <i>value</i> parameter and the highest offset in any IPv6 filter that embeds IPv6 flowspec rules from this routing instance (excluding filters that embed at offset 262143) must not exceed 262143.</p> <p>The <b>ipv6-filter-max-size</b> configuration can be adjusted up or down at any time. If the number of IPv6 flowspec rules that are currently installed is <i>M</i>, and the new limit is <i>N</i>, where <math>N &lt; M</math>, then the last set of rules from <i>N</i> to <i>M</i> (by flowspec order) are immediately removed, but are retained in the BGP RIB. If the limit is increased, new rules are programmed only as they are received again in new BGP updates.</p> |
| <b>Default</b>     | ipv6-filter-max-size 512                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <p><i>value</i> — The maximum number of flowspec routes or rules that can be embedded into an ingress IP filter policy.</p> <p><b>Values</b>      0 to 262143</p> <p><b>default</b> — Keyword to configure the maximum size as 512.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## icmp-tunneling

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] icmp-tunneling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>This command enables the tunneling of ICMP reply packets over MPLS LSP at a LSR node as per RFC 3032.</p> <p>The LSR part of this feature consists of crafting the reply ICMP packet of type=11- 'time exceeded', with a source address set to a local address of the LSR node, and appending the IP header and leading payload octets of the original datagram. The system skips the lookup of the source address of the sender of the label TTL expiry packet, which becomes the destination address of the ICMP reply packet. Instead, CPM injects the ICMP reply packet in the forward direction of the MPLS LSP the label TTL expiry packet was received from. The TTL of pushed labels should be set to 255.</p> <p>The source address of the ICMP reply packet is determined as follows. The LSR uses the address of the outgoing interface for the MPLS LSP. With LDP LSP or BGP LSP multiple ECMP next-hops can exist and in such a case the first outgoing interface is selected. If that interface does not have an address of the same family (IPv4 or IPv6) as the ICMP packet, then the system address of the same family is selected. If one is not configured, the packet is dropped.</p> |

When the packet is received by the egress LER, it performs a regular user packet lookup in the data path in the GRT context for BGP shortcut, 6PE, and BGP label route prefixes, or in VPRN context for VPRN and 6VPE prefixes. It then forwards it to the destination, which is the sender of the original packet which TTL expired at the LSR.

If the egress LER does not have a route to the destination of the ICMP packet, it drops the packets.

The rate of the tunneled ICMP replies at the LSR can be directly or indirectly controlled by the existing IOM level and CPM levels mechanisms. Specifically, the rate of the incoming UDP traceroute packets received with a label stack can be controlled at ingress IOM using the distributed CPU protection feature. The rate of the ICMP replies by CPM can also be directly controlled by configuring a system wide rate limit for packets ICMP replies to MPLS expired packets which are successfully forwarded to CPM using the command 'configure system security vprn-network-exceptions'. While this command's name refers to VPRN service, this feature rate limits ICMP replies for packets received with any label stack, including VPRN and shortcuts.

The 7450 ESS, 7750 SR, and 7950 XRS implementation supports appending to the ICMP reply of type Time Exceeded the MPLS label stack object defined in RFC 4950. It does not include it in the ICMP reply type of Destination unreachable.

The new MPLS Label Stack object permits an LSR to include label stack information including label value, EXP, and TTL field values, from the encapsulation header of the packet that expired at the LSR node. The ICMP message continues to include the IP header and leading payload octets of the original datagram.

In order to include the MPLS Label Stack object, SR OS implementation adds support of RFC 4884 which defines extensions for a multi-part ICMPv4/v6 message of type Time Exceeded.

The **no** form of command disables the tunneling of ICMP reply packets over MPLS LSP at a LSR node.

**Default** no icmp-tunneling

## ip-fast-reroute

**Syntax** [no] ip-fast-reroute

**Context** config>router

**Description** This command enables IP Fast-Reroute (FRR) feature on the system.

This feature provides for the use of a Loop-Free Alternate (LFA) backup next-hop for forwarding in-transit and CPM generated IP packets when the primary next-hop is not available. IP FRR is supported on IPv4 and IPv6 OSPF/IS-IS prefixes forwarded in the base router instance to a network IP interface or to an IES SAP interface or spoke interface. It is also supported for VPRN VPN-IPv4 OSPF prefixes and VPN-IPv6 OSPF prefixes forwarded to a VPRN SAP interface or spoke interface.

IP FRR also provides a LFA backup next-hop for the destination prefix of a GRE tunnel used in an SDP or in VPRN auto-bind.

When any of the following events occurs, IGP instructs in the fast path on the XMA's to enable the LFA backup next-hop:

- OSPF/IS-IS interface goes operationally down: physical or local admin shutdown.
- Timeout of a BFD session to a next-hop when BFD is enabled on the OSPF/IS-IS interface

When the SPF computation determines there is more than one primary next-hop for a prefix, it will not program any LFA next-hop in RTM. Therefore, the IP prefix will resolve to the multiple equal-cost primary next-hops that provide the required protection.

The **no** form of this command disables the IP FRR feature on the system

**Default** no ip-fast-reroute

## ldp-shortcut

**Syntax** **ldp-shortcut [ipv4] [ipv6]**  
**no ldp-shortcut**

**Context** config>router

**Description** This command enables the resolution of IGP routes using LDP LSP across all network interfaces participating in the IS-IS and OSPF routing protocol in the system.

When LDP shortcut is enabled, LDP populates the routing table with next-hop entries corresponding to all prefixes for which it activated an LDP FEC. For a given prefix, two route entries are populated in the system routing table. One route corresponds to the LDP shortcut next-hop and has an owner of LDP. The other route is the regular IP next-hop. The LDP shortcut next-hop always has preference over the regular IP next-hop for forwarding user packets and specified control packets over a given outgoing interface to the route next-hop.

All user and specified control packets for which the longest prefix match in RTM yields the FEC prefix will be forwarded over the LDP LSP.

When an IPv4 packet is received on an ingress network interface, a subscriber IES interface, or a regular IES interface, the lookup of the packet by the ingress IOM, IMMM, or XMA will result in the packet being sent labeled with the label stack corresponding to the NHLFE of the LDP LSP when the preferred RTM entry corresponds to an LDP shortcut.

If the preferred RTM entry corresponds to an IP next-hop, the IPv4 packet is forwarded unlabeled.

When ECMP is enabled and multiple equal-cost next-hops exit for the IGP route, the ingress IOM, IMMM, or XMA will spray the packets for this route based on hashing routine currently supported for IPv4 packets. When the preferred RTM entry corresponds to an LDP shortcut route, spraying will be performed across the multiple next-hops for the LDP FEC. The FEC next-hops can either be direct link LDP neighbors or T-LDP neighbors reachable over RSVP LSPs in the case of LDP-over-RSVP but not both.

When the preferred RTM entry corresponds to a regular IP route, spraying will be performed across regular IP next-hops for the prefix.

The **no** form of this command disables the resolution of IGP routes using LDP shortcuts.

**Default** no ldp-shortcut

## leak-export

**Syntax** **leak-export** *plcy-or-long-expr* [*plcy-or-expr* [*plcy-or-expr*]]  
**no leak-export**

**Context** config>router

**Description** This command associates up to four policies to control the leaking of GRT routes into the associated VPRN.

If a route is being evaluated and the action is accept, then that route is subject leaking into an associated VPRN instance assuming the route is fully resolved and active.

This process creates the pool of routes that can be leaked. Within each VPRN a corresponding **import-grt** policy must be configured to import select routes into that specific VPRN instance.

The **no** form of this command removes all route leaking policy associations and effectively disables the leaking of GRT routes into associated VPRNs.

**Parameters** *plcy-or-long-expr* — Specifies the route policy name, up to 64 characters or a policy logical expression, up to 255 characters.

**Values** *plcy-or-long-expr*: *policy-name* | *long-expr*  
*policy-name*: up to 64 characters  
*long-expr*: up to 255 characters

*plcy-or-expr* — Specifies the route policy name, up to 64 characters or a policy logical expression, up to 64 characters long. A maximum of four policy names or policy logical expressions can be specified in a single statement.

**Values** *plcy-or-expr*: *policy-name* | *expr*  
*policy-name*: up to 64 characters

*expr.* up to 64 characters

## leak-export-limit

|                    |                                                                                                                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] leak-export-limit</b> [ <i>value</i> ]                                                                                                                                                               |
| <b>Context</b>     | config>router                                                                                                                                                                                                |
| <b>Description</b> | <p>This command sets a maximum limit on the number of GRT routes that can be leaked into VPRNs.</p> <p>The <b>no</b> form of this command resets the <b>leak-export-limit</b> to its default value of 5.</p> |
| <b>Default</b>     | leak-export-limit 5                                                                                                                                                                                          |
| <b>Parameters</b>  | <p><i>value</i> — Specifies the maximum number of GRT routes that are eligible to be leaked into VPRN instances.</p> <p><b>Values</b> 1 to 10000</p>                                                         |

## mc-maximum-routes

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>mc-maximum-routes</b> <i>number</i> [ <b>log-only</b> ] [ <b>threshold</b> <i>threshold</i> ]<br><b>no mc-maximum-routes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command specifies the maximum number of multicast routes that can be held within a VPN routing/forwarding (VRF) context. When this limit is reached, a log and SNMP trap are sent. If the <b>log-only</b> parameter is not specified and the maximum-routes value is set below the existing number of routes in a VRF, then no new joins will be processed.</p> <p>The <b>no</b> form of the command disables the limit of multicast routes within a VRF context. Issue the <b>no</b> form of the command only when the VPRN instance is shutdown.</p> |
| <b>Default</b>     | no mc-maximum-routes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <p><i>number</i> — Specifies the maximum number of routes to be held in a VRF context</p> <p><b>Values</b> 1 to 2147483647</p> <p><b>log-only</b> — Specifies that if the maximum limit is reached, only log the event. <b>log-only</b> does not disable the learning of new routes</p> <p><i>threshold</i> — The percentage at which a warning log message and SNMP trap should be sent.</p> <p><b>Values</b> 0 to 100</p> <p><b>Default</b> 10</p>                                                                                                           |

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## mss-adjust-group

|                    |                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>mss-adjust-group</b> <i>bb-group-id</i> <b>segment-size</b> <i>segment-size</i><br><b>no mss-adjust-group</b>                                                                                                                    |
| <b>Context</b>     | config>router<br>config>service>vprn                                                                                                                                                                                                |
| <b>Description</b> | This command associates the MSS adjust group consisting of multiple ISAs with the routing context in which the application requiring TCP MSS adjust resides.                                                                        |
| <b>Parameters</b>  | <i>bb-group-id</i> — Specifies the group used for TCP MSS adjust<br><i>segment-size</i> — Specifies the value to put into the TCP Maximum Segment Size (MSS) option if it is not already present, or if the present value is higher |

## mtrace2

|                    |                                                                   |
|--------------------|-------------------------------------------------------------------|
| <b>Syntax</b>      | <b>mtrace2</b>                                                    |
| <b>Context</b>     | config>router<br>config>service>vprn                              |
| <b>Description</b> | This command traces a multicast path from a source to a receiver. |

## udp-port

|                    |                                                                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>udp-port</b> <i>udp-port-number</i>                                                                                                                                                                                         |
| <b>Context</b>     | config>router>mtrace2<br>config>service>vprn>mtrace2                                                                                                                                                                           |
| <b>Description</b> | This command specifies the destination and listening port for the Mtrace2 command. When set, this command generates Mtrace2 packets with the set UDP-port, and also listens on the same port for any incoming Mtrace2 packets. |
| <b>Default</b>     | udp-port 5000                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <i>udp-port-number</i> — Specifies the UDP port for the test.<br><b>Values</b> 1024 to 49151                                                                                                                                   |

## multicast-info-policy

|               |                                                                                    |
|---------------|------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>multicast-info-policy</b> <i>policy-name</i><br><b>no multicast-info-policy</b> |
|---------------|------------------------------------------------------------------------------------|



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|                    |                                                       |
|--------------------|-------------------------------------------------------|
| <b>Context</b>     | config>router                                         |
| <b>Description</b> | This command configures multicast information policy. |
| <b>Default</b>     | no multicast-info-policy                              |
| <b>Parameters</b>  | <i>policy-name</i> — Specifies the policy name.       |
| <b>Values</b>      | 32 chars max                                          |

## network-domains

|                    |                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>network-domains</b>                                                                                                |
| <b>Context</b>     | config>router                                                                                                         |
| <b>Description</b> | This command opens context for defining network-domains. This command is applicable only in the base routing context. |

## network-domain

|                    |                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] <b>network-domain</b> <i>network-domain-name</i>                                            |
| <b>Context</b>     | config>router>network-domains                                                                    |
| <b>Description</b> | This command creates network-domains that can be associated with individual interfaces and SDPs. |
| <b>Default</b>     | network-domain "default"                                                                         |
| <b>Parameters</b>  | <i>network-domain-name</i> — Network domain name character string.                               |

## origin-validation

|                    |                                                                            |
|--------------------|----------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>origin-validation</b>                                                   |
| <b>Context</b>     | config>router                                                              |
| <b>Description</b> | This command enables the context to display origin validation information. |

## rpki-session

|                |                                            |
|----------------|--------------------------------------------|
| <b>Syntax</b>  | [no] <b>rpki-session</b> <i>ip-address</i> |
| <b>Context</b> | config>router>origin-validation            |

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|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command configures a session with an RPKI local cache server by using the RPKI-Router protocol. It is over these sessions that the router learns dynamic VRP entries expressing valid origin AS and prefix associations. SR OS supports the RPKI-Router protocol over TCP/IPv4 or TCP/IPv6 transport. The router can set up an RPKI-Router session using the base routing table (in-band) or the management router (out-of-band). Configure the command in the <b>config&gt;router management</b> instance to configure a session using the management port. |
| <b>Default</b>     | no rpki-session                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <i>ip-address</i> — An IPv4 address or an IPv6 address. If the IPv6 address is link-local then the interface name must be appended to the IPv6 address after a hyphen (-).                                                                                                                                                                                                                                                                                                                                                                                        |

## connect-retry

|                    |                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>connect-retry</b> <i>seconds</i><br><b>no connect-retry</b>                                                                                                                      |
| <b>Context</b>     | config>router>origin-validation>rpki-session                                                                                                                                        |
| <b>Description</b> | This command configures the time in seconds to wait between one TCP connection attempt that fails and the next attempt. The default (with <b>no connect-retry</b> ) is 120 seconds. |
| <b>Default</b>     | no connect-retry                                                                                                                                                                    |
| <b>Parameters</b>  | <i>seconds</i> — Specifies time in seconds.<br><b>Values</b> 1 to 65535                                                                                                             |

## local-address

|                    |                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>local-address</b> <i>ip-address</i><br><b>no local-address</b>                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>origin-validation>rpki-session                                                                                                                                                                                                                              |
| <b>Description</b> | This command configures the local address to use for setting up the TCP connection used by an RPKI-Router session. The default local-address is the outgoing interface IPv4 or IPv6 address. The local-address cannot be changed without first shutting down the session. |
| <b>Default</b>     | no local-address                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <i>ip-address</i> — Specifies an IPv4 address or an IPv6 address.                                                                                                                                                                                                         |

## port

|               |                            |
|---------------|----------------------------|
| <b>Syntax</b> | <b>port</b> <i>port-id</i> |
|---------------|----------------------------|

**no port**

|                    |                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>router>origin-validation>rpki-session                                                                                                                                                     |
| <b>Description</b> | This command configures the destination port number to use when contacting the cache server. The default port number is 323. The port cannot be changed without first shutting down the session. |
| <b>Default</b>     | no port                                                                                                                                                                                          |
| <b>Parameters</b>  | <i>port-id</i> — Specifies a port ID.                                                                                                                                                            |
|                    | <b>Values</b> 0 to 65535                                                                                                                                                                         |

## refresh-time

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>refresh-time</b> <i>seconds</i> <b>hold-time</b> <i>seconds</i><br><b>no refresh-time</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>origin-validation>rpki-session                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command is used to configure the <b>refresh-time</b> and <b>hold-time</b> intervals that are used for liveness detection of the RPKI-Router session. The <b>refresh-time</b> defaults to 300 seconds and is reset whenever a Reset Query PDU or Serial Query PDU is sent to the cache server. When the timer expires, a new Serial Query PDU is sent with the last known serial number.</p> <p>The <b>hold-time</b> specifies the length of time in seconds that the session is to be considered UP without any indication that the cache server is alive and reachable. The timer defaults to 600 seconds and must be at least 2x the refresh-time (otherwise the CLI command is not accepted). Reception of any PDU from the cache server resets the hold timer. When the <b>hold-time</b> expires, the session is considered to be DOWN and the stale timer is started.</p> |
| <b>Default</b>     | no refresh-time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>  | <i>seconds</i> — Specifies a time in seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                    | <b>Values</b> 30 to 32767                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                    | <i>seconds</i> — Specifies a time in seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                    | <b>Values</b> 60 to 65535                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## stale-time

|                |                                                          |
|----------------|----------------------------------------------------------|
| <b>Syntax</b>  | <b>stale-time</b> <i>seconds</i><br><b>no stale-time</b> |
| <b>Context</b> | config>router>origin-validation>rpki-session             |

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|                    |                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command configures the maximum length of time that prefix origin validation records learned from the cache server remain usable after the RPKI-Router session goes down. The default stale-time is 3600 seconds (1 hour). When the timer expires all remaining stale entries associated with the session are deleted. |
| <b>Default</b>     | no stale-time                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <i>seconds</i> — Specifies a time in seconds.                                                                                                                                                                                                                                                                              |
| <b>Values</b>      | 60 to 3600                                                                                                                                                                                                                                                                                                                 |

## static-entry

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>static-entry</b> <i>ip-prefix/ip-prefix-length upto prefix-length2 origin-as as-number</i> [{ <b>valid</b>   <b>invalid</b> }]<br><b>no static-entry</b> <i>ip-prefix/ip-prefix-length upto prefix-length2 origin-as as-number</i>                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>origin-validation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command configures a static VRP entry indicating that a specific origin AS is either valid or invalid for a specific IP prefix range. Static VRP entries are stored along with dynamic VRP entries (learned from local cache servers using the RPKI-Router protocol) in the origin validation database of the router. This database is used for determining the <b>origin-validation</b> state of IPv4 and/or IPv6 BGP routes received over sessions with the <b>enable-origin-validation</b> command configured.</p> <p>Static entries can only be configured under the <b>config&gt;router&gt;origin-validation</b> context of the base router.</p> |
| <b>Default</b>     | no static entries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>  | <p><i>ip-prefix/ip-prefix-length</i> — Specifies an IPv4 or IPv6 address with a minimum prefix length value.</p> <p><b>Values</b> 60 to 3600</p> <p><i>prefix-length2</i> — Specifies the maximum prefix length.</p> <p><b>Values</b> 1 to 128</p> <p><i>as-number</i> — Specifies as-number.</p> <p><b>Values</b> 0 to 4294967295</p> <p><b>valid</b> — Specifies a keyword meaning the static entry expresses a valid combination of origin AS and prefix range.</p> <p><b>invalid</b> — Specifies a keyword meaning the static entry expresses an invalid combination of origin AS and prefix range.</p>                                                   |

## router-id

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>router-id</b> <i>ip-address</i><br><b>no router-id</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command configures the router ID for the router instance.</p> <p>The router ID is used by both OSPF and BGP routing protocols in this instance of the routing table manager. IS-IS uses the router ID value as its system ID.</p> <p>When configuring a new router ID, protocols are not automatically restarted with the new router ID. The next time a protocol is initialized, the new router ID is used. This can result in an interim period of time when different protocols use different router IDs.</p> <p>It is possible to configure SR OS to operate with an IPv6 only BOF and no IPv4 system interface address. When configured in this manner, the operator must explicitly define IPv4 router IDs for protocols such as OSPF and BGP as there is no mechanism to derive the router ID from an IPv6 system interface address.</p> <p>To force the new router ID to be used, issue the <b>shutdown</b> and <b>no shutdown</b> commands for each protocol that uses the router ID, or restart the entire router.</p> <p>The <b>no</b> form of the command reverts to the default value.</p> |
| <b>Default</b>     | <p>The system uses the system interface address (which is also the loopback address).</p> <p>If a system interface address is not configured, use the last 32 bits of the chassis MAC address.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <i>ip-address</i> — The 32 bit router ID expressed in dotted decimal notation or as a decimal value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## service-prefix

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>service-prefix</b> { <i>ip-prefix</i> / <i>ip-prefix-length</i>   <i>ip-prefix netmask</i> } [ <b>exclusive</b> ]<br><b>no service-prefix</b> { <i>ip-prefix</i> / <i>ip-prefix-length</i>   <i>ip-prefix netmask</i> }                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command creates an IP address range reserved for IES or VPLS services.</p> <p>The purpose of reserving IP addresses using <b>service-prefix</b> is to provide a mechanism to reserve one or more address ranges for services.</p> <p>When services are defined, the address must be in the range specified as a service prefix. If a service prefix is defined, then IP addresses assigned for services must be within one of the ranges defined in the <b>service-prefix</b> command. If the <b>service-prefix</b> command is not configured, then no limitations exist.</p> |

Addresses in the range of a service prefix can be allocated to a network port unless the exclusive parameter is used. Then, the address range is exclusively reserved for services.

When a range that is a superset of a previously defined service prefix is defined, the subset is replaced with the superset definition; for example, if a service prefix exists for 10.10.10.0/24, and a service prefix is configured as 10.10.0.0/16, then 10.10.10.0/24 is replaced by the new 10.10.0.0/16 configuration.

When a range that is a subset of a previously defined service prefix is defined, the subset replaces the existing superset, providing addresses used by services are not affected; for example, if a service prefix exists for 10.10.0.0/16, and a service prefix is configured as 10.10.10.0/24, then the 10.10.0.0/16 entry is removed as long as no services are configured that use 10.10.x.x addresses other than 10.10.10.x.

The **no** form of the command removes all address reservations. A service prefix cannot be removed while one or more service uses an address or addresses in the range.

- Default** no service-prefix - No IP addresses are reserved for services.
- Parameters** *ip-prefix/ip-prefix-length* — The IP address prefix to include in the service prefix allocation in dotted decimal notation.

**Values**

|                     |                                     |              |
|---------------------|-------------------------------------|--------------|
| ipv4-prefix:        | a.b.c.d (host bits must be 0)       |              |
| ipv4-prefix-length: | 0 to 32                             |              |
| ipv6-prefix:        | x:x:x:x:x:x:x (eight 16-bit pieces) |              |
|                     | x:x:x:x:x:d.d.d.d                   |              |
|                     | x:                                  | [0 to FFFF]H |
|                     | d:                                  | [0 to 255]D  |
| ipv6-prefix-length: | 0 to 128                            |              |

**exclusive** — When this option is specified, the addresses configured are exclusively used for services and cannot be assigned to network ports.

- Values** exclusive

sgt-qos

- Syntax** **sgt-qos**
- Context** config>router
- Description** This command configures DSCP/dot1p re-marking for self-generated traffic.

## application

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>application</b> <i>dscp-app-name</i> <b>dscp</b> { <i>dscp-value</i>   <i>dscp-name</i> }<br><b>application</b> <i>dot1p-app-name</i> <b>dot1p</b> <i>dot1p-priority</i><br><b>no application</b> { <i>dscp-app-name</i>   <i>dot1p-app-name</i> }                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>router>sgt-qos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command configures DSCP or dot1p remarking for self-generated traffic. When an application is configured using this command, then the specified DSCP name/value is used for all packets generated by this application.</p> <p>Using the value configured in this command:</p> <ul style="list-style-type: none"> <li>• sets the DSCP bits in the IP packet</li> <li>• maps to the FC. This value will be signaled from the CPM to the egress forwarding complex.</li> <li>• based on this signaled FC, the egress forwarding complex QoS policy sets the IEEE 802.1p and MPLS EXP bits</li> <li>• the DSCP value in the egress IP header will be as configured in this command. The egress QoS policy will not overwrite this value.</li> </ul> <p>Only one DSCP name or value can be configured per application, if multiple entries are configured then the subsequent entry overrides the previous configured entry.</p> <p>The <b>no</b> form of this command resets the command back to the default value.</p>                                                                                            |
| <b>Parameters</b>  | <p><i>dscp-app-name</i> — Specifies the DSCP application name.</p> <p><b>Values</b> bgp, bmp, cflowd, dhcp, diameter, dns, ftp, grpc, gtp, http, icmp, igmp, igmp-reporter, l2tp, ldp, mld, mpls-udp-return, msdp, mtrace2, ndis, ntp, ospf, pcep, pim, ptp, radius, rip, rsvp, sflow, snmp, snmp-notification, srrp, ssh, syslog, tacplus, telnet, tftp, traceroute, vrrp</p> <p><i>dscp-value</i> — Specifies the DSCP value.</p> <p><b>Values</b> 0 to 63</p> <p><i>dscp-name</i> — Specifies the DSCP name.</p> <p>none, be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63</p> <p><i>dot1p-app-name</i> — Specifies the dot1p application name.</p> <p><b>Values</b> arp, isis, pppoe</p> <p><i>dot1p-priority</i> — Specifies the dot1p priority.</p> <p><b>Values</b> none, 0 to 7</p> |

---

## dscp

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dscp</b> <i>dscp-name</i> <b>fc</b> <i>fc-name</i><br><b>no dscp</b> <i>dscp-name</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>sgt-qos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | <p>This command creates a mapping between the DiffServ Code Point (DSCP) of the self-generated traffic and the forwarding class.</p> <p>Self-generated traffic that matches the specified DSCP will be assigned to the corresponding forwarding class. Multiple commands can be entered to define the association of some or all sixty-four DiffServ code points to the forwarding class. For undefined code points, packets are assigned to the forwarding class specified under the default-action command.</p> <p>All DSCP names that defines a DSCP value must be explicitly defined.</p> <p>The <b>no</b> form of this command removes the DiffServ code point to forwarding class association. The default-action then applies to that code point value.</p> |
| <b>Parameters</b>  | <p><i>dscp-name</i> — Specifies the DSCP name.</p> <p><b>Values</b>      be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63</p> <p><i>fc-name</i> — Specifies the forwarding class name.</p> <p><b>Values</b>      be, l2, af, l1, h2, ef, h1, nc</p>                                                                                                                                                                                     |

## single-sfm-overload

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>single-sfm-overload</b> [ <b>holdoff-time</b> <i>holdoff-time</i> ]<br><b>no single-sfm-overload</b>                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command configures OSPF, OSPFv3 and IS-IS to set overload when the router has fewer than the full set of SFMs functioning, which reduces forwarding capacity. Setting overload enables a router to still participate in exchanging routing information, but routes all traffic away from it.</p> <p>The conditions to set overload are as follows:</p> <ul style="list-style-type: none"> <li>• 7750 SR-12/SR-7 and 7450 ESS-12/ESS-7 platforms: protocol sets overload if one of the SF/CPMs fails</li> </ul> |



- 7750 SR-12e and 7950 XRS platforms: protocol sets overload if two SFMs fail (two SFMs belonging to different SFM pairs on the XRS-40)

The **no** form of this command configures the router to not set overload if an SFM fails.

|                   |                                                                                                               |
|-------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no single-sfm-overload                                                                                        |
| <b>Parameters</b> | <i>holdoff-time</i> — This parameter specifies the delay between detecting SFM failures and setting overload. |
| <b>Values</b>     | 1 to 600 seconds                                                                                              |
| <b>Default</b>    | 0 seconds                                                                                                     |

## static-route-entry

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>no static-route-entry</b> <i>ip-prefix/prefix-length</i> [ <b>mcast</b> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command creates a static route entry for both the network and access routes. A prefix and netmask must be specified.</p> <p>Once the static route context for the specified prefix and netmask has been created, additional parameters associated with the static routes may be specified through the inclusion of additional static route parameter commands</p> <p>The <b>no</b> form of the command deletes the static route entry. If a static route needs to be removed when multiple static routes exist to the same destination, then as many parameters to uniquely identify the static route must be entered</p> <p>IPv6 static routes are not supported on the 7450 ESS except in mixed mode.</p> |
| <b>Default</b>     | No static routes are defined.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <i>ip-prefix/prefix-length</i> — The destination address of the static route.<br><b>Values</b> The following values apply to the 7750 SR and 7950 XRS:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

---

|                    |                                        |              |
|--------------------|----------------------------------------|--------------|
| ipv4-prefix        | a.b.c.d (host bits must be 0)          |              |
| ipv4-prefix-length | 0 to 32                                |              |
| ipv6-prefix        | x::x::x::x::x::x (eight 16-bit pieces) |              |
|                    | x::x::x::x::d.d.d.d                    |              |
|                    | x                                      | [0 to FFFF]H |
|                    | d                                      | [0 to 255]D  |
| ipv6-prefix-length | 0 to 128                               |              |

**Values** The following values apply to the 7450 ESS:

|                    |                               |
|--------------------|-------------------------------|
| ipv4-prefix        | a.b.c.d (host bits must be 0) |
| ipv4-prefix-length | 0 to 32                       |

*ip-address* — The IP address of the IP interface. The *ip-addr* portion of the **address** command specifies the IP host address that will be used by the IP interface within the subnet. This address must be unique within the subnet and specified in dotted decimal notation.

**Values** The following values apply to the 7750 SR and 7950 XRS:

|              |                                                                              |
|--------------|------------------------------------------------------------------------------|
| ipv4-address | a.b.c.d (host bits must be 0)                                                |
| ipv6-address | x::x::x::x::x::x[-interface]                                                 |
|              | x::x::x::x::d.d.d.d[-interface]                                              |
|              | x: [0..FFFF]H                                                                |
|              | d: [0..255]D                                                                 |
|              | <i>interface</i> : 32 characters maximum, mandatory for link local addresses |

**Values** The following value applies to the 7450 ESS:

|              |                               |
|--------------|-------------------------------|
| ipv4-address | a.b.c.d (host bits must be 0) |
|--------------|-------------------------------|

**mcast** — Indicates that static route being configured is used for multicast table only.

## black-hole

**Syntax** [no] black-hole

**Context** config>router>static-route-entry

**Description** This command specifies that the route is a black hole route. If the destination address on a packet matches this static route, it will be silently discarded.

**Default** no black-hole

## community

**Syntax** **community** *comm-id*  
**no community** [*comm-id*]

**Context** config>router>static-route-entry>black-hole  
config>router>static-route-entry>indirect  
config>router>static-route-entry>next-hop

**Description** This command associates one BGP community (standard, extended or large) with a next-hop of the static route. This community can be matched in route policies and automatically added to BGP routes that are created from the static route.

Any community specified in one of these contexts is overridden by any communities specified at the prefix level of the static route entry.

The **no** form of this command removes the association.

**Default** no community

**Parameters** *comm-id* — Specifies a BGP community value, up to 72 characters.

**Values** [*as-num:comm-val* | *well-known-comm* | *ext-comm* | *large-comm*]

where:

- *as-num* — 0 to 65535
- *comm-val* — 0 to 65535
- *well-known-comm* — **null** | **no-export** | **no-export-subconfed** | **no-advertise** | **llgr-stale** | **no-llgr** | **blackhole**
- *ext-comm* — the extended community, defined as one of the following:

–{*target* | *origin*}:*ip-address:comm-val*  
–{*target* | *origin*}:*asnum:ext-comm-val*  
–{*target* | *origin*}:*ext-asnum:comm-val*  
–**bandwidth**:*asnum:val-in-mbps*  
–**ext:4300**:*ovstate*  
–**ext**:*value1:value2*  
–color:co-bits:*color-value*

where:

–*target* — route target  
–*origin* — route origin

- ip-address* — a.b.c.d
- ext-comm-val* — 0 to 4294967295
- ext-asnum* — 0 to 4294967295
- val-in-mbps* — 0 to 16777215
- ovstate* — 0, 1, or 2 (0 for valid, 1 for not found, 2 for invalid)
- value1* — 0000 to FFFF
- value2* — 0 to FFFFFFFFFFFFFFFF
- co-bits* — 00, 01, 10 or 11
- color-value* — 0 to 4294967295
- *large-comm* — *asn-or-ex:val-or-ex:val-or-ex*

## dynamic-bgp

|                    |                                                                                                                                                                                                                                                                                                                              |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] dynamic-bgp</b>                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>static-route-entry>black-hole                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | This optional command controls the behavior of the associated static route so that if a matching BGP route to the same exact prefix is present in BGP, the static route's nexthop is set to the BGP's nexthop value. If there is no matching active BGP route, the static route's nexthop is set to be a black-hole nexthop. |
| <b>Default</b>     | no dynamic-bgp                                                                                                                                                                                                                                                                                                               |

## generate-icmp

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] generate-icmp</b>                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>static-route-entry>black-hole                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This optional command causes the ICMP unreachable messages to be sent when received packets match the associated static route. By default, the ICMP unreachable messages for those types of static routes are not generated.</p> <p>This command can only be associated with a static route that has a blackhole next-hop</p> <p>The <b>no</b> form of this command removes the black-hole nexthop from the static route configuration.</p> |
| <b>Default</b>     | no generate-icmp                                                                                                                                                                                                                                                                                                                                                                                                                               |

## metric

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>metric</b> <i>metric</i><br><b>no metric</b> [ <i>metric</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>static-route-entry>black-hole<br>config>router>static-route-entry>indirect<br>config>router>static-route-entry>next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command specifies the cost metric for the static route, expressed as a decimal integer. This value is used when importing the static route into other protocols such as OSPF. When the metric is configured as 0 then the metric configured in OSPF, default-import-metric, applies. When modifying the metric of an existing static route, the preference will not change unless specified. This value is also used to determine which static route to install in the forwarding table.</p> <p>If there are multiple static routes with the same preference but different metrics then the lower cost (metric) route will be installed.</p> <p>The <b>no</b> form of this command returns the metric to the default value</p> |
| <b>Default</b>     | metric 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <i>metric</i> — Specifies the cost metric value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                    | <b>Values</b> 0 to 65535                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## preference

|                    |                                                                                                                                                                              |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>preference</b> <i>preference</i><br><b>no preference</b>                                                                                                                  |
| <b>Context</b>     | config>router>static-route-entry>black-hole<br>config>router>static-route-entry>indirect<br>config>router>static-route-entry>next-hop                                        |
| <b>Description</b> | <p>This command specifies the route preference to be assigned to the associated static route. The lower the preference value the more preferred the route is considered.</p> |

[Table 7](#) shows the default route preference based on the route source.

**Table 7 Default Route Preference**

| Label                | Preference | Configurable |
|----------------------|------------|--------------|
| Direct attached      | 0          | No           |
| Static route         | 5          | Yes          |
| OSPF Internal routes | 10         | Yes          |

**Table 7** Default Route Preference (Continued)

| Label                  | Preference | Configurable |
|------------------------|------------|--------------|
| IS-IS level 1 internal | 15         | Yes          |
| IS-IS level 2 internal | 18         | Yes          |
| RIP                    | 100        | Yes          |
| Aggregate              | 130        | No           |
| OSPF external          | 150        | Yes          |
| IS-IS level 1 external | 160        | Yes          |
| IS-IS level 2 external | 165        | Yes          |
| BGP                    | 170        | Yes          |

The **no** form of this command returns the associated static route preference to its default value.

**Default** preference 5

**Parameters** *preference* — Specifies the route preference value.

**Values** 1 to 255

## prefix-list

**Syntax** **prefix-list** *prefix-list-name* [{**all** | **none**}]  
**no prefix-list** [*prefix-list-name*] [{**all** | **none**}]

**Context** config>router>static-route-entry>black-hole  
config>router>static-route-entry>indirect  
config>router>static-route-entry>next-hop

**Description** This command associates a new constraint to the associated static route such that the static route is only active if **none** or **all** of the routes in the prefix list are present and active in the route-table.

**Default** no prefix-list

**Parameters** *prefix-list-name* — Specifies the name of a currently configured prefix-list.

**all** — Specifies that the static route condition is met if all prefixes in the prefix-list must be present in the active route-table.

**none** — Specifies that the static route condition is met if none of the prefixes in the named prefix-list can be present in the active route-table.

## tag

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tag</b> <i>tag</i><br><b>no tag</b> [ <i>tag</i> ]                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>static-route-entry<br>config>router>static-route-entry>black-hole<br>config>router>static-route-entry>indirect<br>config>router>static-route-entry>next-hop                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command associates a 4-byte route-tag with the static route. The tag value can be used in route policies to control distribution of the static route into other protocols.</p> <p>The tag specified at this level of the static route causes tag values configured under the next-hop, black-hole and indirect contexts of the static route to be ignored.</p> <p>The <b>no</b> form of this command removes the tag association.</p> |
| <b>Default</b>     | no tag                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>  | <i>tag</i> — Specifies an integer tag value.                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Values</b>      | 1 to 4294967295                                                                                                                                                                                                                                                                                                                                                                                                                               |

## community

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>community</b> <i>comm-id</i> [ <i>comm-id</i> ]<br><b>no community</b> [ <i>comm-id</i> [ <i>comm-id</i> ]]                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>router>static-route-entry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>This command associates a list of up to 12 BGP communities (any mix of standard, extended, and large communities) with the static route. These communities can be matched in route policies and are automatically added to BGP routes that are created from the static route.</p> <p>The communities specified at this level of the static route causes communities configured under the next-hop, black-hole and indirect contexts of the static route to be ignored.</p> <p>The <b>no</b> form of this command removes the association.</p> |
| <b>Default</b>     | no community                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <i>comm-id</i> — Specifies a BGP community value, up to 72 characters.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Values</b>      | <p>[<i>as-num:comm-val</i>   <i>well-known-comm</i>   <i>ext-comm</i>   <i>large-comm</i>]<br/>where:</p> <ul style="list-style-type: none"> <li>• <i>as-num</i> — 0 to 65535</li> <li>• <i>comm-val</i> — 0 to 65535</li> <li>• <i>well-known-comm</i> — <b>null</b>   <b>no-export</b>   <b>no-export-subconfed</b>   <b>no-advertise</b>   <b>llgr-stale</b>   <b>no-llgr</b>   <b>blackhole</b></li> </ul>                                                                                                                                   |

- *ext-comm* — the extended community, defined as one of the following:

- {*target* | *origin*}:*ip-address:comm-val*
- {*target* | *origin*}:*asnum:ext-comm-val*
- {*target* | *origin*}:*ext-asnum:comm-val*
- bandwidth**:*asnum:val-in-mbps*
- ext:4300**:*ovstate*
- ext**:*value1:value2*
- color**:*co-bits:color-value*

where:

- target* — route target
- origin* — route origin
- ip-address* — a.b.c.d
- ext-comm-val* — 0 to 4294967295
- ext-asnum* — 0 to 4294967295
- val-in-mbps* — 0 to 16777215
- ovstate* — 0, 1, or 2 (0 for valid, 1 for not found, 2 for invalid)
- value1* — 0000 to FFFF
- value2* — 0 to FFFFFFFFFF
- co-bits* — 00, 01, 10 or 11
- color-value* — 0 to 4294967295

- *large-comm* — *asn-or-ex:val-or-ex:val-or-ex*

## indirect

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] indirect</b> <i>ip-address</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>router>static-route-entry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>This command specifies that the route is indirect and specifies the next hop IP address used to reach the destination.</p> <p>The configured <i>ip-address</i> is not directly connected to a network configured on this node. The destination can be reached via multiple paths. The indirect address can only be resolved from dynamic routing protocol. Another static route cannot be used to resolve the indirect address.</p> <p>The <i>ip-address</i> configured here can be either on the network side or the access side and is typically at least one hop away from this node.</p> |
| <b>Default</b>     | no indirect                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



|                   |                                                         |                           |
|-------------------|---------------------------------------------------------|---------------------------|
| <b>Parameters</b> | <i>ip-address</i> — The IP address of the IP interface. |                           |
|                   | <b>Values</b>                                           |                           |
|                   | ipv4-address                                            | a.b.c.d                   |
|                   | ipv6-address                                            | x:x:x:x:x:x-x-[interface] |

cpe-check

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>cpe-check</b> <i>cpe-ip-address</i><br><b>no cpe-check</b> [ <i>cpe-ip-address</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>static-route-entry>indirect<br>config>router>static-route-entry>next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command enables CPE-check and specifies the IP address of the target CPE device.</p> <p>This option initiates a background ICMP ping test to the configured target IP address. The IP address can either be an IPv4 address for IPv4 static routes or an IPv6 address for IPv6 static routes. The target-ip-address cannot be in the same subnet as the static route subnet itself to avoid possible circular references. This option is mutually exclusive with BFD support on a given static route.</p> <p>The <b>no</b> form of this command disables the <b>cpe-check</b> option.</p> |
| <b>Default</b>     | no cpe-check                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b>  | <i>cpe-ip-address</i> — Specifies the IP address of the CPE device.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

drop-count

|                    |                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>drop-count</b> <i>count</i><br><b>no drop-count</b>                                                                                                              |
| <b>Context</b>     | config>router>static-route-entry>indirect>cpe-check<br>config>router>static-route-entry>next-hop>cpe-check                                                          |
| <b>Description</b> | This optional parameter specifies the number of consecutive ping-replies that must be missed to declare the CPE down and to deactivate the associated static route. |
| <b>Default</b>     | drop-count 3                                                                                                                                                        |
| <b>Parameters</b>  | <i>count</i> — An integer count value.                                                                                                                              |
|                    | <b>Values</b> 1 to 255                                                                                                                                              |

---

## interval

|                    |                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>interval</b> <i>seconds</i><br><b>no interval</b>                                                       |
| <b>Context</b>     | config>router>static-route-entry>indirect>cpe-check<br>config>router>static-route-entry>next-hop>cpe-check |
| <b>Description</b> | This optional parameter specifies the interval between ICMP pings to the target IP address.                |
| <b>Default</b>     | interval 1                                                                                                 |
| <b>Parameters</b>  | <i>seconds</i> — An integer interval value.<br><b>Values</b> 1 to 255                                      |

## log

|                    |                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] log</b>                                                                                                                                                                                |
| <b>Context</b>     | config>router>static-route-entry>indirect>cpe-check<br>config>router>static-route-entry>next-hop>cpe-check                                                                                     |
| <b>Description</b> | This optional parameter enables the ability to log transitions between active and in-active based on the CPE connectivity check. Events will be sent to the system log, syslog and SNMP traps. |
| <b>Default</b>     | no log                                                                                                                                                                                         |

## padding-size

|                    |                                                                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>padding-size</b> <i>padding-size</i><br><b>no padding-size</b>                                                                                                                                       |
| <b>Context</b>     | config>router>static-route-entry>indirect>cpe-check<br>config>router>static-route-entry>next-hop>cpe-check                                                                                              |
| <b>Description</b> | This optional parameter specifies the amount of padding to add to the ICMP packet in bytes. The parameter is only applicable when the <b>cpe-check</b> option is used with the associated static route. |
| <b>Default</b>     | padding-size 56                                                                                                                                                                                         |
| <b>Parameters</b>  | <i>padding-size</i> — An integer value.<br><b>Values</b> 0 to 16384 bytes                                                                                                                               |

## destination-class

|                    |                                                                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>destination-class</b> <i>dest-index</i><br><b>no destination-class</b> [ <i>dest-index</i> ]                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>static-route-entry>indirect<br>config>router>static-route-entry>next-hop                                                                                                                                                                                                                |
| <b>Description</b> | This command configures the policy accounting destination-class index to be used when incrementing accounting statistic for traffic matching the associated static route.<br><br>The <b>no</b> form of the command removes the associated destination-class from the associated static route nexthop. |
| <b>Default</b>     | no destination-class                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <i>dest-index</i> — The destination index integer value.<br><br><b>Values</b> 1 to 255                                                                                                                                                                                                                |

## forwarding-class

|                    |                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>forwarding-class</b> { <b>be</b>   <b>l2</b>   <b>af</b>   <b>l1</b>   <b>h2</b>   <b>ef</b>   <b>h1</b>   <b>nc</b> }<br><b>no forwarding-class</b> [{ <b>be</b>   <b>l2</b>   <b>af</b>   <b>l1</b>   <b>h2</b>   <b>ef</b>   <b>h1</b>   <b>nc</b> }]                                   |
| <b>Context</b>     | config>router>static-route-entry>indirect<br>config>router>static-route-entry>next-hop                                                                                                                                                                                                        |
| <b>Description</b> | This command specifies the enqueueing forwarding class that should be associated with traffic matching the associate static route. If this parameter is not specified, the packet will use the forwarding-class association based on default classification or other QoS Policy associations. |
| <b>Default</b>     | no forwarding-class                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <b>be</b>   <b>l2</b>   <b>af</b>   <b>l1</b>   <b>h2</b>   <b>ef</b>   <b>h1</b>   <b>nc</b> — Specifies the forwarding class.<br><br><b>Values</b> be, l2, af, l1, h2, ef, h1, nc                                                                                                           |

## priority

|                    |                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>priority</b> { <b>low</b>   <b>high</b> }<br><b>no priority</b> [{ <b>low</b>   <b>high</b> }]                                                                                                                                                                                       |
| <b>Context</b>     | config>router>static-route-entry>indirect>forwarding-class<br>config>router>static-route-entry>next-hop>forwarding-class                                                                                                                                                                |
| <b>Description</b> | This optional command associates an enqueueing priority with the static route. The options are either high or low, with low being the default. This parameter has the ability to affect the likelihood that a packet will be enqueued at SAP ingress in the face of ingress congestion. |

Once a packet is enqueued into an ingress buffer, the significance of this parameter is lost.

**Default** priority low

**Parameters** **low** — Setting the enqueueing parameter for a packet to **low** decreases the likelihood of enqueueing the packet when the ingress queue is congested. Ingress enqueueing priority only affects ingress SAP queuing. Once the packet is placed in a buffer on the ingress queue, the significance of the enqueueing priority is lost.

**high** — Setting the enqueueing parameter for a packet to **high** increases the likelihood of enqueueing the packet when the ingress queue is congested. Ingress enqueueing priority only affects ingress SAP queuing. Once the packet is placed in a buffer on the ingress queue, the significance of the enqueueing priority is lost..

## source-class

**Syntax** **source-class** *source-index*  
**no source-class** [*source-index*]

**Context** config>router>static-route-entry>indirect  
config>router>static-route-entry>next-hop

**Description** This command configures the policy accounting source-class index to be used when incrementing accounting statistic for traffic matching the associated static route.

If source route policy accounting is enabled and a source-class index is configured, traffic with a source IP address matches the associated static route, the source accounting statistics for the specified class will be incremented.

The **no** form of the command removes the associated destination-class from the associated static route nexthop.

**Default** no source-class

**Parameters** *source-index* — Specifies an integer value for the accounting source class index.

**Values** 1 to 255

## tunnel-next-hop

**Syntax** **tunnel-next-hop**

**Context** config>router>static-route-entry>indirect

**Description** This command enables the context to configure the static route's nexthop to be resolved to an indirect tunnel next-hop.

## disallow-igp

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] disallow-igp</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>router>static-route-entry>indirect>tunnel-next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This optional command determines if the associated static route can be resolved via an IGP next-hop in the RTM if no tunnel next-hops are found in TTM.</p> <p>When configured, the associated static route will not be resolved to an available IGP route in the RTM.</p> <p>The <b>no</b> form of the command returns the behavior to the default, which does allow for the static route to be resolved via an IGP route in the RTM if no tunnel next-hop can be found in the TTM.</p> |
| <b>Default</b>     | no disallow-igp                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## resolution

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>resolution {any   disabled   filter}</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>router>static-route-entry>indirect>tunnel-next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command determines how the associated static route can be resolved to a tunnel next-hop.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Default</b>     | resolution any                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><b>any</b> — Allows the associated static route to be resolved to any active entry in the TTM, following the TTM preference order.</p> <p><b>disabled</b> — Disables the associated static route to be resolved to any active entry in the TTM. As a result, the static route can only be resolved via IP RTM resolution of the static route's nexthop.</p> <p><b>filter</b> — Allows the associated static route to be resolved to active tunnels in the TTM using the resolution-filter restrictions.</p> |

## resolution-filter

|                    |                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>resolution-filter</b>                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>router>static-route-entry>indirect>tunnel-next-hop                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command creates the context to specify the tunnel next-hop resolution options.</p> <p>If one or more tunnel filter criteria are specified, the static route nexthop will be resolved to an available tunnel from one of those LSP types. The tunnel type will be selected following the TTM preference.</p> |

---

## ldp

|                    |                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] ldp</b>                                                                                                        |
| <b>Context</b>     | config>router>static-route-entry>indirect>tunnel-next-hop>resolution-filter                                            |
| <b>Description</b> | This command enables the use of LDP sourced tunnel entries in the TTM to resolve the associated static route next-hop. |
| <b>Default</b>     | no ldp                                                                                                                 |

## mpls-fwd-policy

|                    |                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] mpls-fwd-policy</b>                                                                                                   |
| <b>Context</b>     | config>router>static-route-entry>indirect>tunnel-next-hop>resolution-filter                                                   |
| <b>Description</b> | This command enables the use of the MPLS forwarding policy to resolve the indirect next hops of statically-configured routes. |
| <b>Default</b>     | no mpls-fwd-policy                                                                                                            |

## rib-api

|                    |                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] rib-api</b>                                                                                                                                              |
| <b>Context</b>     | config>router>static-route-entry>indirect>tunnel-next-hop>resolution-filter                                                                                      |
| <b>Description</b> | This command enables tunnels programmed using the RibApi gRPC service for use in resolving the indirect next hops of statically-configured IPv4 and IPv6 routes. |

## rsvp-te

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] rsvp-te</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>router>static-route-entry>indirect>tunnel-next-hop>resolution-filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This command enables the use of RSVP-TE sourced tunnel entries in the TTM to resolve the associated static route next-hop.</p> <p>The rsvp-te value instructs the code to search for the set of lowest metric RSVP-TE LSPs to the address of the indirect next-hop. The LSP metric is provided by MPLS in the tunnel table. The static route treats a set of RSVP-TE LSPs with the same lowest metric as an ECMP set. The user has the option of configuring a list of RSVP-TE LSP names to be used exclusively instead of searching in the tunnel table. In that case, all LSPs must have the same LSP metric in order for the static route to use them as an ECMP set. Otherwise, only the LSPs with the lowest common metric value will be selected.</p> |

A P2P auto-lsp that is instantiated via an LSP template can be selected in TTM when resolution is set to any. However, it is not recommended to configure an auto-lsp name explicitly under the rsvp-te node as the auto-generated name can change if the node reboots, which will blackhole the traffic of the static route.

**Default** no rsvp-te

## lsp

**Syntax** [no] **lsp** *lsp-name*

**Context** config>router>static-route-entry>indirect>tunnel-next-hop>resolution-filter>rsvp-te  
config>router>static-route-entry>indirect>tunnel-next-hop>resolution-filter>sr-te

**Description** This command restricts the search for a resolving LSP to a specific set of named LSPs. Only those LSPs named in the associated name list will be searched for a match to resolve the associated static route.

**Parameters** *lsp-name* — Specifies the name of the LSP to be searched for a valid resolving tunnel for the static route's next-hop.

## sr-isis

**Syntax** [no] **sr-isis**

**Context** config>router>static-route-entry>indirect>tunnel-next-hop>resolution-filter

**Description** This command enables the use of SR-ISIS sourced tunnel entries in the TTM to resolve the associated static route next hop.

**Default** no sr-isis

## sr-ospf

**Syntax** [no] **sr-ospf**

**Context** config>router>static-route-entry>indirect>tunnel-next-hop>resolution-filter

**Description** This command enables the use of SR-OSPF sourced tunnel entries in the TTM to resolve the associated static route next hop.

**Default** no sr-ospf

sr-te

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] sr-te</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>static-route-entry>indirect>tunnel-next-hop>resolution-filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | The sr-te value instructs the code to search for the set of lowest metric SR-TE LSPs to the address of the indirect next-hop. The LSP metric is provided by MPLS in the tunnel table. The static route treats a set of SR-TE LSPs with the same lowest metric as an ECMP set. The user has the option of configuring a list of SR-TE LSP names to be used exclusively instead of searching in the tunnel table. In that case, all LSPs must have the same LSP metric in order for the static route to use them as an ECMP set. Otherwise, only the LSPs with the lowest common metric value are selected. |
| <b>Default</b>     | no sr-te                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

next-hop

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                             |                                                                    |  |             |  |                   |              |  |         |              |  |                                                                                             |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------|--|-------------|--|-------------------|--------------|--|---------|--------------|--|---------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>next-hop</b> { <i>ip-int-name</i>   <i>ip-address</i>   <i>ipv6-address</i> }                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                             |                                                                    |  |             |  |                   |              |  |         |              |  |                                                                                             |
| <b>Context</b>     | config>router>static-route-entry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                             |                                                                    |  |             |  |                   |              |  |         |              |  |                                                                                             |
| <b>Description</b> | <p>This command specifies the directly connected next hop IP address or interface used to reach the destination. If the next hop is over an unnumbered interface or a point-to-point interface, the <b>ip-int-name</b> of the unnumbered or point-to-point interface (on this node) can be configured.</p> <p>If the next hop is over an unnumbered interface in the 7450 ESS router, the <i>ip-int-name</i> of the unnumbered interface (on this node) can be configured.</p> <p>The configured <i>ip-address</i> can be either on the network side or the access side on this node. The address must be associated with a network directly connected to a network configured on this node.</p> |                                                                                             |                                                                    |  |             |  |                   |              |  |         |              |  |                                                                                             |
| <b>Default</b>     | no next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                             |                                                                    |  |             |  |                   |              |  |         |              |  |                                                                                             |
| <b>Parameters</b>  | <p><i>ip-int-name</i>   <i>ip-address</i>   <i>ipv6-address</i> — The interface or IPv4/IPv6 address of the next hop.</p> <table><tr><td><b>Values</b></td><td colspan="2">The following values apply to the 7750 SR, 7450 ESS, and 7950 XRS:</td></tr><tr><td>ip-int-name</td><td></td><td>32 characters max</td></tr><tr><td>ipv4-address</td><td></td><td>a.b.c.d</td></tr><tr><td>ipv6-address</td><td></td><td>x:x:x:x:x:x:x-[interface]<br/>x:x:x:x:x:d.d.d.d[-interface]<br/>x: [0..FFFF]H<br/>d: [0..255]D</td></tr></table>                                                                                                                                                             | <b>Values</b>                                                                               | The following values apply to the 7750 SR, 7450 ESS, and 7950 XRS: |  | ip-int-name |  | 32 characters max | ipv4-address |  | a.b.c.d | ipv6-address |  | x:x:x:x:x:x:x-[interface]<br>x:x:x:x:x:d.d.d.d[-interface]<br>x: [0..FFFF]H<br>d: [0..255]D |
| <b>Values</b>      | The following values apply to the 7750 SR, 7450 ESS, and 7950 XRS:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                             |                                                                    |  |             |  |                   |              |  |         |              |  |                                                                                             |
| ip-int-name        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 32 characters max                                                                           |                                                                    |  |             |  |                   |              |  |         |              |  |                                                                                             |
| ipv4-address       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | a.b.c.d                                                                                     |                                                                    |  |             |  |                   |              |  |         |              |  |                                                                                             |
| ipv6-address       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | x:x:x:x:x:x:x-[interface]<br>x:x:x:x:x:d.d.d.d[-interface]<br>x: [0..FFFF]H<br>d: [0..255]D |                                                                    |  |             |  |                   |              |  |         |              |  |                                                                                             |



interface: 32 characters  
maximum, mandatory for link  
local addresses

IPv6 static routes are not supported on the 7450 ESS except in  
mixed mode.

## bfd-enable

|                    |                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] bfd-enable</b>                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>router>static-route-entry>next-hop                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command associates the static route state to a BFD session between the local system and the configured nexthop.</p> <p>The remote end of the BFD session must also be configured to originate or accept the BFD session controlling the static route state.</p> <p>The <b>no</b> form of this command removes the association of the static route state to that of the BFD session.</p> |
| <b>Default</b>     | no bfd-enable                                                                                                                                                                                                                                                                                                                                                                                   |

## ldp-sync

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] ldp-sync</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>static-route-entry>next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command extends the LDP synchronization feature to a static route. When an interface comes back up, it is possible that a preferred static route using the interface as next-hop for a given prefix is enabled before the LDP adjacency to the peer LSR comes up on this interface. In this case, traffic on an SDP that uses the static route for the far-end address would be black-holed until the LDP session comes up and the FECs exchanged.</p> <p>This option when enabled delays the activation of the static route until the LDP session comes up over the interface and the ldp-sync-timer configured on that interface has expired</p> |
| <b>Default</b>     | no ldp-sync                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## load-balancing-weight

|               |                                                                                             |
|---------------|---------------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>load-balancing-weight <i>value</i></b><br><b>no load-balancing-weight [<i>value</i>]</b> |
|---------------|---------------------------------------------------------------------------------------------|

---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>router>static-route-entry>next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command configures a weighted ECMP load-balancing weight for a static route next-hop.</p> <p>If all of the ECMP next-hops of a static route have a configured load-balancing-weight then packets matching the route are sprayed according to the relative weights. In other words, the next-hop interface with the largest load-balancing weight should receive the most forwarded traffic if weighted ECMP is applicable.</p> <p>The <b>no</b> form of this command disables weighted ECMP for the interface and effectively disables weighted ECMP for the entire static route.</p> |
| <b>Parameters</b>  | <p><i>value</i> — Specifies the load balancing weight value.</p> <p><b>Values</b>      0 to 4294967295</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## validate-next-hop

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] validate-next-hop</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>router>static-route-entry>next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This optional command tracks the state of the next-hop in the IPv4 ARP cache or IPv6 Neighbor Cache. When the next-hop is not reachable and is removed from the ARP or Neighbor Cache, the next-hop will no longer be considered valid and the associated static-route state removed from the active route-table.</p> <p>When the next-hop is reachable again and present in the ARP/Neighbor Cache, the static route will be considered valid and is subject to being placed into the active route-table.</p> |
| <b>Default</b>     | no validate-next-hop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## triggered-policy

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>triggered-policy</b><br><b>no triggered-policy</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command triggers route policy re-evaluation.</p> <p>By default, when a change is made to a policy in the <b>config router policy options</b> context and then committed, the change is effective immediately. There may be circumstances when the changes should or must be delayed; for example, if a policy change is implemented that would affect every BGP peer on a router, the consequences could be dramatic. It would be more effective to control changes on a peer-by-peer basis.</p> |

If the **triggered-policy** command is enabled, and a given peer is established, and you want the peer to remain up, in order for a change to a route policy to take effect, a **clear** command with the *soft* or *soft inbound* option must be used; for example, **clear router bgp neighbor x.x.x.x soft**. This keeps the peer up, and the change made to a route policy is applied only to that peer or group of peers.

**Default** no triggered-policy

## ttl-propagate

**Syntax** **ttl-propagate**

**Context** config>router

**Description** This command enables the context to configure TTL propagation for transit and locally generated packets in the Global Routing Table (GRT) and VPRN routing contexts

## label-route-local

**Syntax** **label-route-local** [{none | all}]

**Context** config>router>ttl-propagate

**Description** This command configures the TTL propagation for locally generated packets which are forwarded over a BGP label route in the Global Routing Table (GRT) context.

For IPv4 and IPv6 packets forwarded using a RFC 3107 label route in the global routing instance, including 6PE, the all value of the command enables TTL propagation from the IP header into all labels in the transport label stack. The none value reverts to the default mode which disables TTL propagation from the IP header to the labels in the transport label stack. This command does not have a no version.

The TTL of the IP packet is always propagated into the RFC 3107 label itself, and this command only controls the propagation into the transport labels, for example, labels of the RSVP or LDP LSP to which the BGP label route resolves and which are pushed on top of the BGP label.

If the BGP peer advertised the implicit-null label value for the BGP label route, the TTL propagation will not follow the configuration described, but will follow the configuration to which the BGP label route resolves:

RSVP LSP shortcut:

- configure router mpls shortcut-local-ttl-propagate

LDP LSP shortcut:

- configure router ldp shortcut-local-ttl-propagate

This feature does not impact packets forwarded over BGP shortcuts. The ingress LER operates in uniform mode by default and can be changed into pipe mode using the configuration of TTL propagation for RSVP or LDP LSP shortcut listed.

|                   |                                                                                                                                                                                               |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | label-route-local none                                                                                                                                                                        |
| <b>Parameters</b> | <b>none</b> — The TTL of the IP packet is not propagated into the transport label stack.<br><b>all</b> — The TTL of the IP packet is propagated into all labels of the transport label stack. |

## label-route-transit

|                    |                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>label-route-transit</b> [{none   all}]                                                                                                             |
| <b>Context</b>     | config>router>ttl-propagate                                                                                                                           |
| <b>Description</b> | This command configures the TTL propagation for transit packets which are forwarded over a BGP label route in the Global Routing Table (GRT) context. |

For IPv4 and IPv6 packets forwarded using a RFC 3107 label route in the global routing instance, including 6PE, the all value of the command enables TTL propagation from the IP header into all labels in the transport label stack. The none value reverts to the default mode which disables TTL propagation from the IP header to the labels in the transport label stack. This command does not have a no version.

The TTL of the IP packet is always propagated into the RFC 3107 label itself, and this command only controls the propagation into the transport labels, for example, labels of the RSVP or LDP LSP to which the BGP label route resolves and which are pushed on top of the BGP label.

If the BGP peer advertised the implicit-null label value for the BGP label route, the TTL propagation will not follow the configuration described, but will follow the configuration to which the BGP label route resolves.

RSVP LSP shortcut:

- configure router mpls shortcut-transit-ttl-propagate

LDP LSP shortcut:

- configure router ldp shortcut-transit-ttl-propagate

This feature does not impact packets forwarded over BGP shortcuts. The ingress LER operates in uniform mode by default and can be changed into pipe mode using the configuration of TTL propagation for the listed RSVP or LDP LSP shortcut.

|                   |                                                                                                                                                                                               |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | label-route-transit none                                                                                                                                                                      |
| <b>Parameters</b> | <b>none</b> — The TTL of the IP packet is not propagated into the transport label stack.<br><b>all</b> — The TTL of the IP packet is propagated into all labels of the transport label stack. |

## lsr-label-route

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>lsr-label-route</b> [{none   all}]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>ttl-propagate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command configures the TTL propagation for transit packets at a router acting as an LSR for a BGP label route.</p> <p>When an LSR swaps the BGP label for a ipv4 prefix packet, therefore acting as a ABR, ASBR, or data-path Route-Reflector (RR) in the base routing instance, or swaps the BGP label for a vpn-ipv4 or vpn-ipv6 prefix packet, therefore acting as an inter-AS Option B VPRN ASBR or VPRN data path Route-Reflector (RR), the all value of this command enables TTL propagation of the decremented TTL of the swapped BGP label into all outgoing LDP or RSVP transport labels.</p> <p>When an LSR swaps a label or stitches a label, it always writes the decremented TTL value into the outgoing swapped or stitched label. What this feature controls is whether this decremented TTL value is also propagated to the transport label stack pushed on top of the swapped or stitched label.</p> <p>The none value reverts to the default mode which disables TTL propagation. This changes the existing default behavior which propagates the TTL to the transport label stack. When a customer upgrades, the new default becomes in effect. This command does not have a no version.</p> <p>This feature also controls the TTL propagation at an LDP-BGP stitching LSR in the LDP to BGP stitching direction. It also controls the TTL propagation in Carrier Supporting Carrier (CsC) VPRN at both the CsC CE and CsC PE.</p> <p>SR OS does not support ASBR or data path RR functionality for labeled IPv6 routes in the global routing instance (6PE). As such the CLI command of this feature has no impact on prefix packets forwarded in this context.</p> |
| <b>Default</b>     | lsr-label-route none                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <p><b>none</b> — The TTL of the swapped label is not propagated into the transport label stack.</p> <p><b>all</b> — The TTL of the swapped label is propagated into all labels of the transport label stack.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## vprn-local

|                    |                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>vprn-local</b> [{none   all   vc-only}]                                                                                                   |
| <b>Context</b>     | config>router>ttl-propagate                                                                                                                  |
| <b>Description</b> | This command configures the TTL propagation for locally generated packets which are forwarded over a MPLS LSPs in all VPRN service contexts. |

For vpn-ipv4 and vpn-ipv6 packets forwarded in the context of all VPRN services in the system, including 6VPE packets, the all value of the command enables TTL propagation from the IP header into all labels in the stack:

The user can enable the TTL propagation behavior separately for locally generated packets by CPM (vpn-local) and for user and control packets in transit at the node (vpn-transit).

The vc-only value reverts to the default behavior by which the IP TTL is propagated into the VC label but not to the transport labels in the stack. The user can explicitly set the default behavior by configuring the vc-only value. This command does not have a no version.

The value none allows the user to disable the propagation of the IP TTL to all labels in the stack, including the VC label. This is needed for a transparent operation of UDP traceroute in VPRN inter-AS option B such that the ingress and egress ASBR nodes are not traced.

The user can override the global configuration within each VPRN instance using the following commands:

- config service vpn ttl-propagate local [inherit | none | vc-only | all]
- config service vpn ttl-propagate transit [inherit | none | vc-only | all]

The default behavior for a given VPRN instance is to inherit the global configuration for the same command. The user can explicitly set the default behavior by configuring the inherit value.

When a packet is received in a VPRN context but is looked up in the Global Routing Table (GRT), for example, leaking to GRT is enabled, the behavior of the TTL propagation is governed by the RSVP or LDP shortcut configuration when the matching routing is a LSP shortcut route. It is governed by the BGP label route configuration when the matching route is a RFC 3107 label route or a 6PE route.

When a packet is received on one VPRN instance and is redirected using Policy Based Routing (PBR) to be forwarded in another VPRN instance, the TTL propagation is governed by the configuration of the outgoing VPRN instance.

**Default**      vpn-local vc-only

**Parameters**    **none** — The TTL of the IP packet is not propagated into the VC label or labels in the transport label stack

**all** — The TTL of the IP packet is propagated into the VC label and all labels in the transport label stack.

**vc-only** — The TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack.

## vpn-transit

**Syntax**      **vpn-transit** [{**none** | **all** | **vc-only**}]

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>router>ttn-propagate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>This command configures the TTL propagation for in transit packets which are forwarded over a MPLS LSPs in all VPRN service contexts. For vpn-ipv4 and vpn-ipv6 packets forwarded in the context of all VPRN services in the system, including 6VPE packets, the all value of the command enables TTL propagation from the IP header into all labels in the stack:</p> <p>The user can enable the TTL propagation behavior separately for locally generated packets by CPM (vpn-local) and for user and control packets in transit at the node (vpn-transit).</p> <p>The vc-only value reverts to the default behavior by which the IP TTL is propagated into the VC label but not to the transport labels in the stack. The user can explicitly set the default behavior by configuring the vc-only value. This command does not have a no version.</p> <p>The value none allows the user to disable the propagation of the IP TTL to all labels in the stack, including the VC label. This is needed for a transparent operation of UDP trace-route in VPRN inter-AS option B such that the ingress and egress ASBR nodes are not traced.</p> <p>The user can override the global configuration within each VPRN service instance using the following commands:</p> <ul style="list-style-type: none"> <li>• config service vpn ttn-propagate local [inherit   none   vc-only   all]</li> <li>• config service vpn ttn-propagate transit [inherit   none   vc-only   all]</li> </ul> <p>The default behavior for a given VPRN instance is to inherit the global configuration for the same command. The user can explicitly set the default behavior by configuring the inherit value.</p> <p>When a packet is received in a VPRN context but is looked up in the Global Routing Table (GRT), for example, leaking to GRT is enabled, the behavior of the TTL propagation is governed by the RSVP or LDP shortcut configuration when the matching routing is a LSP shortcut route. It is governed by the BGP label route configuration when the matching route is a RFC 3107 label route or a 6PE route.</p> <p>When a packet is received on one VPRN instance and is redirected using Policy Based Routing (PBR) to be forwarded in another VPRN instance, the TTL propagation is governed by the configuration of the outgoing VPRN instance</p> |
| <b>Default</b>     | vpn-transit vc-only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <p><b>none</b> — The TTL of the IP packet is not propagated into the VC label or labels in the transport label stack</p> <p><b>all</b> — The TTL of the IP packet is propagated into the VC label and all labels in the transport label stack.</p> <p><b>vc-only</b> — The TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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## weighted-ecmp

|                    |                                                                                    |
|--------------------|------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] weighted-ecmp</b>                                                          |
| <b>Context</b>     | config>router                                                                      |
| <b>Description</b> | This command enables the weighted load-balancing, or weighted ECMP, over MPLS LSP. |

When this command is enabled, packets of IGP, BGP, and static route prefixes resolved to a set of ECMP tunnel next-hops are sprayed proportionally to the weights configured for each MPLS LSP in the ECMP set.

Weighted load-balancing over MPLS LSP is supported in the following forwarding contexts:

- IGP prefix resolved to IGP shortcuts in RTM (**igp-shortcut** or **advertise-tunnel-link** enabled in the IGP instance).
- BGP prefix with the BGP next-hop resolved to IGP shortcuts in RTM (**igp-shortcut** or **advertise-tunnel-link** enabled in the IGP instance).
- Static route prefix resolved to an indirect next-hop, which itself is resolved to a set of equal-metric MPLS LSPs in TTM. The user can allow automatic selection or specify the names of the equal-metric MPLS LSPs in TTM to be used in the ECMP set.
- Static route prefix resolved to an indirect next-hop, which is resolved to IGP shortcuts in RTM.
- BGP prefix with a BGP next-hop resolved to a static route, which resolves to a set of tunnel next-hops toward an indirect next-hop in RTM or TTM.
- BGP prefix resolving to another BGP prefix, whose next-hop is resolved to a set of ECMP tunnel next-hops with a static route in RTM or TTM or to IGP shortcuts in RTM.

IGP computes the normalized weight for each prefix tunnel next-hop. IGP updates the route in RTM with the set of tunnel next-hops and normalized weights. RTM downloads the information to IOM for inclusion in the FIB.

If one or more LSPs in the ECMP set of a prefix do not have a weight configured, the regular ECMP spraying for the prefix will be performed.

The weight assigned to an LSP impacts only the forwarding decision, not the routing decision. In other words, it does not change the selection of the set of ECMP tunnel next-hops of a prefix when more next-hops exist than the value of the router **ecmp** option. Once the set of tunnel next-hops is selected, the LSP weight is used to modulate the amount of packets forwarded over each next-hop. It also does not change the hash routine, but only the spraying of the flows over the tunnel next-hops is modified to reflect the normalized weight of each tunnel next-hop.

The **no** form of the command resumes regular ECMP spraying of packets of IGP, BGP, and static route prefixes over MPLS LSP.

|                |                  |
|----------------|------------------|
| <b>Default</b> | no weighted-ecmp |
|----------------|------------------|



## bfd-template

|                    |                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] bfd-template</b> <i>name</i>                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>bfd                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | This command creates or edits a BFD template. A BFD template defines the set of configurable parameters used by a BFD session. These include the transmit and receive timers used for BFD CC packets, the transmit timer interval used when the session is providing a CV function, the multiplier value, the echo-receive interval, and whether the BFD session terminates in the CPM network processor. |
| <b>Default</b>     | no bfd-template                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <i>name</i> — Specifies a text string name for the template up to 32 characters in printable 7-bit ASCII, enclosed in double quotes.                                                                                                                                                                                                                                                                      |

## echo-receive

|                    |                                                                                                                                                                                                                |               |                                         |                |     |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------|----------------|-----|
| <b>Syntax</b>      | <b>echo-receive</b> <i>echo-interval</i><br><b>no echo-receive</b>                                                                                                                                             |               |                                         |                |     |
| <b>Context</b>     | config>router>bfd>bfd-template                                                                                                                                                                                 |               |                                         |                |     |
| <b>Description</b> | This command sets the minimum echo receive interval, in milliseconds, for a session. This is not used by a BFD session for MPLS-TP.                                                                            |               |                                         |                |     |
| <b>Default</b>     | echo-receive 100                                                                                                                                                                                               |               |                                         |                |     |
| <b>Parameters</b>  | <i>echo-interval</i> — Specifies the echo receive interval.<br><table> <tr> <td><b>Values</b></td><td>100 ms to 100,000 ms in 1 ms increments</td></tr> <tr> <td><b>Default</b></td><td>100</td></tr> </table> | <b>Values</b> | 100 ms to 100,000 ms in 1 ms increments | <b>Default</b> | 100 |
| <b>Values</b>      | 100 ms to 100,000 ms in 1 ms increments                                                                                                                                                                        |               |                                         |                |     |
| <b>Default</b>     | 100                                                                                                                                                                                                            |               |                                         |                |     |

## multiplier

|                    |                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>multiplier</b> <i>multiplier</i><br><b>no multiplier</b>                                                                                                                                                   |
| <b>Context</b>     | config>router>bfd>bfd-template                                                                                                                                                                                |
| <b>Description</b> | This command specifies the detect multiplier used for a BFD session. If a BFD control packet is not received for a period of <i>multiplier</i> x <i>receive-interval</i> , then the session is declared down. |
| <b>Default</b>     | multiplier 3                                                                                                                                                                                                  |

---

|                   |                                               |
|-------------------|-----------------------------------------------|
| <b>Parameters</b> | <i>multiplier</i> — Specifies the multiplier. |
| <b>Values</b>     | 3 to 20, integers                             |
| <b>Default</b>    | 3                                             |

## receive-interval

|                    |                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>receive-interval</b> <i>receive-interval</i><br><b>no receive-interval</b>                                                                                       |
| <b>Context</b>     | config>router>bfd>bfd-template                                                                                                                                      |
| <b>Description</b> | This command specifies the receive timer used for BFD packets. If the template is used for a BFD session on an MPLS-TP LSP, then this timer is used for CC packets. |
| <b>Default</b>     | receive-interval 100                                                                                                                                                |
| <b>Parameters</b>  | <i>receive-interval</i> — Specifies the receive interval. The minimum interval that can be configured is hardware dependent.                                        |
| <b>Values</b>      | 10 ms to 100,000 ms in 1 ms intervals                                                                                                                               |
| <b>Default</b>     | 10 ms for CPM3 or higher; 1 second for other hardware                                                                                                               |

## transmit-interval

|                    |                                                                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>transmit-interval</b> <i>transmit-interval</i><br><b>no transmit-interval</b>                                                                                     |
| <b>Context</b>     | config>router>bfd>bfd-template                                                                                                                                       |
| <b>Description</b> | This command specifies the transmit timer used for BFD packets. If the template is used for a BFD session on an MPLS-TP LSP, then this timer is used for CC packets. |
| <b>Default</b>     | transmit-interval 100                                                                                                                                                |
| <b>Parameters</b>  | <i>transmit-interval</i> — Specifies the transmit interval. The minimum interval that can be configured is hardware dependent.                                       |
| <b>Values</b>      | 10 ms to 100,000 ms in 1 ms intervals                                                                                                                                |
| <b>Default</b>     | 10 ms for CPM3 or higher; 1 second for other hardware                                                                                                                |

## type

|               |                                        |
|---------------|----------------------------------------|
| <b>Syntax</b> | <b>type</b> {cpm-np}<br><b>no type</b> |
|---------------|----------------------------------------|

|                    |                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>router>bfd>bfd-template                                                                                                 |
| <b>Description</b> | This command selects the CPM network processor as the local termination point for the BFD session. This is enabled by default. |
| <b>Default</b>     | no type                                                                                                                        |

### 2.13.2.3 Router L2TP Commands

Router L2TP commands only apply to the 7750 SR and 7450 ESS.

#### l2tp

|                    |                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>l2tp</b>                                                                                                                                                                                                 |
| <b>Context</b>     | config>router                                                                                                                                                                                               |
| <b>Description</b> | This command enables the context to configure L2TP parameters. L2TP extends the PPP model by allowing Layer 2 and PPP endpoints to reside on different devices interconnected by a packet-switched network. |

#### calling-number-format

|                    |                                                                                                                                           |                    |                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------------|
| <b>Syntax</b>      | <b>calling-number-format</b> <i>ascii-spec</i><br><b>no calling-number-format</b>                                                         |                    |                             |
| <b>Context</b>     | config>router>l2tp                                                                                                                        |                    |                             |
| <b>Description</b> | This command what string to put in the Calling Number AVP, for L2TP control messages related to a session in this L2TP protocol instance. |                    |                             |
| <b>Default</b>     | calling-number-format "%S %s"                                                                                                             |                    |                             |
| <b>Parameters</b>  | <i>ascii-spec</i> — Specifies the L2TP calling number AVP.                                                                                |                    |                             |
|                    | <b>Values</b>                                                                                                                             |                    |                             |
|                    | ascii-spec                                                                                                                                | char-specification | ascii-spec                  |
|                    |                                                                                                                                           | char-specification | ascii-char   char-origin    |
|                    |                                                                                                                                           | ascii-char         | a printable ASCII character |
|                    |                                                                                                                                           | char-origin        | %origin                     |
|                    |                                                                                                                                           | origin             | S   c   r   s   l           |

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|   |                                                                       |
|---|-----------------------------------------------------------------------|
| S | system name, the value of<br>TIMETRA-CHASSIS-<br>MIB::tmnxChassisName |
| c | Agent Circuit Id                                                      |
| r | Agent Remote Id                                                       |
| s | SAP ID, formatted as a<br>character string                            |
| l | Logical Line ID                                                       |

## challenge

|                    |                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>challenge {always}</b><br><b>no challenge</b>                                                                                                          |
| <b>Context</b>     | config>router>l2tp                                                                                                                                        |
| <b>Description</b> | This command configures the use of challenge-response authentication.<br><br>The <b>no</b> form of the command reverts to the default <b>never</b> value. |
| <b>Default</b>     | no challenge                                                                                                                                              |
| <b>Parameters</b>  | <b>always</b> — Specifies that the challenge-response authentication is always used.<br><br><b>Default</b> no challenge<br><b>Values</b> always           |

## destruct-timeout

|                    |                                                                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>destruct-timeout</b> <i>destruct-timeout</i><br><b>no destruct-timeout</b>                                                                                                                           |
| <b>Context</b>     | config>router>l2tp<br>config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                       |
| <b>Description</b> | This command configures the period of time that the data of a disconnected tunnel will persist before being removed.<br><br>The <b>no</b> form of the command removes the value from the configuration. |
| <b>Default</b>     | no destruct-timeout                                                                                                                                                                                     |

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|                   |                                                                                                                            |
|-------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>destruct-timeout</i> — Specifies the automatic removal of dynamic L2TP sessions, in seconds, that are no longer active. |
| <b>Default</b>    | no destruct-timeout                                                                                                        |
| <b>Values</b>     | 60 to 86400                                                                                                                |

## df-bit-lac

|                    |                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>df-bit-lac</b> { <b>always</b>   <b>never</b> }<br><b>no df-bit-lac</b>                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>router>l2tp<br>config>service>vprn>l2tp                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | By default, the LAC df-bit-lac is always set and sends all L2TP packets with the DF bit set to 1. The DF bit is configurable to allow downstream routers to fragment the L2TP packets. The LAC itself will not fragment L2TP packets. L2TP packets that have a larger MTU size than what the LAC egress ports allows are dropped. |
| <b>Default</b>     | df-bit-lac always                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <b>always</b> — Specifies that the LAC will send all L2TP packets with the DF bit set to 1.<br><b>never</b> — Specifies that the LAC will send all L2TP packets with the DF bit set to 0.                                                                                                                                         |

## eth-tunnel

|                    |                                                                                  |
|--------------------|----------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>eth-tunnel</b>                                                                |
| <b>Context</b>     | config>router>l2tp                                                               |
| <b>Description</b> | This command enables the context to configure Ethernet tunnel client parameters. |

## reconnect-timeout

|                    |                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>reconnect-timeout</b> <i>reconnect-timeout</i><br><b>no reconnect-timeout</b>                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>router>l2tp>eth-tunnel                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | This command configures the number of seconds that the Ethernet tunnel client of L2TPv3 waits before attempting to re-establish a new session after a session setup fails or a session closes.<br><br>The <b>no</b> form of the command returns <b>reconnect-timeout</b> to an infinite timeout value, meaning that reconnection will not be attempted by the local client. |

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|                   |                                                                                                                                                        |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no reconnect-timeout (infinite timeout)                                                                                                                |
| <b>Parameters</b> | <i>reconnect-timeout</i> — Specifies the number of seconds before a session reconnection is attempted after a previous session or session setup fails. |
| <b>Values</b>     | 10 to 3600                                                                                                                                             |

## exclude-avps

|                    |                                                                                          |
|--------------------|------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>exclude-avps</b> [calling-number] [initial-rx-lcp-conf-req]<br><b>no exclude-avps</b> |
| <b>Context</b>     | config>router>l2tp                                                                       |
| <b>Description</b> | This command configures the L2TP AVPs to exclude.                                        |
| <b>Default</b>     | no exclude-avps                                                                          |

## group

|                    |                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>group</b> tunnel-group-name [create]<br><b>group</b> tunnel-group-name [create] [protocol protocol]<br><b>no group</b> tunnel-group-name                                                                                                                                                                                                                 |
| <b>Context</b>     | config>router>l2tp                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | This command configures an L2TP tunnel group.                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <i>tunnel-group-name</i> — Specifies a name string to identify a L2TP group up to 63 characters in length.<br><br><b>create</b> — Mandatory keyword when creating a tunnel group name. The <b>create</b> keyword requirement can be enabled or disabled in the <b>environment&gt;create</b> context.<br><br><i>protocol</i> — Displays the active protocol. |

## avp-hiding

|                    |                                                                                                                                                                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>avp-hiding</b> {sensitive   always   never}<br><b>no avp-hiding</b>                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                                                                                                                 |
| <b>Description</b> | This command configures Attribute Value Pair (AVP) hiding. This capability can be used to avoid the passing of sensitive data, such as user passwords, as cleartext in an AVP.<br><br>The <b>no</b> form of the command returns the value to <b>never</b> allow AVP hiding. |

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|                   |                                                                                                                                                                                             |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no avp-hiding                                                                                                                                                                               |
| <b>Parameters</b> | <b>sensitive</b> — AVP hiding is used only for sensitive information (such as username/password).<br><b>always</b> — AVP hiding is always used.<br><b>never</b> — AVP hiding is never used. |

## challenge

|                    |                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>challenge {always   never}</b><br><b>no challenge</b>                                                                                                                                                               |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                                                            |
| <b>Description</b> | This command configures the use of challenge-response authentication.<br><br>The <b>no</b> form of the command removes the parameter from the configuration and indicates that the value on group level will be taken. |
| <b>Default</b>     | no challenge                                                                                                                                                                                                           |
| <b>Parameters</b>  | <b>always</b> — Always allows the use of challenge-response authentication of the tunnel.<br><b>never</b> — Never allows the use of challenge-response authentication of the tunnel.                                   |

## df-bit-lac

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>df-bit-lac {always   never   default}</b><br><b>no df-bit-lac</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | By default, the LAC df-bit-lac is set to default and sends all L2TP packets with the DF bit set to 1. The DF bit is configurable to allow downstream routers to fragment the L2TP packets. The LAC itself will not fragment L2TP packets. L2TP packets that have a larger MTU size than what the LAC egress ports allows are dropped. The configuration of the df-bit can be overridden at different levels: l2tp, tunnel, and group. The configuration at the tunnel level overrides the configuration on both group and l2tp. The configuration at the group level overrides the configuration on l2tp. |
| <b>Default</b>     | df-bit-lac default                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>  | <b>always</b> — Specifies that the LAC will send all L2TP packets with the DF bit set to 1.<br><b>never</b> — Specifies that the LAC will send all L2TP packets with the DF bit set to 0.                                                                                                                                                                                                                                                                                                                                                                                                                 |

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**default** — Follows the DF-bit configuration specified on upper levels.

## hello-interval

|                    |                                                                                                                                                                                                                                                                                                                                                     |                |                   |               |            |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------|---------------|------------|
| <b>Syntax</b>      | <b>hello-interval</b> <i>hello-interval</i><br><b>hello-interval infinite</b><br><b>no hello-interval</b>                                                                                                                                                                                                                                           |                |                   |               |            |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                                                                                                                                                                                         |                |                   |               |            |
| <b>Description</b> | <p>This command configures the time interval between two consecutive tunnel Hello messages. The Hello message is an L2TP control message sent by either peer of a LAC-LNS control connection. This control message is used as a keepalive for the tunnel.</p> <p>The <b>no</b> form of the command removes the interval from the configuration.</p> |                |                   |               |            |
| <b>Default</b>     | no hello-interval                                                                                                                                                                                                                                                                                                                                   |                |                   |               |            |
| <b>Parameters</b>  | <p><i>hello-interval</i> — Specifies the time interval, in seconds, between two consecutive tunnel Hello messages.</p> <table><tr><td><b>Default</b></td><td>no hello-interval</td></tr><tr><td><b>Values</b></td><td>60 to 3600</td></tr></table> <p><b>infinite</b> — Specifies that no hello interval messages are sent.</p>                     | <b>Default</b> | no hello-interval | <b>Values</b> | 60 to 3600 |
| <b>Default</b>     | no hello-interval                                                                                                                                                                                                                                                                                                                                   |                |                   |               |            |
| <b>Values</b>      | 60 to 3600                                                                                                                                                                                                                                                                                                                                          |                |                   |               |            |

## idle-timeout

|                    |                                                                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>idle-timeout</b> <i>idle-timeout</i><br><b>idle-timeout infinite</b><br><b>no idle-timeout</b>                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command configures the period of time that an established tunnel with no active sessions will persist before being disconnected.</p> <p>Enter the <b>no</b> form of the command to maintain a persistent tunnel.</p> <p>The <b>no</b> form of the command removes the idle timeout from the configuration.</p> |
| <b>Default</b>     | no idle-timeout                                                                                                                                                                                                                                                                                                        |



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|                   |                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>idle-timeout</i> — Specifies the idle timeout value, in seconds until the group is removed. |
| <b>Default</b>    | no idle-timeout                                                                                |
| <b>Values</b>     | 0 to 3600                                                                                      |
|                   | <b>infinite</b> — Specifies that the tunnel will not be closed when idle.                      |

## l2tpv3

|                    |                                                                  |
|--------------------|------------------------------------------------------------------|
| <b>Syntax</b>      | <b>l2tpv3</b>                                                    |
| <b>Context</b>     | config>router>l2tp<br>config>router>l2tp>group                   |
| <b>Description</b> | This command enables the context to configure L2TPv3 parameters. |

## cookie-length

|                    |                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>cookie-length</b> <i>cookie-length</i><br><b>cookie-length default</b><br><b>no cookie-length</b>                                                                                                                                                                                        |
| <b>Context</b>     | config>router>l2tp>group>l2tpv3                                                                                                                                                                                                                                                             |
| <b>Description</b> | This command configures the length of the optional cookie field. The <b>default</b> parameter only applies in the <b>config&gt;router&gt;l2tp&gt;group&gt;l2tpv3</b> context.<br><br>The <b>no</b> form of the command returns the <b>cookie-length</b> to a default of <b>none</b> .       |
| <b>Default</b>     | no cookie-length                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <i>cookie-length</i> — Specifies the cookie length in bytes.<br><br><b>Values</b> 4, 8<br><br><b>default</b> — In the <b>config&gt;router&gt;l2tp&gt;group&gt;l2tpv3</b> , this parameter references the cookie length configured in the <b>config&gt;router&gt;l2tp&gt;l2tpv3</b> context. |

## digest-type

|                    |                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>digest-type {default   none   md5   sha1}</b><br><b>no digest-type</b>                                                                                                                        |
| <b>Context</b>     | config>router>l2tp>group>l2tpv3                                                                                                                                                                  |
| <b>Description</b> | This command configures the hashing algorithm used to calculate the message digest. The <b>default</b> parameter only applies in the <b>config&gt;router&gt;l2tp&gt;group&gt;l2tpv3</b> context. |

The **no** form of the command returns the **digest-type** to **none**.

- Default** no digest-type
- Parameters** **default** — In the **config>router>l2tp>group>l2tpv3**, this parameter references the digest type configured in the **config>router>l2tp>l2tpv3** context.
- none** — Specifies that no digest should be used.
- md5** — Specifies that the MD5 algorithm should be used.
- sha1** — Specifies that the SHA1 algorithm should be used.

## nonce-length

- Syntax** **nonce-length** *length*  
**nonce-length** **default**  
**no** **nonce-length**
- Context** config>router>l2tp>group>l2tpv3
- Description** This command configures the length for the local L2TPv3 nonce (random number) value used in the Nonce AVP. The **default** parameter only applies in the **config>router>l2tp>group>l2tpv3** context
- The **no** form of the command returns the **nonce-length** to a default of **none**.
- Default** no nonce-length
- Parameters** *length* — Specifies the length of the Nonce AVP value.
- Values** 16 to 64
- default** — In the **config>router>l2tp>group>l2tpv3**, this parameter references the nonce length configured in the **config>router>l2tp>l2tpv3** context.

## password

- Syntax** **password** *password* [{**hash** | **hash2**}]  
**no** **password**
- Context** config>router>l2tp>group  
config>router>l2tp>group>tunnel  
config>router>l2tp>l2tpv3  
config>router>l2tp>group>l2tpv3
- Description** This command configures the password between L2TP LAC and LNS
- The **no** form of the command removes the password.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no password                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b> | <p><i>password</i> — Configures the password used for challenge/response calculation and AVP hiding. The maximum length can be up to 20 characters if unhashed, 32 characters if hashed, 54 characters if the hash2 keyword is specified.</p> <p><b>hash</b> — Specifies the key is entered in an encrypted form. If the <b>hash</b> or <b>hash2</b> parameter is not used, the key is assumed to be in an unencrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the <b>hash</b> or <b>hash2</b> parameter specified.</p> <p><b>hash2</b> — Specifies the key is entered in a more complex encrypted form that involves more variables than the key value alone, meaning that the <b>hash2</b> encrypted variable cannot be copied and pasted. If the <b>hash</b> or <b>hash2</b> parameter is not used, the key is assumed to be in an unencrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the <b>hash</b> or <b>hash2</b> parameter specified.</p> |

## private-tcp-mss-adjust

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>private-tcp-mss-adjust</b> <i>octets</i><br><b>private-tcp-mss-adjust default</b><br><b>no private-tcp-mss-adjust</b>                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>l2tp>group>l2tpv3<br>config>service>vpn>l2tp>group>l2tpv3                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command enables TCP MSS adjust for L2TPv3 tunnels on the private side of the group or tunnel level. When this command is configured, the system updates the TCP MSS option value of the received TCP SYN packet on the private side.</p> <p>With the <b>default</b> parameter, the system uses the upper-level configuration. With the non-default parameter, the system uses this configuration instead of the upper level configuration.</p> <p>The <b>no</b> form of this command disables TCP MSS adjust on the private side.</p> |
| <b>Default</b>     | no private-tcp-mss-adjust                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <p><i>octets</i> — Specifies the new TCP MSS value in octets.</p> <p><b>Values</b> 512 to 9000</p> <p><b>default</b> — Specifies to use the upper-level configuration</p>                                                                                                                                                                                                                                                                                                                                                                     |

## public-tcp-mss-adjust

|               |                                                                                                                       |
|---------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>public-tcp-mss-adjust</b> <i>octets</i><br><b>public-tcp-mss-adjust default</b><br><b>no public-tcp-mss-adjust</b> |
|---------------|-----------------------------------------------------------------------------------------------------------------------|

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|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>router>l2tp>group>l2tpv3<br>config>service>vpn>l2tp>group>l2tpv3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>This command enables TCP MSS adjust for L2TPv3 tunnels on the public side on the group or tunnel level. When the command is configured, the system updates the TCP MSS option value of the received TCP SYN packet on the public side that is encapsulated in the L2TPv3 tunnel.</p> <p>With the <b>default</b> parameter, the system uses the upper level configuration. With the non-default parameter, the system uses this configuration instead of the upper level configuration.</p> <p>The <b>no</b> form of this command disables TCP MSS adjust on the public side.</p> |
| <b>Default</b>     | no public-tcp-mss-adjust                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <p><i>octets</i> — Specifies the new TCP MSS value in octets</p> <p><b>Values</b>      512 to 9000</p> <p><b>default</b> — Specifies to use the upper-level configuration</p>                                                                                                                                                                                                                                                                                                                                                                                                       |

## pw-cap-list

|                    |                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>pw-cap-list {ethernet   ethernet-vlan} [{ethernet   ethernet-vlan}]</b><br><b>no pw-cap-list</b>                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>l2tp>group>l2tpv3                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command configures the allowable pseudowire capability list that is advertised to the far end. An empty list results in both pseudowire capabilities being advertised.</p> <p>The <b>no</b> form of this command removes the list and advertises both pseudowire capabilities to the far end.</p>                                                                                |
| <b>Default</b>     | no pw-cap-list                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <p><b>ethernet</b> — Specifies that the Ethernet pseudo-wire type is advertised. A maximum of two Ethernet pseudo-wire types can be specified.</p> <p><b>ethernet-vlan</b> — Specifies that the Ethernet-VLAN pseudo-wire type is advertised. A maximum of two Ethernet-VLAN pseudo-wire types can be specified. This parameter is only supported in SR OS Release 14.0 R4 or later.</p> |

## rem-router-id

|                |                                                            |
|----------------|------------------------------------------------------------|
| <b>Syntax</b>  | <b>rem-router-id ip-address</b><br><b>no rem-router-id</b> |
| <b>Context</b> | config>router>l2tp>group>l2tpv3                            |

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|                    |                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command configures the IP address that should be used within the Remote Router-ID AVP.<br><br>The <b>no</b> form of this command removes the configured IP address. |
| <b>Default</b>     | no rem-router-id                                                                                                                                                         |
| <b>Parameters</b>  | <i>ip-address</i> — Specifies an IP address to be used within the Remote Router-ID AVP.                                                                                  |

## track-password-change

|                    |                                                                                                                                                                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] track-password-change</b>                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>router>l2tp>group>l2tpv3                                                                                                                                                                                                                                       |
| <b>Description</b> | This command enables tracking of password changes, allowing password tunnel passwords to be changed without bringing down active tunnels or sessions. This is only supported with L2TPv3.<br><br>The <b>no</b> form of the command disables password change tracking. |
| <b>Default</b>     | no track-password-change                                                                                                                                                                                                                                              |

## lns-group

|                    |                                                                               |
|--------------------|-------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>lns-group <i>lns-group-id</i></b><br><b>no lns-group</b>                   |
| <b>Context</b>     | config>router>l2tp>group                                                      |
| <b>Description</b> | This command configures the ISA LNS group.                                    |
| <b>Default</b>     | no lns-group                                                                  |
| <b>Parameters</b>  | <i>lns-group-id</i> — Specifies the LNS group ID.<br><br><b>Values</b> 1 to 4 |

## load-balance-method

|                    |                                                                                        |
|--------------------|----------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>load-balance-method {per-session   per-tunnel}</b><br><b>no load-balance-method</b> |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                            |
| <b>Description</b> | This command describes how new sessions are assigned to an L2TP ISA MDA.               |

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|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | load-balance-method per-session                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b> | <p><b>per-session</b> — Specifies that the lowest granularity for load-balancing is a session; each session can be assigned to a different ISA MDA.</p> <p><b>per-tunnel</b> — Specifies that the lowest granularity for load-balancing is a tunnel; all sessions associated with the same tunnel are assigned to the same ISA MDA; this may be useful or required in certain cases, for example:</p> <ul style="list-style-type: none"> <li>MLPPP with multiple links per bundle;</li> <li>HPol intermediate destination arbiters where the intermediate destination is an L2TP tunnel.</li> </ul> |

## local-address

|                    |                                                                               |
|--------------------|-------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>local-address</b> <i>ip-address</i><br><b>no local-address</b>             |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                   |
| <b>Description</b> | This command configures the local address.                                    |
| <b>Default</b>     | no local-address                                                              |
| <b>Parameters</b>  | <i>ip-address</i> — Specifies the IP address used during L2TP authentication. |

## local-name

|                    |                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>local-name</b> <i>host-name</i><br><b>no local-name</b>                                                                                                                                                                                                                               |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                                                                                                                              |
| <b>Description</b> | <p>This command creates the local host name used by this system for the tunnels in this L2TP group during the authentication phase of tunnel establishment. It can be used to distinguish tunnels.</p> <p>The <b>no</b> form of the command removes the name from the configuration.</p> |
| <b>Default</b>     | no local-name                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <p><i>host-name</i> — Specifies the host name, up to 64 characters in length, that the router will use to identify itself during L2TP authentication.</p> <p><b>Default</b> no local-name</p>                                                                                            |

## max-retries-estab

|                    |                                                                                                                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>max-retries-estab</b> <i>max-retries</i><br><b>no max-retries-estab</b>                                                                                                                                                      |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                                                                     |
| <b>Description</b> | This command configures the number of retries allowed for this L2TP tunnel while it is established, before its control connection goes down.<br><br>The <b>no</b> form of the command removes the value from the configuration. |
| <b>Default</b>     | no max-retries-estab                                                                                                                                                                                                            |
| <b>Parameters</b>  | <i>max-retries</i> — Specifies the maximum number of retries for an established tunnel.<br><br><b>Default</b> no max-retries-estab<br><b>Values</b> 2 to 7                                                                      |

## max-retries-not-estab

|                    |                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>max-retries-not-estab</b> <i>max-retries</i><br><b>no max-retries-not-estab</b>                                                                                                                                                  |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                                                                         |
| <b>Description</b> | This command configures the number of retries allowed for this L2TP tunnel while it is not established, before its control connection goes down.<br><br>The <b>no</b> form of the command removes the value from the configuration. |
| <b>Default</b>     | no max-retries-not-estab                                                                                                                                                                                                            |
| <b>Parameters</b>  | <i>max-retries</i> — Specifies the maximum number of retries for non-established tunnels.<br><br><b>Default</b> no max-retries-not-estab<br><b>Values</b> 2 to 7                                                                    |

## ppp

|                    |                                                             |
|--------------------|-------------------------------------------------------------|
| <b>Syntax</b>      | <b>ppp</b>                                                  |
| <b>Context</b>     | config>router>l2tp>group<br>config>router>l2tp>group>tunnel |
| <b>Description</b> | This command configures PPP for the L2TP tunnel group.      |

---

## authentication

|                    |                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>authentication</b> { <b>chap</b>   <b>pap</b>   <b>pref-chap</b>   <b>prep-pap</b> }                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>l2tp>group>ppp                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command configures the PPP authentication protocol to negotiate authentication.                                                                                                                                                                                                                                                                                              |
| <b>Default</b>     | authentication pref-chap                                                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <b>chap</b> — Specifies to always use CHAP for authentication.<br><b>pap</b> — Specifies to always use PAP for authentication.<br><b>pref-chap</b> — Specifies to use CHAP as the preferred authentication method, and to use PAP if that attempt fails.<br><b>prep-pap</b> — Specifies to use PAP as the preferred authentication method, and to use CHAP if that attempt fails. |

## authentication-policy

|                    |                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>authentication-policy</b> <i>auth-policy-name</i><br><b>no authentication-policy</b>           |
| <b>Context</b>     | config>router>l2tp>group>ppp                                                                      |
| <b>Description</b> | This command configures the authentication policy.                                                |
| <b>Default</b>     | no authentication-policy                                                                          |
| <b>Parameters</b>  | <i>auth-policy-name</i> — Specifies the authentication policy name.<br><b>Values</b> 32 chars max |

## default-group-interface

|                    |                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>default-group-interface</b> <i>ip-int-name</i> <b>service-id</b> <i>service-id</i><br><b>default-group-interface</b> <i>ip-int-name</i> <b>service-name</b> <i>svc-name</i><br><b>no default-group-interface</b> |
| <b>Context</b>     | config>router>l2tp>group>ppp                                                                                                                                                                                        |
| <b>Description</b> | This command configures the default group interface.                                                                                                                                                                |
| <b>Default</b>     | no default-group-interface                                                                                                                                                                                          |
| <b>Parameters</b>  | <i>ip-int-name</i> — Specifies the interface name.<br><b>Values</b> 32 chars max                                                                                                                                    |



*service-id* — Specifies the service ID.

**Values** 1 to 2147483648

*svc-name* — Specifies the service name (instead of service ID).

**Values** 64 chars max

## keepalive

|                    |                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>keepalive</b> <i>seconds</i> [ <b>hold-up-multiplier</b> <i>multiplier</i> ]<br><b>no keepalive</b>                                                  |
| <b>Context</b>     | config>router>l2tp>group>ppp                                                                                                                            |
| <b>Description</b> | This command configures the PPP keepalive interval and multiplier.                                                                                      |
| <b>Default</b>     | keepalive 30 hold-up-multiplier 3                                                                                                                       |
| <b>Parameters</b>  | <i>seconds</i> — Specifies in seconds the interval.<br><b>Values</b> 10 to 300<br><i>multiplier</i> — Specifies the multiplier.<br><b>Values</b> 1 to 5 |

## lcp-force-ack-accm

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] <b>lcp-force-ack-accm</b>                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>router>l2tp>group>ppp                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | This command enables or disables the LCP Asynchronous Control Character Map (ACCM) configuration option. When the ACCM configuration option is enabled, the option is acknowledged during the LCP negotiation between the LNS and the PPP client, but no ACCM mapping is performed. By default, the ACCM configuration option is rejected.<br><br>The <b>no</b> form of this command reverts to the default value. |
| <b>Default</b>     | no lcp-force-ack-accm                                                                                                                                                                                                                                                                                                                                                                                              |

## mtu

|                    |                                                   |
|--------------------|---------------------------------------------------|
| <b>Syntax</b>      | <b>mtu</b> <i>mtu-bytes</i><br><b>no mtu</b>      |
| <b>Context</b>     | config>router>l2tp>group>ppp                      |
| <b>Description</b> | This command configures the maximum PPP MTU size. |

---

|                   |                                                                   |
|-------------------|-------------------------------------------------------------------|
| <b>Default</b>    | mtu 1500                                                          |
| <b>Parameters</b> | <i>mtu-bytes</i> — Specifies, in bytes, the maximum PPP MTU size. |
| <b>Values</b>     | 512 to 9212                                                       |

## proxy-authentication

|                    |                                                                                   |
|--------------------|-----------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] proxy-authentication</b>                                                  |
| <b>Context</b>     | config>router>l2tp>group>ppp                                                      |
| <b>Description</b> | This command configures the use of the authentication AVPs received from the LAC. |
| <b>Default</b>     | no proxy-authentication                                                           |

## proxy-lcp

|                    |                                                                              |
|--------------------|------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] proxy-lcp</b>                                                        |
| <b>Context</b>     | config>router>l2tp>group>ppp                                                 |
| <b>Description</b> | This command configures the use of the proxy LCP AVPs received from the LAC. |
| <b>Default</b>     | no proxy-lcp                                                                 |

## reject-disabled-ncp

|                    |                                                                                                                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] reject-disabled-ncp</b>                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>l2tp>group>ppp<br>config>router>l2tp>group>tunnel>ppp                                                                                                                                                                       |
| <b>Description</b> | <p>This command forces an LCP Protocol Reject when receiving an IPv6CP Configure Request message when IPv6 is not configured.</p> <p>By default, an IPv6CP Configure Request message is silently ignored when IPv6 is not configured.</p> |

## user-db

|                |                                                               |
|----------------|---------------------------------------------------------------|
| <b>Syntax</b>  | <b>user-db</b> <i>local-user-db-name</i><br><b>no user-db</b> |
| <b>Context</b> | config>router>l2tp>group>ppp                                  |

---

|                    |                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------|
| <b>Description</b> | This command configures the local user database to use for PPP PAP/CHAP authentication. |
| <b>Default</b>     | no user-db                                                                              |
| <b>Parameters</b>  | <i>local-user-db-name</i> — Specifies the local user database name.                     |
| <b>Values</b>      | 32 chars max                                                                            |

## session-assign-method

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>session-assign-method</b> [existing-first   weighted   weighted-random]<br><b>no session-assign-method</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>router>l2tp>group                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | This command specifies how new sessions are assigned to one of the set of suitable tunnels that are available or could be made available.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Default</b>     | existing-first                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><b>existing-first</b> — Specifies that all new sessions are placed by preference in the existing tunnels.</p> <p><b>weighted</b> — Specifies that the sessions are shared between the available tunnels. If necessary, new tunnels are set up until the maximum number is reached. The distribution aims at an equal ratio of the actual number of sessions to the maximum number of sessions.</p> <p><b>weighted-random</b> — Enhances the weighted algorithm such that when there are multiple tunnels with an equal number of sessions (equal weight), LAC randomly selects a tunnel.</p> |

## session-limit

|                    |                                                                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>session-limit</b> <i>session-limit</i><br><b>session-limit unlimited</b><br><b>no session-limit</b>                                                                                                                                         |
| <b>Context</b>     | config>router>l2tp<br>config>router>l2tp>group<br>config>router>l2tp>group>tunnel                                                                                                                                                              |
| <b>Description</b> | <p>This command configures the session limit. The value controls how many L2TP sessions will be allowed within a given context (system, group, tunnel).</p> <p>The <b>no</b> form of the command removes the value from the configuration.</p> |
| <b>Default</b>     | no session-limit                                                                                                                                                                                                                               |

---

**Parameters**    *session-limit* — Specifies the allowed number of sessions within the given context.

**Values**        1 to 131071

**unlimited** — Specifies to use the maximum number of sessions available.

## group-session-limit

**Syntax**        **group-session-limit** *session-limit*  
                  **group-session-limit unlimited**  
                  **no group-session-limit**

**Context**        config>router>l2tp

**Description**    This command configures the L2TP session limit for each group of this router.

**Default**        no group-session-limit

## cookie-length

**Syntax**        **cookie-length** *cookie-length*  
                  **no cookie-length**

**Context**        config>router>l2tp>l2tpv3

**Description**    This command configures the length of the optional cookie field.

**Parameters**    *cookie-length* — Specifies the cookie length in bytes.

**Values**        4, 8

## digest-type

**Syntax**        **digest-type** {*none* | *md5* | *sha1*}  
                  **no digest-type**

**Context**        config>router>l2tp>l2tpv3

**Description**    This command configures the hashing algorithm used to calculate the message digest.

**Parameters**    **none** — Specifies that no digest should be used.  
                  **md5** — Specifies that the MD5 algorithm should be used.  
                  **sha1** — Specifies that the SHA1 algorithm should be used.

## nonce-length

|                    |                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>nonce-length</b> <i>length</i><br><b>no nonce-length</b>                                                |
| <b>Context</b>     | config>router>l2tp>l2tpv3                                                                                  |
| <b>Description</b> | This command configures the length for the local L2TPv3 nonce (random number) value used in the Nonce AVP. |
| <b>Parameters</b>  | <i>length</i> — Specifies the length of the Nonce AVP value.<br><b>Values</b> 16 to 64                     |

## private-tcp-mss-adjust

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>private-tcp-mss-adjust</b> <i>octets</i><br><b>no private-tcp-mss-adjust</b>                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>l2tp>l2tpv3<br>config>service>vprn>l2tp>l2tpv3                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | This command enables TCP MSS adjust for L2TPv3 tunnels on the private side of the service level. When this command is configured, the system updates the TCP MSS option value of the received TCP SYN packet on the private side.<br><br>Note that this command can be overridden by the corresponding configuration on the group or tunnel level.<br><br>The <b>no</b> form of this command disables TCP MSS adjust on the private side. |
| <b>Default</b>     | no private-tcp-mss-adjust                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <i>octets</i> — Specifies the new TCP MSS value in octets.<br><b>Values</b> 512 to 9000                                                                                                                                                                                                                                                                                                                                                   |

## public-tcp-mss-adjust

|                    |                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>public-tcp-mss-adjust</b> <i>octets</i><br><b>no public-tcp-mss-adjust</b>                                                                                                                                                                                            |
| <b>Context</b>     | config>router>l2tp>l2tpv3<br>config>service>vprn>l2tp>l2tpv3                                                                                                                                                                                                             |
| <b>Description</b> | This command enables TCP MSS adjust for L2TPv3 tunnels on the public side on the service level. When the command is configured, the system updates the TCP MSS option value of the received TCP SYN packet on the public side that is encapsulated in the L2TPv3 tunnel. |

Note that this command can be overridden by the corresponding configuration on the group or tunnel level.

The **no** form of this command disables TCP MSS adjust on the public side.

|                   |                                                           |
|-------------------|-----------------------------------------------------------|
| <b>Default</b>    | no public-tcp-mss-adjust                                  |
| <b>Parameters</b> | <i>octets</i> — Specifies the new TCP MSS value in octets |
| <b>Values</b>     | 512 to 9000                                               |

## transport-type

|                    |                                                                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>transport-type {ip}</b><br><b>no transport-type</b>                                                                                                                                                                         |
| <b>Context</b>     | config>router>l2tp>l2tpv3                                                                                                                                                                                                      |
| <b>Description</b> | This command configures the transport type to be used to carry the L2TPv3 tunnel. Currently, only IP transport is supported.<br><br>The <b>no</b> form of this command returns the <b>transport-type</b> to the default value. |
| <b>Default</b>     | no transport-type                                                                                                                                                                                                              |
| <b>Parameters</b>  | <b>ip</b> — Specifies that IP should be used as the transport type for the L2TPv3 tunnel.                                                                                                                                      |

## next-attempt

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>next-attempt {same-preference-level   next-preference-level}</b><br><b>no next-attempt</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>router>l2tp<br>config>service>vpn>l2tp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | This command enables tunnel selection algorithm based on the tunnel preference level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <b>same-preference-level</b> — In case that the tunnel-spec selection algorithm evaluates into a tunnel that is currently unavailable (for example tunnel in a blacklist) then the next elected tunnel, if available, will be chosen within the same preference-level as the last attempted tunnel. Only when all tunnels within the same preference level are exhausted, the tunnel selection algorithm will move to the next preference level.<br><br>In case that a new session setup request is received while all tunnels on the same preference level are blacklisted, the L2TP session will try to be established on blacklisted tunnels before the tunnel selection moves to the next preference level. |

**next-preference-level** — In case that the tunnel-spec selection algorithm evaluates into a tunnel that is currently unavailable (for example tunnel in a blacklist) then the selection algorithm will try to select the tunnel from the next preference level, even though the tunnels on the same preference level might be available for selection.

**Default** next-preference-level

## peer-address-change-policy

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>peer-address-change-policy</b> { <b>accept</b>   <b>ignore</b>   <b>reject</b> }                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router>l2tp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | This command specifies what to do in case the system receives a L2TP response from another address than the one the request was sent to.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Default</b>     | peer-address-change-policy reject                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><b>accept</b> — Specifies that this system accepts any source IP address change of received L2TP control messages related to a locally originated tunnel in the state waitReply and rejects any peer address change for other tunnels; in case the new peer IP address is accepted, it is learned and used as destination address in subsequent L2TP messages.</p> <p><b>ignore</b> — Specifies that this system ignores any source IP address change of received L2TP control messages, does not learn any new peer IP address and does not change the destination address in subsequent L2TP messages.</p> <p><b>reject</b> — Specifies that this system rejects any source IP address change of received L2TP control messages and drops those messages.</p> |

## receive-window-size

|                    |                                                                                |
|--------------------|--------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>receive-window-size</b> <i>window-size</i><br><b>no receive-window-size</b> |
| <b>Context</b>     | config>router>l2tp                                                             |
| <b>Description</b> | This command configures the L2TP receive window size.                          |
| <b>Default</b>     | receive-window-size 64                                                         |
| <b>Parameters</b>  | <i>window-size</i> — Specifies the window size.                                |

## replace-result-code

**Syntax** **replace-result-code** *code* [*code*]

---

|                    |                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | <b>no replace-result-code</b>                                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>l2tp<br>config>service>vpn>l2tp                                                                                                                                                                                                       |
| <b>Description</b> | This command will replace CDN Result-Code 4, 5 and 6 on LNS with the Result Code 2. This is needed for interoperability with some implementation of LAC which only take action based on CDN Result-Code 2, while ignore CDN Result-Code 4, 5 and 6. |
| <b>Default</b>     | no replace-result-code                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <i>code</i> — Specifies the L2TP Result codes that need to be replaced. Up to three codes can be specified.                                                                                                                                         |
|                    | <b>Values</b>                                                                                                                                                                                                                                       |
|                    | cdn-tmp-no-facilities — CDN Result-Code 4 on LNS will be replaced with the result code 2 before it is sent to LAC.                                                                                                                                  |
|                    | cdn-prem-no-facilities — CDN Result-Code 5 on LNS will be replaced with the result code 2 before it is sent to LAC.                                                                                                                                 |
|                    | cdn-inv-dest — CDN Result-Code 6 on LNS will be replaced with the result code 2 before it is sent to LAC.                                                                                                                                           |

## rtm-debounce-time

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>rtm-debounce-time</b> <i>debounce-time</i><br><b>no rtm-debounce-time</b>                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>router>l2tp                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | This command configures the amount of time, in milliseconds, that the system will wait before declaring an L2TP tunnel down when the remote endpoint IP address cannot be resolved to an active IP route in the local routing table.<br><br>The default behavior is for the L2TP tunnel to not be declared down based on the remote endpoint IP address reachability.<br><br>The <b>no</b> form of this command returns the <b>rtm-debounce-time</b> to a value of 0. |
| <b>Default</b>     | no rtm-debounce-time                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <i>debounce-time</i> — Specifies the amount of time, in milliseconds, that the system will wait before declaring the associated L2TP tunnel as down.                                                                                                                                                                                                                                                                                                                  |
|                    | <b>Values</b> 0 to 5000                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## tunnel-selection-blacklist

|                |                                   |
|----------------|-----------------------------------|
| <b>Syntax</b>  | <b>tunnel-selection-blacklist</b> |
| <b>Context</b> | config>router>l2tp                |



**Description** This command enables the context to configure L2TP Tunnel Selection Blacklist parameters.

## add-tunnel

**Syntax** **add-tunnel never**  
**add-tunnel on** *reason* [*reason*]  
**no add-tunnel**

**Context** config>router>l2tp>tunnel-selection-blacklist  
config>service>vpn>l2tp>tunnel-selection-blacklist

**Description** This command will force the tunnel to the blacklist and render it unavailable for new sessions for the duration of preconfigured time. Peers are always forced to the black list in case that they time out (failure to receive response to control packets). In addition to time outs, certain events can be used to trigger placement of the tunnel on the black list.

**Default** add-tunnel never

**Parameters** **never** — When specified, no tunnels will be placed on blacklist under any circumstance. This parameter will available to preserve backward compatibility.

**reason** — Specifies the return codes or events that determine which tunnels are added to the blacklist. A maximum of eight reasons can be specified in a single statement.

**Table 8 Return codes**

| Return code                           | Tunnels added to blacklist                                                                                                                                                                                  |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>cdn-err-code</b>                   | A tunnel will be forced to the blacklist in case that CDN message with the Result Code 2 (Call disconnected for the reasons indicated in error code) is received.                                           |
| <b>cdn-inv-dest</b>                   | A tunnel will be forced to the blacklist in case that CDN message with the Result Codes 6 (Invalid destination) is received.                                                                                |
| <b>cdn-tmp-no-facilities</b>          | A tunnel will be forced to the blacklist in case that CDN message with the Result Code 4 is received (Call failed due to lack of appropriate facilities being available - temporary condition) is received. |
| <b>cdn-perm-no-facilities</b>         | A tunnel will be forced to the blacklist in case that CDN message with the Result Codes 5 (Call failed due to lack of appropriate facilities being available - permanent condition) is received.            |
| <b>tx-cdn-not-established-in-time</b> | A tunnel will be forced to the blacklist in case that CDN message with the Result Code 10 (Call was not established within time allotted by LAC) is sent from the LAC to the LNS.                           |

**Table 8** Return codes (Continued)

| Return code                | Tunnels added to blacklist                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>stop-ccn-err-code</b>   | A tunnel will be forced to the blacklist in case that StopCCN message with the Result Code 2 (General error – Error Code indicates the problem) is sent or received.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>stop-ccn-other</b>      | <p>A tunnel will be forced to the blacklist in case that StopCCN message with the following Result Codes is received:</p> <ul style="list-style-type: none"> <li>(1) General request to clear control connection</li> <li>(4) Requester is not authorized to establish a control channel</li> <li>(5) Protocol version not supported</li> <li>(6) Requester is being shutdown</li> </ul> <p>Or in the case that the StopCCN with the following result codes is transmitted:</p> <ul style="list-style-type: none"> <li>(4) Requester is not authorized to establish a control channel.</li> <li>(5) Protocol version not supported</li> </ul> <p>The receipt of the following Result Codes will NEVER blacklist a tunnel:</p> <ul style="list-style-type: none"> <li>(0) Reserved</li> <li>(3) Control channel already exist</li> <li>(7) Finite state machine error</li> <li>(8) Undefined</li> </ul> <p>Transmission of the following Result Codes will NEVER blacklist a tunnel:</p> <ul style="list-style-type: none"> <li>(1) General request to clear control connection</li> <li>(3) Control channel already exist</li> <li>(6) Requester is being shutdown</li> <li>(7) Finite state machine error</li> </ul> |
| <b>addr-change-timeout</b> | A timed-out tunnel for which the peer IP address has changed mid-session (from the one that is provided initially during configuration) will be forced to the blacklist. In absence of this configuration option, only the configured peer for the tunnel will be blacklisted, but not the tunnel itself which now has a different peer address than the one initially configured.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## max-list-length

**Syntax**    **max-list-length unlimited**  
**max-list-length** *count*  
**no max-list-length**

---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>router>l2tp>tunnel-selection-blacklist<br>config>service>vprn>l2tp>tunnel-selection-blacklist                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | This command configured the maximum length of the peer/tunnel blacklist.<br><br>This command specifies how many items (tunnels or peers) can be in the tunnel-selection-blacklist. If a tunnel or peer needs to be added to the tunnel-selection-blacklist and the tunnel-selection-blacklist is full, the system will remove the item (tunnel or peer) from the blacklist that was in this blacklist for the longest time. |
| <b>Default</b>     | max-list-length unlimited                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <b>unlimited</b> — Specifies there is no limit.<br><br><i>count</i> — Specifies how many items (tunnels or peers) can be in the tunnel-selection-blacklist.<br><br><b>Values</b> 1 to 65635                                                                                                                                                                                                                                 |

## max-time

|                    |                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>max-time</b> <i>minutes</i><br><b>no max-time</b>                                                                   |
| <b>Context</b>     | config>router>l2tp>tunnel-selection-blacklist<br>config>service>vprn>l2tp>tunnel-selection-blacklist                   |
| <b>Description</b> | This command configures time for which an entity (peer or a tunnel) are kept in the blacklist.                         |
| <b>Default</b>     | max-time 5                                                                                                             |
| <b>Parameters</b>  | <i>minutes</i> — Specifies the maximum time a tunnel or peer may remain in the blacklist.<br><br><b>Values</b> 1 to 60 |

## timeout-action

|                    |                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>timeout-action</b> <i>action</i><br><b>no timeout-action</b>                                                                                         |
| <b>Context</b>     | config>router>l2tp>tunnel-selection-blacklist<br>config>service>vprn>l2tp>tunnel-selection-blacklist                                                    |
| <b>Description</b> | This command defines an action that will be executed on the entity (peer/tunnel) in the blacklist once the entity becomes eligible for selection again. |
| <b>Default</b>     | timeout-action remove-from-blacklist                                                                                                                    |

**Parameters**    *action* — Specifies the Action to be taken when a tunnel or peer has been in the blacklist for the max-period of time.

**Values**        **remove-from-blacklist** — The peer or tunnel in the blacklist will be removed completely from the blacklist and made eligible for the selection process once the max-time expires. In this mode of operation, multiple new sessions can be mapped into the same, newly released tunnel from the blacklist. The first such session will try to setup the tunnel, while the other will be buffered until the tunnel establishment process is completed. In case that the tunnel remains unavailable, it will be placed in the blacklist again. Consequently all new sessions will have to be renegotiated over an alternate tunnel.

**try-one-session** — Once the max-time expired, the peer or tunnel in the blacklist is made available for selection only to a single new session request. Only upon successful tunnel establishment will the incoming new sessions be eligible to be mapped into this tunnel. This behavior will avoid session establishment delays in case that the tunnel just removed from the blacklist is still unavailable.

### 2.13.2.3.1 Router L2TP Tunnel Commands

Router L2TP tunnel commands only apply to the 7750 SR and 7450 ESS.

#### tunnel

**Syntax**        **tunnel** *tunnel-name* [**create**]  
                  **no tunnel** *tunnel-name*

**Context**        config>router>l2tp>group

**Description**    This command configures an L2TP tunnel. A tunnel exists between a LAC-LNS pair and consists of a Control Connection and zero or more L2TP sessions. The tunnel carries encapsulated PPP datagrams and control messages between the LAC and the L2TP Network Server (LNS).

**Parameters**    *tunnel-name* — Specifies a valid string to identify a L2TP up to 32 characters in length.  
                  **create** — Mandatory while creating a new tunnel.

#### auto-establish

**Syntax**        [**no**] **auto-establish**

**Context**        config>router>l2tp>group>tunnel

**Description**    This command specifies if this tunnel is to be automatically set up by the system.

---

**Default** no auto-establish

## peer

**Syntax** **peer** *ip-address*  
**no peer**

**Context** config>router>l2tp>group>tunnel

**Description** This command configures the peer address.

The **no** form of the command removes the IP address from the tunnel configuration.

**Default** no peer

**Parameters** *ip-address* — Sets the LNS IP address for the tunnel.

## lcp-force-ack-accm

**Syntax** **lcp-force-ack-accm** {**always** | **never**}  
**no lcp-force-ack-accm**

**Context** config>router>l2tp>group>tunnel>ppp

**Description** This command enables or disables the LCP Asynchronous Control Character Map (ACCM) configuration option. When the ACCM configuration option is enabled, the option is acknowledged during the LCP negotiation between the LNS and the PPP client, but no ACCM mapping is performed. By default, the ACCM configuration option is rejected.

The **no** form of this command reverts to the default value.

**Parameters** **always** — LCP ACCM is always used.  
**never** — LCP ACCM is never used.

## preference

**Syntax** **preference** *preference*  
**no preference**

**Context** config>router>l2tp>group>tunnel

**Description** This command configures a preference number that indicates the relative preference assigned to a tunnel when using a weighted session assignment.

The **no** form of the command removes the preference value from the tunnel configuration.

---

|                   |                                                                                                                               |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no preference                                                                                                                 |
| <b>Parameters</b> | <i>preference</i> — Specifies the tunnel preference number with its group. The value 0 corresponds to the highest preference. |
| <b>Values</b>     | 0 to 16777215                                                                                                                 |

## remote-name

|                    |                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>remote-name</b> <i>host-name</i><br><b>no remote-name</b>                                                                                      |
| <b>Context</b>     | config>router>l2tp>group>tunnel                                                                                                                   |
| <b>Description</b> | This command configures a string to be compared to the host name used by the tunnel peer during the authentication phase of tunnel establishment. |
| <b>Default</b>     | no remote-name                                                                                                                                    |
| <b>Parameters</b>  | <i>host-name</i> — Specifies a remote host name for the tunnel up to 64 characters.                                                               |

## 2.13.2.4 Router Interface Commands

### if-attribute

|                    |                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>if-attribute</b>                                                                                                                                         |
| <b>Context</b>     | config>router<br>config>router>if<br>config>service>ies>if<br>config>service>vpn>if                                                                         |
| <b>Description</b> | This command creates the context to configure or apply IP interface attributes such as administrative group (admin-group) or Shared Risk Loss Group (SRLG). |

### admin-group

|                    |                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>admin-group</b> <i>group-name</i> <b>value</b> <i>group-value</i><br><b>no admin-group</b> <i>group-name</i> |
| <b>Context</b>     | config>router>if-attribute                                                                                      |
| <b>Description</b> | This command defines an administrative group (admin-group) that can be associated with an IP or MPLS interface. |

Admin groups, also known as affinity, are used to tag IP and MPLS interfaces that share a specific characteristic with the same identifier. For example, an admin group identifier can represent all links that connect to core routers, or all links that have a bandwidth higher than 10G, or all links that are dedicated to a specific service.

The user first configures locally on each router the name and identifier of each admin group. A maximum of 32 admin groups can be configured per system.

The user then configures the admin group membership of an interface. The user can apply admin groups to a IES, VPRN, network IP, or MPLS interface.

When applied to MPLS interfaces, the interfaces can be included or excluded in the LSP path definition by inferring the admin-group name. CSPF will compute a path that satisfies the admin-group include and exclude constraints.

When applied to IES, VPRN, or network IP interfaces, the interfaces can be included or excluded in the route next-hop selection by inferring the admin-group name in a route next-hop policy template applied to an interface or a set of prefixes.

The following provisioning rules are applied to admin group configuration. The system will reject the creation of an admin-group if it re-uses the same name but with a different group value than an existing group. The system will also reject the creation of an admin-group if it re-uses the same group value but with a different name than an existing group.

Only the admin groups bound to an MPLS interface are advertised area-wide in TE link TLVs and sub-TLVs when the **traffic-engineering** option is enabled in IS-IS or OSPF. IES and VPRN interfaces do not have their attributes advertised in TE TLVs.

|                   |                                                                                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>group-name</i> — Specifies the name of the group with up to 32 characters. The association of group name and value should be unique within an IP/MPLS domain |
|                   | <i>group-value</i> — Specifies the integer value associated with the group. The association of group name and value should be unique within an IP/MPLS domain.  |
|                   | <b>Values</b> 0 to 31                                                                                                                                           |

## srlg-group

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>srlg-group</b> <i>group-name</i> <b>value</b> <i>group-value</i> [ <b>penalty-weight</b> <i>penalty-weight</i> ]<br><b>no srlg-group</b> <i>group-name</i>                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>router>if-attribute                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command defines a Shared Risk Link Group (SRLG) which can be associated with an IP or MPLS interface.</p> <p>SRLG is used to tag IP or MPLS interfaces which share a specific fate with the same identifier. For example, an SRLG group identifier could represent all links which use separate fibers but are carried in the same fiber conduit. If the conduit is accidentally cut, all the fiber links are cut which means all interfaces using these fiber links will fail.</p> |

The user first configures locally on each router the name and identifier of each SRLG group. A maximum of 1024 SRLGs can be configured per system.

The user then configures the SRLG membership of an interface. The user can apply SRLGs to an IES, VPRN, network IP, or MPLS interface. A maximum of 64 SRLGs can be applied to a given interface.

When SRLGs are applied to MPLS interfaces, CSPF at an LER will exclude the SRLGs of interfaces used by the LSP primary path when computing the path of the secondary path. CSPF at an LER or LSR will also exclude the SRLGs of the outgoing interface of the primary LSP path in the computation of the path of the FRR backup LSP. This provides path disjointness between the primary path and the secondary path or FRR backup path of an LSP.

When SRLGs applied to IES, VPRN, or network IP interfaces, they are evaluated in the route next-hop selection by adding the **srlg-enable** option in a route next-hop policy template applied to an interface or a set of prefixes. For instance, the user can enable the SRLG constraint to select a LFA next-hop for a prefix which avoids all interfaces that share fate with the primary next-hop.

The following provisioning rules are applied to SRLG configuration. The system will reject the creation of a SRLG if it re-uses the same name but with a different group value than an existing group. The system will also reject the creation of an SRLG if it re-uses the same group value but with a different name than an existing group.

Only the SRLGs bound to an MPLS interface are advertised area-wide in TE link TLVs and sub-TLVs when the **traffic-engineering** option is enabled in IS-IS or OSPF. IES and VPRN interfaces do not have their attributes advertised in TE TLVs.

A user may specify a penalty weight (**penalty-weight**) associated with an SRLG. This controls the likelihood of paths with links sharing SRLG values with a primary path being used by a bypass or detour LSP. The higher the penalty weight, the less desirable it is to use the link with a given SRLG.

|                   |                                                                                                                                                                |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>group-name</i> — Specifies the name of the group, up to 32 characters. The association of group name and value should be unique within an IP/MPLS domain.   |
|                   | <i>group-value</i> — Specifies the integer value associated with the group. The association of group name and value should be unique within an IP/MPLS domain. |
|                   | <b>Values</b> 0 to 4294967295                                                                                                                                  |
|                   | <i>penalty-weight</i> — Specifies the integer value of the penalty weight that is assigned to the SRLG group                                                   |
|                   | <b>Values</b> 0 to 65535                                                                                                                                       |
|                   | <b>Default</b> 0                                                                                                                                               |



## interface

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>interface</b> <i>interface-name</i> [unnumbered-mpls-tp]</p> <p><b>interface</b> <i>interface-name</i> control-tunnel</p> <p><b>interface</b> <i>interface-name</i> gmpls-loopback</p> <p><b>interface</b> <i>interface-name</i> pdn</p> <p><b>no interface</b> <i>interface-name</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>This command creates a logical IP routing or unnumbered MPLS-TP interface. Once created, attributes like IP address, port, or system can be associated with the IP interface.</p> <p>Interface names are case-sensitive and must be unique within the group of IP interfaces defined for <b>config router interface</b> and <b>config service ies interface</b>. Interface names must not be in the dotted decimal notation of an IP address.; for example, the name “1.1.1.1” is not allowed, but “int-1.1.1.1” is allowed. Show commands for router interfaces use either the interface names or the IP addresses. Ambiguity can exist if an IP address is used as an IP address and an interface name. Duplicate interface names can exist in different router instances, although this is not recommended because it is confusing.</p> <p>When a new name is entered, a new logical router interface is created. When an existing interface name is entered, the user enters the router interface context for editing and configuration.</p> <p>Although not a keyword, the ip-int-name “<b>system</b>” is associated with the network entity (such as a specific router), not a specific interface. The system interface is also referred to as the loopback address.</p> <p>An unnumbered MPLS-TP interface is a special type of interface that is only intended for MPLS-TP LSPs. IP routing protocols are blocked on interfaces of this type. If an interface is configured as unnumbered-mpls-tp, then it can only be associated with an Ethernet port or VLAN, using the port command, then either a unicast, multicast, or broadcast remote MAC address may be configured. Only static ARP is supported.</p> <p>A GMPLS loopback interface is a special type of loopback interface that is used as the IP interface for a GMPLS IP Control Channel (IPCC). RSVP and LMP packets associated with GMPLS are associated with this loopback interface. All other IP protocols are blocked on this interface. One <b>gmpls-loopback</b> interface is required for each GMPLS peer node.</p> <p>The control-tunnel parameter creates a loopback interface representing a GRE tunnel. One IP tunnel can be created in this interface.</p> <p>Only the primary IPv4 interface address and only one IP tunnel per interface are allowed. Multiple tunnels can be configured using up to four controlTunnel loopback interfaces. A static route can take the new controlTunnel interface as a next hop.</p> <p>The <b>no</b> form of the command removes the IP interface and all the associated configurations. The interface must be administratively shut down before issuing the <b>no interface</b> command.</p> |

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|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | No interfaces or names are defined within the system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b> | <p><i>interface-name</i> — The name of the IP interface. Interface names must be unique within the group of defined IP interfaces for <b>config router interface</b> and <b>config service ies interface</b> commands. An interface name cannot be in the form of an IP address. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes.</p> <p><b>Values</b> 1 to 32 alphanumeric characters.</p> <p>If the <i>ip-int-name</i> already exists, the context is changed to maintain that IP interface. If <i>ip-int-name</i> already exists within another service ID or is an IP interface defined within the <b>config router</b> commands, an error will occur and the context will not be changed to that IP interface. If <i>ip-int-name</i> does not exist, the interface is created and the context is changed to that interface for further command processing.</p> <p><b>unnumbered-mpls-tp</b> — Specifies that an interface is an unnumbered MPLS-TP. An unnumbered MPLS-TP interface is a special type of interface that is only intended for MPLS-TP LSPs. IP routing protocols are blocked on interfaces of this type. If an interface is configured as <b>unnumbered-mpls-tp</b>, then it can only be associated with an Ethernet port or VLAN, using the <b>port</b> command. A unicast, multicast, or broadcast remote MAC address can be configured using the <b>static-arp</b> command. Only static ARP is supported.</p> <p><b>gmpls-loopback</b> — Specifies that the interface is a loopback interface for GMPLS control plane packets.</p> <p><b>control-tunnel</b> — Specifies that the interface represents a loopback interface for a GRE tunnel to be used for the GMPLS IPCC.</p> <p><b>pdn</b> — Specifies that the interface is a PDN.</p> |

## address

|                    |                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>address</b> { <i>ip-address/mask</i>   <i>ip-address netmask</i> } [ <b>broadcast</b> { <b>all-ones</b>   <b>host-ones</b> }] [ <b>track-srrp</b> <i>srrp-instance</i> ]<br><b>no address</b>                                    |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This command assigns an IP address, IP subnet, and broadcast address format to an IP interface. Only one IP address can be associated with an IP interface. Use the <b>secondary</b> command to assign additional addresses.</p> |

An IP address must be assigned to each IP interface. An IP address and a mask combine to create a local IP prefix. The defined IP prefix must be unique within the context of the routing instance. It cannot overlap with other existing IP prefixes defined as local subnets on other IP interfaces in the same routing context within the router.

The local subnet that the **address** command defines must not be part of the services address space within the routing context by use of the **config router service-prefix** command. Once a portion of the address space is allocated as a service prefix, that portion is not available to IP interfaces for network core connectivity.

The IP address for the interface can be entered in either CIDR (Classless Inter-Domain Routing) or traditional dotted decimal notation. **Show** commands display CIDR notation and are stored in configuration files.

By default, no IP address or subnet association exists on an IP interface until it is explicitly created.

The **no** form of the command removes the IP address assignment from the IP interface. Interface specific configurations for MPLS are also removed. This will operationally stop any MPLS LSPs that explicitly reference that IP address. When a new IP address is configured, interface specific configurations for MPLS need to be added. IEEE 1588 port based timestamping configured with **ptp-hw-assist** is also disabled.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | No IP address is assigned to the IP interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b> | <p><i>ip-address</i> — The IP address of the IP interface. The <i>ip-address</i> portion of the <b>address</b> command specifies the IP host address that will be used by the IP interface within the subnet. This address must be unique within the subnet and specified in dotted decimal notation.</p> <p><b>Values</b> 1.0.0.0 to 223.255.255.255</p> <p><i>/</i> — The forward slash is a parameter delimiter that separates the <i>ip-address</i> portion of the IP address from the mask that defines the scope of the local subnet. No spaces are allowed between the <i>ip-address</i>, the <i>"/"</i> and the <i>mask</i> parameter. If a forward slash does not immediately follow the <i>ip-address</i>, a dotted decimal mask must follow the prefix.</p> <p><i>mask</i> — The subnet mask length when the IP prefix is specified in CIDR notation. When the IP prefix is specified in CIDR notation, a forward slash (<i>/</i>) separates the <i>ip-address</i> from the <i>mask</i> parameter. The <i>mask</i> parameter indicates the number of bits used for the network portion of the IP address; the remainder of the IP address is used to determine the host portion of the IP address. Allowed values are integers in the range 1— 32. A mask length of 32 is reserved for system IP addresses.</p> <p><b>Values</b> 1 to 32</p> <p><i>netmask</i> — The subnet mask in dotted decimal notation.</p> <p><b>Values</b> 0.0.0.0 to 255.255.255.255 (network bits all 1 and host bits all 0)</p> <p><b>broadcast</b> — The optional <b>broadcast</b> parameter overrides the default broadcast address used by the IP interface when sourcing IP broadcasts on the IP interface. If no broadcast format is specified for the IP address, the default value is <b>host-ones</b>, which indicates a subnet broadcast address. Use this parameter to change the broadcast address to <b>all-ones</b> or revert back to a broadcast address of <b>host-ones</b>.</p> |

The **broadcast** parameter within the **address** command does not have a negate feature, which is usually used to revert a parameter to the default value. To change the **broadcast** type to **host-ones** after being changed to **all-ones**, the **address** command must be executed with the **broadcast** parameter defined.

The broadcast format on an IP interface can be specified when the IP address is assigned or changed.

This parameter does not affect the type of broadcasts that can be received by the IP interface. A host sending either the local broadcast (**all-ones**) or the valid subnet broadcast address (**host-ones**) will be received by the IP interface.

**Default**      host-ones

**Values**      all-ones, host-ones

**all-ones** — The **all-ones** keyword following the **broadcast** parameter specifies that the broadcast address used by the IP interface for this IP address will be 255.255.255.255, also known as the local broadcast.

**host-ones** — The **host-ones** keyword following the **broadcast** parameter specifies that the broadcast address used by the IP interface for this IP address will be the subnet broadcast address. This is an IP address that corresponds to the local subnet described by the *ip-address* and the *netmask* with all the host bits set to binary 1. This is the default broadcast address used by an IP interface.

*srrp-instance* — Specifies the SRRP instance ID that this interface route needs to track.

## allow-directed-broadcasts

**Syntax**      [no] **allow-directed-broadcasts**

**Context**      config>router>if

**Description**      This command enables the forwarding of directed broadcasts out of the IP interface.

A directed broadcast is a packet received on a local router interface destined for the subnet broadcast address of another IP interface. The **allow-directed-broadcasts** command on an IP interface enables or disables the transmission of packets destined to the subnet broadcast address of the egress IP interface.

When enabled, a frame destined to the local subnet on this IP interface is sent as a subnet broadcast out this interface.



**Note:** Allowing directed broadcasts is a well-known mechanism used for denial-of-service attacks.

By default, directed broadcasts are not allowed and are discarded at this egress IP interface.

The **no** form of the command disables directed broadcasts forwarding out of the IP interface.

---

**Default** no allow-directed-broadcasts — Directed broadcasts are dropped.

## arp-learn-unsolicited

**Syntax** [no] arp-learn-unsolicited

**Context** config>router>if

**Description** This command allows the ARP application to learn new entries based on any received ARP message (GARP/ARP-Request/ARP-Reply, such as any frame with ethertype 0x0806).

The **no** form of this command disables the above behavior and ARP entries are only learned when needed, that is, when the router receives an ARP-reply after an ARP-request triggered by some received traffic.

## arp-limit

**Syntax** arp-limit *limit* [log-only] [threshold *percent*]  
no arp-limit

**Context** config>router>if

**Description** This command configures the maximum amount of dynamic IPv4 ARP entries that can be learned on an IP interface.

When the number of dynamic ARP entries reaches the configured percentage of this limit, an SNMP trap is sent. When the limit is exceeded, no new entries are learned until an entry expires and traffic to these destinations will be dropped. Entries that have already been learned will be refreshed.

The **no** form of the command removes the **arp-limit**.

**Default** 90 percent

**Parameters** *limit* — The number of entries that can be learned on an IP interface expressed as a decimal integer. If the limit is set to 0, dynamic ARP learning is disabled and no dynamic ARP entries are learned.

**Values** 0 to 524288

**log-only** — Enables the warning message to be sent at the specified threshold percentage, and also when the limit is exceeded. However, entries above the limit will be learned.

*percent* — The threshold value (as a percentage) that triggers a warning message to be sent.

**Values** 0 to 100

---

## arp-proactive-refresh

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] arp-proactive-refresh</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command enables the router to always send out a refresh message 30 seconds prior to the timeout of the entry (a single refresh message with no retries).</p> <p>The <b>no</b> form of this command sets the default behavior, in which an entry is marked as stale 30 seconds prior to age-out, and the router only sends an ARP request to refresh the entry if the IOM receives traffic that uses it. If so, the IOM asks the ARP application to send a refresh message. With <b>arp-proactive-refresh</b> enabled, the ARP module sends a refresh message regardless of the IOM receiving traffic.</p> |

## arp-retry-timer

|                    |                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>arp-retry-timer</b> <i>timer-multiple</i><br><b>no arp-retry-timer</b>                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>This command allows the arp retry timer to be configured to a specific value.</p> <p>The timer value is entered as a multiple of 100 ms. So a timer value of 1, means the ARP timer will be set to 100 ms.</p> <p>The <b>no</b> form of this command removes the command from the active configuration and returns the ARP retry timer to its default value of 5 seconds.</p> |
| <b>Default</b>     | arp-retry-timer 50                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <p><i>timer-multiple</i> — Specifies the multiple of 100 ms that the ARP retry timer will be configured as.</p> <p><b>Values</b> 1 to 300 (equally a timer range of 100 ms to 30,000 ms)</p>                                                                                                                                                                                     |

## arp-timeout

|                    |                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>arp-timeout</b> <i>seconds</i><br><b>no arp-timeout</b>                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command configures the minimum time, in seconds, an ARP entry learned on the IP interface is stored in the ARP table. ARP entries are automatically refreshed when an ARP request or gratuitous ARP is seen from an IP host. Otherwise, the ARP entry is aged from the ARP table. If the <b>arp-timeout</b> value is set to 0 seconds, ARP aging is disabled.</p> |

The **no** form of the command reverts to the default value.

|                   |                                                                                                                                                                                                                               |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | 14400 seconds (4 hours)                                                                                                                                                                                                       |
| <b>Parameters</b> | <i>seconds</i> — The minimum number of seconds a learned ARP entry is stored in the ARP table, expressed as a decimal integer. A value of 0 specifies that the timer is inoperative and learned ARP entries will not be aged. |
| <b>Values</b>     | 0 to 65535                                                                                                                                                                                                                    |

## bfd

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>bfd</b> <i>transmit-interval</i> [ <b>receive</b> <i>receive-interval</i> ] [ <b>multiplier</b> <i>multiplier</i> ] [ <b>echo-receive</b> <i>echo-interval</i> ] [ <b>type</b> <b>cpm-np</b> ]<br><b>no bfd</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>if<br>config>router>if>ipv6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>This command specifies the bidirectional forwarding detection (BFD) parameters for the associated IP interface. If no parameters are defined the default values are used.</p> <p>The multiplier specifies the number of consecutive BFD messages that must be missed from the peer before the BFD session state is changed to down and the upper level protocols (OSPF, IS-IS, BGP or PIM) is notified of the fault.</p> <p>The <b>no</b> form of the command removes BFD from the router interface regardless of the IGP/RSVP.</p> <p><b>Important notes:</b> On the 7750 SR and 7950 XRS SR OS, the <i>transmit-interval</i> and <b>receive receive-interval</b> values can only be modified to a value less than 100 ms when:</p> <ol style="list-style-type: none"> <li>1. The <b>type cpm-np option</b> is explicitly configured.</li> <li>2. The service is shut down (<b>shutdown</b>)</li> <li>3. The interval is specified 10 to 100000.</li> <li>4. The service is re-enabled (<b>no shutdown</b>)</li> </ol> <p>To remove the <b>type cpm-np</b> option, re-issue the <b>bfd</b> command without specifying the <b>type</b> parameter.</p> |
| <b>Default</b>     | no bfd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <p><i>transmit-interval</i> — Sets the transmit interval, in milliseconds, for the BFD session.</p> <p><b>Values</b> 10 to 100000 (see Important Notes above) The minimum value is 300 msec for central BFD sessions in the 7950 XRS.</p> <p><b>Default</b> 100</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

*receive-interval* — Sets the receive interval, in milliseconds, for the BFD session.

**Values** 10 to 100000 (see Important Notes above)

**Default** 100

*multiplier* — Sets the multiplier for the BFD session.

**Values** 3 to 20

**Default** 3

*echo-interval* — Sets the minimum echo receive interval, in milliseconds, for the session.

**Values** 100 to 100000

**Default** 0

**cpm-np** — Selects the CPM network processor type as the local termination point for the BFD session for the 7750 SR and 7950 XRS. See Important Notes, above.

## cflowd-parameters

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>cflowd-parameters</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>This command creates the configuration context to configure cflowd parameters for the associated IP interfaces.</p> <p><b>cflowd</b> is used for network planning and traffic engineering, capacity planning, security, application and user profiling, performance monitoring, usage-based billing, and SLA measurement.</p> <p>At a minimum, the <b>sampling</b> command must be configured within this context in order to enable cflowd sampling, otherwise traffic sampling will not occur.</p> |
| <b>Default</b>     | no cflowd-parameters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## sampling

|                    |                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sampling {unicast   multicast} type {acl   interface} [direction {ingress-only   egress-only   both}]</b><br><b>no sampling {unicast   multicast}</b> |
| <b>Context</b>     | config>router>if>cflowd-parameters                                                                                                                       |
| <b>Description</b> | This command enables and configures the cflowd sampling behavior to collect traffic flow samples through a router for analysis.                          |



This command can be used to configure the sampling parameters for unicast and multicast traffic separately. If sampling is not configured for either unicast or multicast traffic, then that type of traffic will not be sampled.

If cflowd is enabled without either **egress-only** or **both** specified or with the **ingress-only** keyword specified, then only ingress sampling will be enabled on the associated IP interface.

The **no** form of the command disables the associated type of traffic sampling on the associated interface.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no sampling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b> | <p><b>unicast</b> — Specifies that the sampling command will control the sampling of unicast traffic on the associated interface/SAP.</p> <p><b>multicast</b> — Specifies that the sampling command will control the sampling of multicast traffic on the associated interface/SAP.</p> <p><b>type</b> — Specifies whether the traffic sampling is based on an <b>acl</b> match, or all traffic entering or exiting the associated interface.</p> <p><b>Values</b></p> <p><b>acl</b> — Specifies that the sampled traffic is controlled via an IP traffic filter entry with the action “filter-sample” configured.</p> <p><b>interface</b> — Specifies that all traffic entering or exiting the interface is subject to sampling.</p> <p><b>direction</b> — Specifies the direction to collect traffic flow samples.</p> <p><b>Values</b></p> <p><b>ingress-only</b> — Enables ingress sampling only on the associated interface.</p> <p><b>egress-only</b> — Enables egress sampling only on the associated interface.</p> <p><b>both</b> — Enables both ingress and egress cflowd sampling.</p> |

## cpu-protection

|                    |                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>cpu-protection</b> <i>policy-id</i><br><b>no cpu-protection</b>                                                                                                                                                                |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                  |
| <b>Description</b> | This command assigns an existing CPU protection policy for the interface. The CPU protection policies are configured in the <b>config&gt;sys&gt;security&gt;cpu-protection&gt;policy</b> <i>cpu-protection-policy-id</i> context. |
| <b>Default</b>     | cpu-protection 255                                                                                                                                                                                                                |
| <b>Parameters</b>  | <p><i>policy-id</i> — Specifies an existing CPU protection policy</p> <p><b>Values</b> 1 to 255</p>                                                                                                                               |

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## dist-cpu-protection

|                    |                                                                                                                                                                                                                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dist-cpu-protection</b> <i>policy-name</i><br><b>no dist-cpu-protection</b>                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | This command assigns a Distributed CPU Protection (DCP) policy to the SAP. Only a valid created DCP policy can be assigned to a SAP or a network interface (note that this rule does not apply to templates such as an msap-policy).                                                                   |
| <b>Default</b>     | If no dist-cpu-protection policy is assigned to a router interface, then, the default network DCP policy (_default-network-policy) is used.<br><br>If no DCP functionality is desired on the router interface then an empty DCP policy can be created and explicitly assigned to the router interface. |
| <b>Parameters</b>  | <i>policy-name</i> — Specifies the name of the DCP policy up to 32 characters in length                                                                                                                                                                                                                |

## enable-ingress-stats

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] enable-ingress-stats</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>router>if<br>config>service>ies >if<br>config>service>vprn>if<br>config>service>ies>sub-if>grp-if<br>config>service>vprn>sub-if>grp-if                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | This command enables the collection of ingress interface IP stats. This command is only applicable to IP statistics, and not to uRPF statistics.<br><br>If enabled, then the following statistics are collected: <ul style="list-style-type: none"><li>• IPv4 offered packets</li><li>• IPv4 offered octets</li><li>• IPv6 offered packets</li><li>• IPv6 offered octets</li></ul><br>Octet statistics for IPv4 and IPv6 bytes at IP interfaces include the Layer 2 frame overhead. |
| <b>Default</b>     | no enable-ingress-stats                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## enable-mac-accounting

|               |                                   |
|---------------|-----------------------------------|
| <b>Syntax</b> | <b>[no] enable-mac-accounting</b> |
|---------------|-----------------------------------|

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|                    |                                                                      |
|--------------------|----------------------------------------------------------------------|
| <b>Context</b>     | config>router>if                                                     |
| <b>Description</b> | This command enables MAC Accounting functionality for the interface. |
| <b>Default</b>     | no enable-mac-accounting                                             |

## eth-cfm

|                    |                                                                   |
|--------------------|-------------------------------------------------------------------|
| <b>Syntax</b>      | <b>eth-cfm</b>                                                    |
| <b>Context</b>     | config>router>if                                                  |
| <b>Description</b> | This command enables the context to configure ETH-CFM parameters. |

## mep

|                    |                                                                                                                                                                                                                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] mep</b> <i>mep-id</i> <b>domain</b> <i>md-index</i> <b>association</b> <i>ma-index</i>                                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>if>eth-cfm                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | This command provisions an 802.1ag maintenance endpoint (MEP).<br><br>The <b>no</b> form of the command deletes the MEP.                                                                                                                                                                                             |
| <b>Parameters</b>  | <i>mep-id</i> — Specifies the MEP identifier.<br><br><b>Values</b> 1 to 81921<br><br><i>md-index</i> — Specifies the maintenance domain (MD) index value.<br><br><b>Values</b> 1 to 4294967295<br><br><i>ma-index</i> — Specifies the maintenance association (MA) index value.<br><br><b>Values</b> 1 to 4294967295 |

## collect-lmm-fc-stats

|                    |                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>collect-lmm-fc-stats</b>                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>if>eth-cfm>mep                                                                                                                                                                                                      |
| <b>Description</b> | This command enables the context to configure per-forwarding class (FC) LMM information collection.<br><br>This command is mutually exclusive with the <b>collect-lmm-stats</b> command when there is entity resource contention. |

---

## fc

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>fc</b> <i>fc-name</i> [ <i>fc-name</i> ]<br><b>no fc</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>router>if>eth-cfm>mep>collect-lmm-fc-stats                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command creates individual counters for the specified FCs without regard for profile. All countable packets that match a configured FC, regardless of profile, will be included in this counter.</p> <p>A differential is performed when this command is re-entered. Omitted FCs will stop counting, newly added FCs will start counting, and unchanged FCs will continue to count.</p> <p>Up to eight FCs may be specified. An FC that is specified as part of this command for this specific context cannot be specified as a profile-aware FC using the <b>fc-in-profile</b> command under the same context.</p> <p>The <b>no</b> form of the command removes all previously defined FCs and stops counting for those FCs.</p> |
| <b>Default</b>     | no fc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <p><i>fc-name</i> — Specifies the name of the FC for which to create an individual profile-unaware counter. A maximum of eight <i>fc-names</i> can be specified in a single statement. In order for the counter to be used, the <b>config&gt;oam-pm&gt;session&gt;ethernet&gt;priority</b> command must be configured with a numerical value representing the FC name (7 = NC, 6 = H1, 5 = EF, 4 = H2, 3 = L1, 2 = AF, 1 = L2, 0 = BE), and the <b>config&gt;oam-pm&gt;session&gt;ethernet&gt;lmm&gt;enable-fc-collection</b> command must be enabled.</p> <p><b>Values</b>      nc, h1, ef, h2, l1, af, l2, be</p>                                                                                                                       |

## fc-in-profile

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>fc-in-profile</b> <i>fc-name</i> [ <i>fc-name</i> ]<br><b>no fc-in-profile</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>if>eth-cfm>mep>collect-lmm-fc-stats                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command creates individual counters for the specified FCs with regard for profile. All countable packets that match a configured FC and are deemed to be in-profile will be included in this counter.</p> <p>A differential is performed when this command is re-entered. Omitted FCs will stop counting, newly added FCs will start counting, and unchanged FCs will continue to count.</p> <p>Up to eight FCs may be specified. An FC that is specified as part of this command for this specific context cannot be specified as a profile-unaware FC using the <b>fc</b> command under the same context.</p> |

The **no** form of the command removes all previously defined FCs and stops counting for those FCs.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no fc-in-profile                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b> | <i>fc-name</i> — Specifies the name of the FC for which to create an individual profile-aware counter. A maximum of eight fc-names can be specified in a single statement. In order for the counter to be used, the <b>config&gt;oam-pm&gt;session&gt; ethernet&gt;priority</b> command must be configured with a numerical value representing the FC name (7 = NC, 6 = H1, 5 = EF, 4 = H2, 3 = L1, 2 = AF, 1 = L2, 0 = BE), and the <b>config&gt;oam-pm&gt;session&gt;ethernet&gt;imm&gt;enable-fc-collection</b> command must be enabled. |
| <b>Values</b>     | nc, h1, ef, h2, l1, af, l2, be                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## grace

|                    |                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>grace</b>                                                                                                                     |
| <b>Context</b>     | config>router>if>eth-cfm>mep                                                                                                     |
| <b>Description</b> | This command enables the context to configure Nokia ETH-CFM Grace and ITU-T Y.1731 ETH-ED expected defect functional parameters. |

## eth-ed

|                    |                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>eth-ed</b>                                                                                            |
| <b>Context</b>     | config>router>if>eth-cfm>mep>grace                                                                       |
| <b>Description</b> | This command enables the context to configure ITU-T Y.1731 ETH-ED expected defect functional parameters. |

## max-rx-defect-window

|                    |                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>max-rx-defect-window</b> <i>seconds</i><br><b>no max-rx-defect-window</b>                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>if>eth-cfm>mep>grace>eth-ed                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command limits the duration of the received ETH-ED expected defect window to the lower value of either the received value from the peer or this parameter.</p> <p>The <b>no</b> form of the command removes the limitation, and any valid defect window value received from a peer MEP in the ETH-ED PDU will be used.</p> |
| <b>Default</b>     | no max-rx-defect-window                                                                                                                                                                                                                                                                                                            |

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|                   |                                                                                             |
|-------------------|---------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>seconds</i> — Specifies the duration, in seconds, of the maximum expected defect window. |
| <b>Values</b>     | 1 to 86400                                                                                  |

## priority

|                    |                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>priority</b> <i>priority</i><br><b>no priority</b>                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>router>if>eth-cfm>mep>grace>eth-ed                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>This command sets the priority bits and determines the forwarding class based on the mapping of priority to FC.</p> <p>The <b>no</b> form of the command disables the local priority configuration and sets the priority to the <b>ccm-ltm-priority</b> associated with this MEP.</p> |
| <b>Default</b>     | no priority                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <i>priority</i> — Specifies the priority bit.                                                                                                                                                                                                                                            |
| <b>Values</b>      | 0 to 7                                                                                                                                                                                                                                                                                   |

## rx-eth-ed

|                    |                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] rx-eth-ed</b>                                                                                                                                                                                          |
| <b>Context</b>     | config>router>if>eth-cfm>mep>grace>eth-ed                                                                                                                                                                      |
| <b>Description</b> | <p>This command enables the reception and processing of the ITU-T Y.1731 ETH-ED PDU on the MEP.</p> <p>The <b>no</b> form of the command disables the reception of the ITU-T Y.1731 ETH-ED PDU on the MEP.</p> |
| <b>Default</b>     | rx-eth-ed                                                                                                                                                                                                      |

## tx-eth-ed

|                    |                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] tx-eth-ed</b>                                                                                                                                      |
| <b>Context</b>     | config>router>if>eth-cfm>mep>grace>eth-ed                                                                                                                  |
| <b>Description</b> | This command enables the transmission of the ITU-T Y.1731 ETH-ED PDU from the MEP when a system soft reset notification is received for one or more cards. |

The **config>eth-cfm>system>grace-tx-enable** command must be configured to instruct the system that the node is capable of transmitting expected defect windows to the peers. Only one form of ETH-CFM grace (Nokia ETH-CFM Grace or ITU-T Y.1731 ETH-ED) may be transmitted.

The **no** form of the command disables the transmission of the ITU-T Y.1731 ETH-ED PDU from the MEP.

**Default** no tx-eth-ed

## eth-vsm-grace

**Syntax** eth-vsm-grace

**Context** config>router>if>eth-cfm>mep>grace

**Description** This command enables the context to configure Nokia ETH-CFM Grace functional parameters.

## rx-eth-vsm-grace

**Syntax** [no] rx-eth-vsm-grace

**Context** config>router>if>eth-cfm>mep>grace>eth-vsm-grace

**Description** This command enables the reception and processing of the Nokia ETH-CFM Grace PDU on the MEP.

The Nokia Grace function is a vendor-specific PDU that informs MEP peers that the local node may be entering a period of expected defect.

The **no** form of the command disables the reception of the Nokia ETH-CFM Grace PDU on the MEP.

**Default** rx-eth-vsm-grace

## tx-eth-vsm-grace

**Syntax** [no] tx-eth-vsm-grace

**Context** config>router>if>eth-cfm>mep>grace>eth-vsm-grace

**Description** This command enables the transmission of the Nokia ETH-CFM Grace PDU from the MEP when a system soft reset notification is received for one or more cards.

The Nokia Grace function is a vendor-specific PDU that informs MEP peers that the local node may be entering a period of expected defect.

The **config>eth-cfm>system>grace-tx-enable** command must be configured to instruct the system that the node is capable of transmitting expected defect windows to the peers. Only one form of ETH-CFM grace (Nokia ETH-CFM Grace or ITU-T Y.1731 ETH-ED) may be transmitted.

The **no** form of the command disables the transmission of the Nokia ETH-CFM Grace PDU from the MEP.

**Default** tx-eth-vsm-grace

## lbm-svc-act-responder

**Syntax** [no] lbm-svc-act-responder

**Context** config>router>if>eth-cfm>mep

**Description** This command enables the MEP to process service activation streams encapsulated in ETH-CFM LBM frames that are directed to the MEP. The MEP will be allocated additional resources to rapidly respond to a high-speed stream of LBM messages. A MEP created with this option will not validate any TLVs, will not validate the ETH-LBM MAC Address, and will not increment or compute any loopback statistics. Statistical computation and reporting is the responsibility of the test head-end. The ETH-CFM level of the high speed ETH-LBM stream must match the level of a MEP configured with this command. It must not target any lower ETH-CFM level the MEP will terminate. When the service activation test is complete, the MEP may be returned to standard processing by removing this command. If there is available bandwidth, the MEP will respond to other ETH-CFM PDUs, such as ETH-DMM marker packets, using standard processing.

The interaction between this command and the **tools perform service id service-id loopback eth** command must be carefully considered. It is recommended that either the **lbm-svc-act-responder** or the **tools perform service id service-id loopback eth** command be used at any given time within a service. If both commands must be configured, and the target reflection point is the MAC Swap Loopback function, the inbound stream of data must not include ETH-CFM traffic that is equal to or lower than the domain level of any configured MEP which would otherwise extract and process the ETH-CFM message. If the reflection target is a MEP configured with the **lbm-svc-act-responder** option, the mode (ingress or egress) of the SAP or SDP specified with this tools command and the MEP **direction** (up or down) must match when the functions are enabled on the same reflection point, and the domain level of the inbound ETH-LBM must be the same as that of the MEP configured with the **lbm-svc-act-responder** option. At no time should the two functions be conflicting with each other along the path of the stream. This conflict would lead to unpredictable and possibly destabilizing situations.

The **no** form of the command reverts to MEP LBM standard processing.

**Default** no lbm-svc-act-responder



## gre-termination

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] gre-termination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command enables the termination of MPLS-over-GRE and IP-over-GRE packets on destination IP addresses from a user-defined subnet. The user defines a subnet for the termination of GRE packets by applying the <b>gre-termination</b> command to a numbered network IP interface, including a loopback interface.</p> <p>For more information, refer to <a href="#">IP-over-GRE and MPLS-over-GRE Termination on a User-Configured Subnet</a>.</p> <p>The <b>no</b> form of this command disables the termination of MPLS-over-GRE and IP-over-GRE packets on the subnet of the interface. Packets are dropped.</p> |

## admin-group

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] admin-group group-name [group-name]</b><br><b>no admin-group</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router>if>if-attribute<br>config>service>ies>if>if-attribute<br>config>service>vprn>if>if-attribute<br>config>router>mpls>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command configures the admin group membership of an interface. The user can apply admin groups to an IES, VPRN, network IP, or MPLS interface.</p> <p>Each single operation of the <b>admin-group</b> command allows a maximum of five (5) groups to be specified at a time. However, a maximum of 32 groups can be added to a given interface through multiple operations. Once an admin group is bound to one or more interface, its value cannot be changed until all bindings are removed.</p> <p>The configured admin-group membership will be applied in all levels/areas the interface is participating in. The same interface cannot have different memberships in different levels/areas.</p> <p>Only the admin groups bound to an MPLS interface are advertised area-wide in TE link TLVs and sub-TLVs when the <b>traffic-engineering</b> option is enabled in IS-IS or OSPF. IES and VPRN interfaces do not have their attributes advertised in TE TLVs.</p> <p>The <b>no</b> form of this command deletes one or more of the admin-group memberships of an interface. The user can also delete all memberships of an interface by not specifying a group name.</p> |
| <b>Parameters</b>  | <i>group-name</i> — Specifies the name of the group with up to 32 characters. The association of group name and value should be unique within an IP/MPLS domain. A maximum of five group-names can be specified in a single statement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

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## srlg-group

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] srlg-group</b> <i>group-name</i> [ <i>group-name</i> ]<br><b>no srlg-group</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>router>if>if-attribute<br>config>service>ies>if>if-attribute<br>config>service>vpn>if>if-attribute<br>config>router>mpls>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command configures the SRLG membership of an interface. The user can apply SRLGs to an IES, VPRN, network IP, or MPLS interface.</p> <p>An interface can belong to up to 64 SRLG groups. However, each single operation of the <b>srlg-group</b> command allows a maximum of five (5) groups to be specified at a time. Once an SRLG group is bound to one or more interface, its value cannot be changed until all bindings are removed.</p> <p>The configured SRLG membership will be applied in all levels/areas the interface is participating in. The same interface cannot have different memberships in different levels/areas.</p> <p>Only the SRLGs bound to an MPLS interface are advertised area-wide in TE link TLVs and sub-TLVs when the <b>traffic-engineering</b> option is enabled in IS-IS or OSPF. IES and VPRN interfaces do not have their attributes advertised in TE TLVs.</p> <p>The <b>no</b> form of this command deletes one or more of the SRLG memberships of an interface. The user can also delete all memberships of an interface by not specifying a group name.</p> |
| <b>Parameters</b>  | <i>group-name</i> — Specifies the name of the group, up to 32 characters. The association of group name and value should be unique within an IP/MPLS domain. A maximum of five group-names can be specified in a single statement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## ip-helper-address

|                    |                                                                                                                                                                                                                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip-helper-address</b> <i>gateway-address</i><br><b>no ip-helper-address</b>                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command enables broadcast UDP packets received on the associated interface to be redirected to the specified gateway address and then forwarded on to the gateway.</p> <p>The <b>no</b> form of this command removes the gateway address from the interface configuration and stops the UDP broadcast redirect function.</p> |
| <b>Parameters</b>  | <i>gateway-address</i> — Specifies the IPv4 address of the target UDP broadcast gateway.                                                                                                                                                                                                                                             |

## ip-mtu

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip-mtu</b> <i>octets</i><br><b>no ip-mtu</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>This command configures the IP maximum transmit unit (packet) for the associated router IP interface.</p> <p>The configured IP-MTU cannot be larger than the calculated IP MTU based on the port MTU configuration.</p> <p>The MTU that will be used is:</p> <p>MINIMUM((Port_MTU - EtherHeaderSize), (Configured ip-mtu))</p> <p>The <b>no</b> form of the command returns the associated IP interfaces MTU to its default value, which is calculated, based on the port MTU setting. (For Ethernet ports this will typically be 1554.)</p> |
| <b>Default</b>     | no ip-mtu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><i>octets</i> — Specifies the IP MTU value associated with the IP interface, specified in octets.</p> <p><b>Values</b> 512 to 9000</p>                                                                                                                                                                                                                                                                                                                                                                                                       |

## ip-tunnel

|                    |                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip-tunnel</b>                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command enables the context to configure parameters for an IP tunnel on a <b>control-channel</b> loopback interface. The default encapsulation is IP/GRE. The local end tunnel IP address will be configured using the interface primary IP address.</p> <p>The <b>ip-tunnel</b> command can only be configured on <b>control-channel</b> loopback interfaces.</p> |

## remote-ip

|                    |                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>remote-ip</b> <i>ip-address</i><br><b>no remote-ip</b>                                                                                                                                                           |
| <b>Context</b>     | config>router>if>ip-tunnel                                                                                                                                                                                          |
| <b>Description</b> | <p>This command configures the far-end IP address for an IP/GRE tunnel used by a <b>control-channel</b> loopback interface. The address refers to the “to” address of the outer IP header in the encapsulation.</p> |

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|                   |                                                |
|-------------------|------------------------------------------------|
| <b>Default</b>    | no remote-ip                                   |
| <b>Parameters</b> | <i>ip-address</i> — Specifies an IPv4 address. |
| <b>Values</b>     | a.b.c.d                                        |

## lag-link-map-profile

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>lag-link-map-profile</b> <i>link-map-profile-id</i><br><b>no lag-link-map-profile</b>                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command assigns a preconfigured lag link map profile to a SAP/network interface configured on a LAG or a PW port that exists on a LAG. Once assigned/unassigned, the SAP/network interface egress traffic will be re-hashed over LAG as required by the new configuration.</p> <p>The <b>no</b> form of this command reverts the SAP/network interface to use per-flow, service or link hash as configured for the service/LAG.</p> |
| <b>Default</b>     | no lag-link-map-profile                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <i>link-map-profile-id</i> — An integer from 1 to 32 that defines a unique lag link map profile on which the LAG the SAP/network interface exist.                                                                                                                                                                                                                                                                                           |

## lag-per-link-hash

|                    |                                                                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>lag-per-link-hash class</b> <i>class</i> <b>weight</b> [ <i>weight</i> ]<br><b>no lag-per-link-hash</b>                                                                                                                            |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                      |
| <b>Description</b> | <p>This command configures weight and class to this interface to be used on LAG egress when the LAG uses weighted per-link-hash.</p> <p>The <b>no</b> form of this command restores the default configuration (weight 1 class 1).</p> |
| <b>Default</b>     | no lag-per-link-hash                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <i>class</i> — Specifies the class.<br><b>Values</b> 1, 2, 3<br><i>weight</i> — Specifies the weight.<br><b>Values</b> 1 to 1024                                                                                                      |

## ldp-sync-timer

|                    |                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ldp-sync-timer</b> <i>seconds</i> [ <b>end-of-lib</b> ]<br><b>no ldp-sync-timer</b>                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | This command enables synchronization of an IGP and LDP. When a link is restored after a failure, the IGP sets the link cost to infinity and advertises it. The actual value advertised in OSPF is 0xFFFF (65535). The actual value advertised in IS-IS regular metric is 0x3F (63) and in IS-IS wide-metric is 0xFFFFFE (16777214). This feature is not supported on RIP interfaces. |

If an interface belongs to both IS-IS and OSPF, a physical failure will cause both IGPs to advertise an infinite metric and to follow the IGP-LDP synchronization procedures. If only one IGP bounces on this interface or on the system, then only the affected IGP advertises the infinite metric and follows the IGP-LDP synchronization procedures.

Next, an LDP Hello adjacency is brought up with the neighbor. The LDP synchronization timer is started by the IGP when the LDP session to the neighbor is up over the interface. This is to allow time for the label-FEC bindings to be exchanged.

When the LDP synchronization timer expires, the link cost is restored and is readvertised. The IGP will announce a new best next hop and LDP will use it if the label binding for the neighbor's FEC is available.

If the user changes the cost of an interface, the new value is advertised at the next flooding of link attributes by the IGP. However, if the LDP synchronization timer is still running, the new cost value will only be advertised after the timer expires. The new cost value will also be advertised after the user executes any of the following commands:

- **tools>perform>router>isis>ldp-sync-exit**
- **tools>perform>router>ospf>ldp-sync-exit**
- **config>router>if>no ldp-sync-timer**
- **config>router>ospf>disable-ldp-sync**
- **router>isis>disable-ldp-sync**

If the user changes the value of the LDP synchronization timer parameter, the new value will take effect at the next synchronization event. If the timer is still running, it will continue to use the previous value.

If parallel links exist to the same neighbor, then the bindings and services should remain up as long as there is one interface that is up. However, the user-configured LDP synchronization timer still applies on the interface that failed and was restored. In this case, the router will only consider this interface for forwarding after the IGP readvertises its actual cost value.

The LDP Sync Timer State is not always synchronized across to the standby CPM. Therefore, after an activity switch, the timer state might not be same as it was on the previously active CPM.

If the **end-of-lib** option is configured, then the system will start the LDP synchronization timer as usual. If the LDP End of LIB Typed Wildcard FEC messages are received for every FEC type negotiated for a given session to an LDP peer for that IGP interface, the **ldp-sync-timer** is terminated early and the IGP link cost is restored. If the **ldp-sync-timer** expires before the LDP End of LIB messages are received for every negotiated FEC type, then the system will restore the IGP link cost. The **end-of-lib** option is disabled by default.

The **no** form of this command disables IGP-LDP synchronization and deletes the configuration.

|                   |                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no ldp-sync-timer                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b> | <b>seconds</b> — Specifies the time interval for the IGP-LDP synchronization timer.<br><b>Values</b> 1 to 1800<br><b>end-of-lib</b> — Specifies that the system should terminate the <b>ldp-sync-timer</b> early if the LDP End of LIB Typed Wildcard FEC messages are received for every FEC type negotiated for a given session to an LDP peer for that IGP interface. |

## load-balancing

|                    |                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>load-balancing</b>                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command enables the load-balancing context to configure interface per-flow load balancing options that will apply to traffic entering this interface and egressing over a LAG/ECMP on system-egress. This is a per interface setting. For load-balancing options that can also be enabled on the system level, the options enabled on the interface level overwrite system level configurations. |

## egr-ip-load-balancing

|                    |                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>egr-ip-load-balancing {source   destination   inner-ip}</b><br><b>no egr-ip-load-balancing</b>                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>router>if>load-balancing                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | This command specifies whether to include source address or destination address or both in LAG/ECMP hash on IP interfaces. Additionally, when I4-load-balancing is enabled the command applies also to inclusion of source/destination port in the hash inputs.<br><br>The <b>no</b> form of this command includes both source and destination parameters. |
| <b>Default</b>     | no egr-ip-load-balancing                                                                                                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <b>source</b> — Specifies using source address and (if I4-load balancing is enabled) source port in the hash, ignore destination address/port                                                                                                                                                                                                              |

**destination** — Specifies using destination address and (if I4-load balancing is enabled) destination port in the hash, ignore source address/port.

**inner-ip** — Specifies use of the inner IP header parameters instead of outer IP header parameters in LAG/ECMP hash for IPv4 encapsulated traffic.

## lsr-load-balancing

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>lsr-load-balancing</b> { <b>lbl-only</b>   <b>lbl-ip</b>   <b>ip-only</b>   <b>eth-encap-ip</b>   <b>lbl-ip-l4-teid</b> }<br><b>no lsr-load-balancing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router>if>load-balancing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | This command specifies whether the IP header is used in the LAG and ECMP LSR hashing algorithm. This is the per interface setting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Default</b>     | no lsr-load-balancing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><b>lbl-only</b> — Specifies that only the label is used in the hashing algorithm</p> <p><b>lbl-ip</b> — Specifies that only the IP header is included in the hashing algorithm.</p> <p><b>ip-only</b> — Specifies that only the IP header is used exclusively in the hashing algorithm</p> <p><b>eth-encap-ip</b> — Specifies that the hash algorithm parses down the label stack (up to three labels supported) and once it hits the bottom, the stack assumes Ethernet II non-tagged header follows. At the expected Ethertype offset location, algorithm checks whether the value present is IPv4/v6 (0x0800 or 0x86DD). If the check passes, the hash algorithm checks the first nibble at the expected IP header location for IPv4/IPv6 (0x0100/0x0110). If the secondary check passes, the hash is performed using IP SA/DA fields in the expected IP header; otherwise (any of the check failed) label-stack hash is performed.</p> <p><b>lbl-ip-l4-teid</b> — Specifies that this hashing algorithm hashes based on label, IP header, Layer 4 header and GTP header (TEID) in order. The algorithm uses all the supported headers that are found in the header fragment of incoming traffic.</p> |

## spi-load-balancing

|                    |                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] spi-load-balancing</b>                                                                                                                                                    |
| <b>Context</b>     | config>router>if>load-balancing                                                                                                                                                   |
| <b>Description</b> | <p>This command enables use of the SPI in hashing for ESP/AH encrypted IPv4/v6 traffic. This is a per interface setting.</p> <p>The <b>no</b> form disables the SPI function.</p> |
| <b>Default</b>     | no spi-load-balancing                                                                                                                                                             |

---

## teid-load-balancing

|                    |                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] teid-load-balancing</b>                                                                                                                                 |
| <b>Context</b>     | config>router>if>load-balancing                                                                                                                                 |
| <b>Description</b> | This command enables inclusion of TEID in hashing for GTP-U/C encapsulates traffic for GTPv1/GTPv2. The <b>no</b> form of this command ignores TEID in hashing. |
| <b>Default</b>     | no teid-load-balancing                                                                                                                                          |

## local-proxy-arp

|                    |                                                        |
|--------------------|--------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] local-proxy-arp</b>                            |
| <b>Context</b>     | config>router>if                                       |
| <b>Description</b> | This command enables local proxy ARP on the interface. |
| <b>Default</b>     | no local-proxy-arp                                     |

## loopback

|                    |                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] loopback</b>                                                                                                                      |
| <b>Context</b>     | config>router>if                                                                                                                          |
| <b>Description</b> | This command configures the interface as a loopback interface. The <b>vas-if-type</b> and <b>loopback</b> commands are mutually exclusive |
| <b>Default</b>     | Not enabled                                                                                                                               |

## mac

|                    |                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>mac</b> <i>ieee-address</i><br><b>no mac</b>                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command assigns a specific MAC address to an IP interface. Only one MAC address can be assigned to an IP interface. When multiple <b>mac</b> commands are entered, the last command overwrites the previous command.</p> <p>The <b>no</b> form of the command returns the MAC address of the IP interface to the default value.</p> |
| <b>Default</b>     | IP interface has a system-assigned MAC address.                                                                                                                                                                                                                                                                                             |



---

**Parameters**    *ieee-address* — Specifies the 48-bit MAC address for the IP interface in the form *aa:bb:cc:dd:ee:ff* or *aa-bb-cc-dd-ee-ff*, where *aa*, *bb*, *cc*, *dd*, *ee* and *ff* are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC and non-IEEE reserved MAC addresses.

## network-domain

**Syntax**    **[no] network-domain** *network-domain-name*

**Context**    config>router>if

**Description**    This command assigns a given interface to a given network-domain. The network-domain is then taken into account during sap-ingress queue allocation for VPLS SAP.

                  The network-domain association can only be done in a base-routing context. Associating a network domain with an loop-back or system interface will be rejected. Associating a network-domain with an interface that has no physical port specified will be accepted, but will have no effect as long as a corresponding port, or LAG, is defined.

                  Single interfaces can be associated with multiple network-domains.

**Default**    per default “default” network domain is assigned

---

## port

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>port</b> <i>port-name</i><br><b>no port</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command creates an association with a logical IP interface and a physical port.</p> <p>An interface can also be associated with the system (loopback address).</p> <p>The command returns an error if the interface is already associated with another port or the system. In this case, the association must be deleted before the command is re-attempted. The <i>port-id</i> or <i>port-id</i> for Ethernet ports can be in one of the following forms:</p> <p>Ethernet interfaces</p> <p>If the card in the slot has MDAs/XMAs, <i>port-id</i> is in the <i>slot_number/MDA</i> or <i>XMA_number/port_number</i> format; for example, <b>1/1/3</b> specifies port 3 of the MDA/XMA installed in MDA/XMA slot 1 on the card installed in chassis slot 1.</p> <p>SONET/SDH interfaces</p> <p>When the <i>port-id</i> represents a POS interface, the <i>port-id</i> must include the <i>channel-id</i>. The POS interface must be configured as a <b>network</b> port.</p> <p>The <b>no</b> form of the command deletes the association with the port. The <b>no</b> form of this command can only be performed when the interface is administratively down.</p> |
| <b>Default</b>     | no port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <i>port-name</i> — The physical port identifier to associate with the IP interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Values</b>      | The following values apply to the 7750 SR and 7450 ESS:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

**Table 9 Port names**

|           |                         |                                                     |
|-----------|-------------------------|-----------------------------------------------------|
| port-name | port-id[:encap-val]     |                                                     |
|           | encap-val               | 0 for null                                          |
|           |                         | [0 to 4094] for dot1q                               |
|           |                         | [0 to 4094].* or<br>[1 to 4094].[0to 4094] for qinq |
| port-id   | slot/mda/port[.channel] |                                                     |
|           | bundle-id               | bundle-<type>-slot/mda.<bundle-num>                 |
|           | bundle                  | keyword                                             |
|           | type                    | ima, fr, ppp                                        |
|           | bundle-num              | 1 to 336                                            |
|           | bpgrp-id                | bpgrp-<type>-<bpgrp-num>                            |
|           | bpgrp                   | keyword                                             |
|           | type                    | ima, ppp                                            |
|           | bpgrp-num               | 1 to 2000                                           |
|           | aps-id                  | aps-<group-id>[.channel]                            |
|           | aps                     | keyword                                             |
|           | group-id                | 1 to 128                                            |
|           | ccag-id                 | ccag-<id>.<path-id>[cc-type]                        |
|           | ccag                    | keyword                                             |
|           | id                      | 1 to 8                                              |
|           | path-id                 | a, b                                                |
|           | cc-type                 | [.sap-net .net-sap]                                 |
|           | eth-tunnel-id           | eth-tunnel-<id>                                     |
|           | eth-tunnel              | keyword                                             |
|           | id                      | 1 to 1024                                           |
|           | lag-id                  | lag-<id>                                            |
|           | lag                     | keyword                                             |
|           | id                      | 1 to 800                                            |

**Table 9** Port names (Continued)

|  |               |                    |
|--|---------------|--------------------|
|  | gtg-id        | gmpls-tun-grp-<id> |
|  | gmpls-tun-grp | keyword            |
|  | id            | 1 to 1024          |

**Values** The following values apply to the 7950 XRS:

**Table 10** Port names

|           |                         |                                               |
|-----------|-------------------------|-----------------------------------------------|
| port-name | <port-id>[:encap-val]   |                                               |
|           | encap-val               | 0 for null                                    |
|           |                         | 0 to 4094 for dot1q                           |
|           |                         | 0 to 4094.* or<br>1..4094].[0..4094] for qinq |
| port-id   | slot/mda/port[.channel] |                                               |
|           | eth-tunnel-id           | eth-tunnel-<id>                               |
|           | eth-tunnel              | keyword                                       |
|           | id                      | 1 to 1024                                     |
|           | lag-id                  | lag-<id>                                      |
|           | lag                     | keyword                                       |
|           | id                      | 1 to 800                                      |
|           | gtg-id                  | gmpls-tun-grp-<id>                            |
|           | gmpls-tun-grp           | keyword                                       |
|           | id                      | 1 to 1024                                     |
|           | eth-sat-id              | esat-<id>/<slot>/[u]<port>                    |
|           | esat                    | keyword                                       |
|           | id                      | 1 to 20                                       |
|           | u                       | keyword for up-link port                      |
|           | pxc-id                  | pxc-<id>.<sub-port>                           |
|           | pxc                     | keyword                                       |
|           | id                      | 1 to 64                                       |

**Table 10 Port names (Continued)**

|  |          |        |
|--|----------|--------|
|  | sub-port | a to b |
|--|----------|--------|

## proxy-arp-policy

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>proxy-arp-policy</b> <i>policy-name</i> [ <i>policy-name</i> ]<br><b>no proxy-arp-policy</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command enables and configure proxy ARP on the interface and specifies an existing policy-statement to analyze match and action criteria that controls the flow of routing information to and from a given protocol, set of protocols, or a specific neighbor. The policy-name is configured in the <b>config&gt;router&gt;policy-options</b> context.</p> <p>Use proxy ARP so the router responds to ARP requests on behalf of another device. Static ARP is used when a router needs to know about a device on an interface that cannot or does not respond to ARP requests. Therefore, the router configuration can state that if it has a packet that has a certain IP address to send it to the corresponding ARP address.</p> |
| <b>Default</b>     | no proxy-arp-policy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <i>policy-name</i> — Specifies the export route policy name. Allowed values are any string up to 32 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes. A maximum of five policy names can be specified in a single statement. The specified policy names must already be defined.                                                                                                                                                                                                                                                                                                                |

## ptp-hw-assist

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] ptp-hw-assist</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command configures the 1588 port based timestamping assist function for the interface. Various checks are performed to ensure that this feature can be enabled. If a check fails:</p> <ul style="list-style-type: none"> <li>• The command is blocked/rejected with an appropriate error message.</li> <li>• If the SAP configuration of the interface is removed, the ptp-hw-assist configuration will be removed.</li> <li>• If the IPv4 address configuration of the interface is removed, the ptp-hw-assist configuration will be removed.</li> </ul> |

The port will validate the destination IP address on received 1588 messages. If the 1588 messages are sent to a loopback address within the node rather than the address of the interface, then the loopback address must be configured in the **configure>system>security>source-address application ptp** context.

**Default** no ptp-hw-assist

## qos

**Syntax** **qos** *network-policy-id*  
**qos** *network-policy-id* **egress-port-redirect-group** *queue-group-name* **egress-instance** *instance-id* **ingress-fp-redirect-group** *queue-group-name* **ingress-instance** *instance-id*  
**qos** *network-policy-id* **egress-port-redirect-group** *queue-group-name* **egress-instance** *instance-id*  
**qos** *network-policy-id* **ingress-fp-redirect-group** *queue-group-name* **ingress-instance** *instance-id*  
**no qos**

**Context** config>router>if

**Description** This command associates a network Quality of Service (QoS) policy with a network IP interface. Only one network QoS policy can be associated with an IP interface at one time. Attempts to associate a second QoS policy return an error.

Associating a network QoS policy with a network interface is useful for the following purposes:

- To apply classification rules for determining the forwarding-class and profile of ingress packets on the interface.
- To associate ingress packets on the interface with a queue-group instance applied to the ingress context of the interface's forwarding plane (FP). The referenced ingress queue-group instance may have policers defined in order to rate limit ingress traffic on a per-forwarding class (and forwarding type: unicast vs. multicast) basis.
- To perform 802.1p, DSCP, IP precedence and/or MPLS EXP re-marking of egress packets on the interface.
- To associate egress packets on the interface with a queue-group instance applied to the egress context of the interface's port. The referenced egress queue-group instance may have policers and/or queues defined in order to rate limit egress traffic on a per-forwarding class basis.

The **no** form of the command removes the network QoS policy association from the network IP interface, and the QoS policy reverts to the default.

**Default** no qos

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <p><i>network-policy-id</i> — Specifies an existing network policy ID to associate with the IP interface.</p> <p><b>Values</b> 1 to 65535</p> <p><b>egress-port-redirect-group</b> <i>queue-group-name</i> — This optional parameter specifies the egress queue-group used for all egress forwarding-class redirections specified within the network QoS policy ID. The specified <i>queue-group-name</i> must exist as an egress queue group applied to the egress context of the port associated with the IP interface.</p> <p><b>egress-instance</b> <i>instance-id</i> — Since multiple instances of the same egress queue-group can be applied to the same port this optional parameter is used to specify which instance to associate with this specific network IP interface.</p> <p><b>Values</b> 1 to 16384</p> <p><b>ingress-fp-redirect-group</b> <i>queue-group-name</i> — This optional parameter specifies the ingress queue-group used for all ingress forwarding-class redirections specified within the network QoS policy ID. The specified <i>queue-group-name</i> must exist as an ingress queue group applied to the ingress context of the forwarding plane associated with the IP interface.</p> <p><b>ingress-instance</b> <i>instance-id</i> — Since multiple instances of the same ingress queue-group can be applied to the same forwarding plane this parameter is required to specify which instance to associate with this specific network IP interface.</p> <p><b>Values</b> 1 to 16384</p> |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## qos-route-lookup

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>qos-route-lookup</b> [{<b>source</b>   <b>destination</b>}]</p> <p><b>no qos-route-lookup</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | <p>config&gt;router&gt;if</p> <p>config&gt;router&gt;if&gt;ipv6</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This command enables QoS classification of the ingress IP packets on an interface based on the QoS information associated with routes in the forwarding table.</p> <p>If the optional <b>destination</b> parameter is specified and the destination address of an incoming IP packet matches a route with QoS information the packet is classified to the fc and priority associated with that route, overriding the fc and priority/profile determined from the sap-ingress or network qos policy associated with the IP interface. If the destination address of the incoming packet matches a route with no QoS information the fc and priority of the packet remain as determined by the sap-ingress or network qos policy.</p> |

If the optional **source** parameter is specified and the source address of an incoming IP packet matches a route with QoS information the packet is classified to the fc and priority associated with that route, overriding the fc and priority/profile determined from the sap-ingress or network qos policy associated with the IP interface. If the source address of the incoming packet matches a route with no QoS information the fc and priority of the packet remain as determined by the sap-ingress or network qos policy.

If neither the optional **source** or **destination** parameter is present, then the default is **destination** address matching.

The functionality enabled by the qos-route-lookup command can be applied to IPv4 packets or IPv6 packets on an interface, depending on whether it is present at the interface context (applies to IPv4) or the interface>ipv6 context (applies to IPv6). Subscriber management group interfaces for the 7750 SR and 7450 ESS also do not support the source QPPB option.

The **no** form of the command reverts to the default.

|                   |                                                                                                                                                                                                                                                                                                   |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no qos-route-lookup                                                                                                                                                                                                                                                                               |
| <b>Parameters</b> | <p><b>source</b> — Enables QoS classification of incoming IP packets based on the source address matching a route with QoS information.</p> <p><b>destination</b> — Enables QoS classification of incoming IP packets based on the destination address matching a route with QoS information.</p> |

## remote-proxy-arp

|                    |                                                         |
|--------------------|---------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] remote-proxy-arp</b>                            |
| <b>Context</b>     | config>router>if                                        |
| <b>Description</b> | This command enables remote proxy ARP on the interface. |
| <b>Default</b>     | no remote-proxy-arp                                     |

## secondary

|                    |                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>secondary</b> {<i>ip-address/mask</i>   <i>ip-address netmask</i>} [<b>broadcast</b> {<b>all-ones</b>   <b>host-ones</b>}] [<b>igp-inhibit</b>] [<b>track-srrp</b> <i>srrp-instance</i>]</p> <p><b>no secondary</b> {<i>ip-address/mask</i>   <i>ip-address netmask</i>}</p>              |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                |
| <b>Description</b> | This command assigns additional IP addresses to the interface. Up to 16 total primary and secondary IPv4 and IPv6 addresses can be assigned to network interfaces, and up to 256 to access interfaces. Each address can be configured in an IP address, IP subnet, or broadcast address format. |





**Caution:** Configurations must not exceed 16 secondary IP addresses when IPsec, GRE, L2TPv3, or IP in IP protocols are active on an access interface.

## Parameters

*ip-address* — Specifies the IP address of the IP interface. The *ip-address* portion of the **address** command specifies the IP host address that will be used by the IP interface within the subnet. This address must be unique within the subnet and specified in dotted decimal notation.

**Values** 1.0.0.0 to 223.255.255.255

*/* — The forward slash is a parameter delimiter that separates the *ip-address* portion of the IP address from the mask that defines the scope of the local subnet. No spaces are allowed between the *ip-addr*, the “/” and the *mask-length* parameter. If a forward slash does not immediately follow the *ip-addr*, a dotted decimal mask must follow the prefix.

*mask* — Specifies the subnet mask length when the IP prefix is specified in CIDR notation. When the IP prefix is specified in CIDR notation, a forward slash (/) separates the *ip-address* from the *mask* parameter. The *mask* parameter indicates the number of bits used for the network portion of the IP address; the remainder of the IP address is used to determine the host portion of the IP address. Allowed values are integers in the range 1 to 32. A mask length of 32 is reserved for system IP addresses.

**Values** 1 to 32

*netmask* — Specifies the subnet mask in dotted decimal notation. When the IP prefix is not specified in CIDR notation, a space separates the *ip-address* from a traditional dotted decimal mask. The *mask* parameter indicates the complete mask that will be used in a logical ‘AND’ function to derive the local subnet of the IP address. A mask of 255.255.255.255 is reserved for system IP addresses.

**Values** 128.0.0.0 to 255.255.255.255

**broadcast** — The optional **broadcast** parameter overrides the default broadcast address used by the IP interface when sourcing IP broadcasts on the IP interface. If no broadcast format is specified for the IP address, the default value is **host-ones**, which indicates a subnet broadcast address. Use this parameter to change the broadcast address to **all-ones** or revert back to a broadcast address of **host-ones**.

The **broadcast** parameter within the **address** command does not have a negate feature, which is usually used to revert a parameter to the default value. To change the **broadcast** type to **host-ones** after being changed to **all-ones**, the **address** command must be executed with the **broadcast** parameter defined.

The broadcast format on an IP interface can be specified when the IP address is assigned or changed.

This parameter does not affect the type of broadcasts that can be received by the IP interface. A host sending either the local broadcast (**all-ones**) or the valid subnet broadcast address (**host-ones**) will be received by the IP interface.

**all-ones** — The **all-ones** keyword following the **broadcast** parameter specifies that the broadcast address used by the IP interface for this IP address will be 255.255.255.255, also known as the local broadcast.

**host-ones** — The **host-ones** keyword following the **broadcast** parameter specifies that the broadcast address used by the IP interface for this IP address will be the subnet broadcast address. This is an IP address that corresponds to the local subnet described by the *ip-address* and the *mask* with all the host bits set to binary 1. This is the default broadcast address used by an IP interface.

**igp-inhibit** — The secondary IP address should not be recognized as a local interface by the running IGP.

*srrp-instance* — Specifies the SRRP instance ID that this interface route needs to track.

## static-arp

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>static-arp</b> <i>ip-address</i> <i>ieee-address</i><br><b>no static-arp</b> <i>ip-address</i><br><b>static-arp</b> <i>ieee-address</i> <b>unnumbered</b><br><b>no static-arp</b> <b>unnumbered</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command configures a static Address Resolution Protocol (ARP) entry associating an IP address with a MAC address for the core router instance. This static ARP appears in the core routing ARP table. A static ARP can only be configured if it exists on the network attached to the IP interface.</p> <p>If an entry for a specific IP address already exists and a new MAC address is configured for the IP address, the existing MAC address is replaced by the new MAC address.</p> <p>The number of static-arp entries that can be configured on a single node is limited to 1000.</p> <p>Static ARP is used when a router needs to know about a device on an interface that cannot or does not respond to ARP requests. Therefore, the router configuration can state that if it has a packet that has a certain IP address to send it to the corresponding ARP address. Use proxy ARP so the router responds to ARP requests on behalf of another device.</p> <p>The <b>no</b> form of the command removes a static ARP entry.</p> |
| <b>Default</b>     | No static ARPs are defined.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>  | <p><i>ieee-address</i> — Specifies the 48-bit MAC address for the static ARP in the form <i>aa:bb:cc:dd:ee:ff</i> or <i>aa-bb-cc-dd-ee-ff</i>, where <i>aa</i>, <i>bb</i>, <i>cc</i>, <i>dd</i>, <i>ee</i> and <i>ff</i> are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC and non-IEEE reserved MAC addresses.</p> <p><b>unnumbered</b> — Specifies the static ARP MAC for an unnumbered interface. Unnumbered interfaces support dynamic ARP. Once this command is configured, it overrides any dynamic ARP.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## strip-label

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] strip-label</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command forces packets to be stripped of all (max 5) MPLS labels before the packets are handed over for possible filter (PBR) processing.</p> <p>If the packets do not have an IP header immediately following the MPLS label stack after the strip, they are discarded. Only MPLS encapsulated IP, IGP shortcuts and VPRN over MPLS packets will be processed. However, IPv4 and IPv6 packets that arrive without any labels are supported on an interface with <b>strip-label</b> enabled.</p> <p>This command operates in promiscuous mode. This means that the router does not filter on the destination MAC address of the Ethernet frames. In some network designs, multiple ports may be tapped and combined into interface toward the router. Promiscuous mode allows all of these flows to be processed without requiring the destination MAC address to be updated to match the router address.</p> <p>This command is supported on:</p> <ul style="list-style-type: none"> <li>• Optical ports for the 7750 SR and 7450 ESS</li> <li>• IOM3-XP cards for the 7750 SR and 7450 ESS</li> <li>• Null/Dot1q encaps</li> <li>• Network ports</li> <li>• IPv4</li> <li>• IPv6</li> </ul> <p>In order to associate an interface that is configured with the strip-label parameter with a port, the port must be configured as single-fiber for the command to be valid.</p> <p>Packets that are subject to the strip-label action and are mirrored (using mirrors or lawful interception) will contain the original MPLS labels (and other L2 encapsulation) in the mirrored copy of the packet, as they appeared on the wire, when the mirror-dest type is the default type “ether”. If the mirror-dest type is “ip-only”, then the mirrored copy of the packet will not contain the original L2 encapsulation or the stripped MPLS labels.</p> <p>The <b>no</b> form of the command removes the strip-label command.</p> |
| <b>Default</b>     | no strip-label                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## tcp-mss

|                |                                               |
|----------------|-----------------------------------------------|
| <b>Syntax</b>  | <b>tcp-mss mss-value</b><br><b>no tcp-mss</b> |
| <b>Context</b> | config>router>if                              |

```
config>router>if>ipv6
```

**Description** This command statically sets the TCP maximum segment size (MSS) for TCP connections originated from the associated IP interface to the specified value.

The **no** form of the command removes the static value and allows the TCP MSS value to be calculated based on the IP MTU value by subtracting the base IP and TCP header lengths from the IP MTU value ( $\text{tcp\_mss} = \text{ip\_mtu} - 40$ ).

**Default** no tcp-mss

**Parameters** *mss-value* — Specifies the TCP MSS value that should be used in the TCP SYN packet during the three-way handshake negotiation of a TCP connection.

9158 = max-IP\_MTU (9198)-40

**Values** 536 to 9158 (IPv4)  
1220 to 9138 (IPv6)

## tos-marking-state

**Syntax** **tos-marking-state {trusted | untrusted}**  
**no tos-marking-state**

**Context** config>router>if

**Description** This command is used on a network IP interface to alter the default trusted state to a non-trusted state. When unset or reverted to the trusted default, the ToS field will not be remarked by egress network IP interfaces unless the egress network IP interface has the remark-trusted state set, in which case the egress network interface treats all IES and network IP interface as untrusted.

When the ingress network IP interface is set to untrusted, all egress network IP interfaces will remark IP packets received on the network interface according to the egress marking definitions on each network interface. The egress network remarking rules also apply to the ToS field of IP packets routed using IGP shortcuts (tunneled to a remote next-hop). However, the tunnel QoS markings are always derived from the egress network QoS definitions.

Egress marking and remarking is based on the internal forwarding class and profile state of the packet once it reaches the egress interface. The forwarding class is derived from ingress classification functions. The profile of a packet is either derived from ingress classification or ingress policing.

The default marking state for network IP interfaces is trusted. This is equivalent to declaring no tos-marking-state on the network IP interface. When undefined or set to tos-marking-state trusted, the trusted state of the interface will not be displayed when using show config or show info unless the detail parameter is given. The **save config** command will not store the default tos-marking-state trusted state for network IP interfaces unless the detail parameter is also specified.

The **no** form of the command is used to restore the trusted state to a network IP interface. This is equivalent to executing the tos-marking-state trusted command.

---

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | tos-marking-state trusted                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b> | <p><b>trusted</b> — Specifies that the default prevents the ToS field to not be remarked by egress network IP interfaces unless the egress network IP interface has the remark-trusted state set</p> <p><b>untrusted</b> — Specifies that all egress network IP interfaces will remark IP packets received on the network interface according to the egress marking definitions on each network interface.</p> |

## unnumbered

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>unnumbered</b> [{ <i>ip-int-name</i>   <i>ip-address</i> }]<br><b>no unnumbered</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>This command sets an IP interface as an unnumbered interface and specifies the IP address to be used for the interface.</p> <p>To conserve IP addresses, unnumbered interfaces can be configured. The address used when generating packets on this interface is the <i>ip-addr</i> parameter configured.</p> <p>An error message will be generated if an <b>unnumbered</b> interface is configured, and an IP address already exists on this interface.</p> <p>The <b>no</b> form of the command removes the IP address from the interface, effectively removing the unnumbered property. The interface must be <b>shutdown</b> before <b>no unnumbered</b> is issued to delete the IP address from the interface, or an error message will be generated.</p> |
| <b>Default</b>     | no unnumbered                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <i>ip-int-name</i>   <i>ip-address</i> — Optional. Specifies the IP address or IP interface name to associate with the unnumbered IP interface in dotted decimal notation. The configured IP address must exist on this node. It is recommended to use the system IP address as it is not associated with a specific interface and is therefore always reachable. The system IP address is the default if no <i>ip-addr</i> or <i>ip-int-name</i> is configured.                                                                                                                                                                                                                                                                                                 |

## untrusted

|                    |                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>untrusted</b> [default-forwarding <i>default-forwarding</i> ]<br><b>no untrusted</b> |
| <b>Context</b>     | config>router>if                                                                        |
| <b>Description</b> | This command configures the state of untrusted for a network IP interface.              |

The untrusted state identifies the participating interfaces in the label security feature for prefixes of a VPN family at an inter-AS boundary. The router supports a maximum of 15 network interfaces that can participate in this feature.

The user normally applies this command to an inter-AS interface. PIP keeps track of the untrusted status of each interface. In the data path, such an interface causes the default forwarding to be set to the *default-forwarding* value.

For backward compatibility reasons, the interface **default-forwarding** is set to the **forward** value; this means that labeled packets are checked in the normal way against the table of programmed ILMs to decide if they should be dropped or forwarded in a GRT, a VRF, or a L2 service context.

If the user sets the *default-forwarding* value to **drop**, all labeled packets received on that interface are automatically dropped.

This command sets the default behavior for an untrusted interface in the data path and for all ILMs. When enabling the label security for VPN IPv4 or VPN IPv6 prefixes, BGP programs the data path to provide an exception to the normal way of forwarding handling away from the default for those VPRN ILMs.

The **no** form of the command returns the interface into the default state of trusted.

|                   |                                                                                                                      |
|-------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no untrusted                                                                                                         |
| <b>Parameters</b> | <i>default-forwarding</i> — Specifies the default forwarding behavior of labeled packets received on this interface. |
| <b>Values</b>     | forward, drop                                                                                                        |
| <b>Default</b>    | forward                                                                                                              |

urpf-check

|                    |                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] urpf-check                                                                                                                                                |
| <b>Context</b>     | config>router>if<br>config>router>if>ipv6                                                                                                                      |
| <b>Description</b> | This command enables unicast RPF (uRPF) Check on this interface.<br><br>The <b>no</b> form of the command disables unicast RPF (uRPF) Check on this interface. |

ignore-default

|                |                                                                 |
|----------------|-----------------------------------------------------------------|
| <b>Syntax</b>  | [no] ignore-default                                             |
| <b>Context</b> | config>router>if>urpf-check<br>config>router>if>ipv6>urpf-check |

**Description** This command configures the uRPF check (if enabled) to ignore default routes for purposes of determining the validity of incoming packets. By default, default routes are considered eligible.

## mode

**Syntax** **mode {strict | loose | strict-no-ecmp}**

**Context** config>router>if>urpf-check  
config>router>if>ipv6>urpf-check

**Description** This command specifies the mode of unicast RPF check.

The **no** form of the command reverts to the default (strict) mode.

**Default** mode strict

**Parameters** **strict** — When specified, uRPF checks whether incoming packet has a source address that matches a prefix in the routing table, and whether the interface expects to receive a packet with this source address prefix.

**loose** — In **loose** mode, uRPF checks whether incoming packet has source address with a corresponding prefix in the routing table. However, the loose mode does not check whether the interface expects to receive a packet with a specific source address prefix. This object is valid only when **urpf-check** is enabled.

**strict-no-ecmp** — When a packet is received on an interface in this mode and the SA matches an ECMP route the packet is dropped by uRPF.

## urpf-selected-vprns

**Syntax** **[no] urpf-selected-vprns**

**Context** config>router>if

**Description** This command enables uRPF checking of incoming traffic on the network interface for the following packets.

- Packets associated with the global routing table (base router) context.
- Packets associated with VPRNs that have enabled the uRPF check using the **config>service>vprn>network>ingress>urpf-check** command.

If the command is not configured, the default action is to perform uRPF checks for all ingress traffic on the network interface (associated with the base router and all VPRNs) based on the IPv4 and IPv6 **urpf-check** configuration options of the network interface.

**Default** no urpf-selected-vprns

---

## vas-if-type

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>vas-if-type</b> { <b>to-from-access</b>   <b>to-from-network</b>   <b>to-from-both</b> }<br><b>no vas-if-type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | <p>This command configures the type of a Value Added Service (VAS) facing interface. To change the <b>vas-if-type</b>, the <b>shutdown</b> command is required. The <b>vas-if-type</b> and <b>loopback</b> commands are mutually exclusive.</p> <p>The <b>no</b> form of the command removes the VAS interface type configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Default</b>     | no vas-if-type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>  | <p><b>to-from-access</b> — Used when two separate (<b>to-from-access</b> and <b>to-from-network</b>) interfaces are used for VAS connectivity. For service chaining, traffic arriving from access interfaces (upstream) is redirected to a PBR target reachable over this interface for upstream VAS processing. Downstream traffic after VAS processing must arrive on this interface, so that the traffic is subject to regular routing but is not subject to AA divert, nor egress subscriber PBR.</p> <p><b>to-from-network</b> — Used when two separate (<b>to-from-access</b> and <b>to-from-network</b>) interfaces are used for VAS connectivity. For service chaining, traffic arriving from network interfaces (downstream) is redirected to a PBR target reachable over this interface for downstream VAS processing. Upstream traffic after VAS processing must arrive on this interface, so that regular routing can be applied.</p> <p><b>to-from-both</b> — Used when a single interface is used for VAS connectivity (no local-to-local traffic). For service chaining, both traffic arriving from access interfaces and from network interfaces is redirected to a PBR target reachable over this interface for upstream/downstream VAS processing. Traffic after VAS processing must arrive on this interface, so that the traffic is subject to regular routing but is not subject to AA divert, nor to egress subscriber PBR.</p> |

## route-next-hop-policy

|                    |                                                                        |
|--------------------|------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>route-next-hop-policy</b>                                           |
| <b>Context</b>     | config>router                                                          |
| <b>Description</b> | This command creates the context to configure route next-hop policies. |

## template

|                |                                     |
|----------------|-------------------------------------|
| <b>Syntax</b>  | [no] <b>template</b> <i>name</i>    |
| <b>Context</b> | config>router>route-next-hop-policy |



|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command creates a template to configure the attributes of a Loop-Free Alternate (LFA) Shortest Path First (SPF) policy. An LFA SPF policy allows the user to apply specific criteria, such as admin group and SRLG constraints, to the selection of an LFA backup next-hop for a subset of prefixes that resolve to a specific primary next-hop.</p> <p>The user first creates a route next-hop policy template under the global router context and then applies it to a specific OSPF or IS-IS interface in the global routing instance or in a VPRN instance.</p> <p>A policy template can be used in both IS-IS and OSPF to apply the specific criteria to prefixes protected by LFA. Each instance of IS-IS or OSPF can apply the same policy template to one or more interface.</p> <p>The commands within the route next-hop policy template use the <b>begin-commit-abort</b> model. The following are the steps to create and modify the template:</p> <p>To create a template, the user enters the name of the new template directly under the route-next-hop-policy context.</p> <ol style="list-style-type: none"> <li>1. To delete a template that is not in use, the user enters the <b>no</b> form for the template name under the route-next-hop-policy context.</li> <li>2. The user enters the editing mode by executing the begin command under the route-next-hop-policy context. The user can then edit and change any number of route next-hop policy templates. However, the parameter value will still be stored temporarily in the template module until the commit is executed under the route-next-hop-policy context. Any temporary parameter changes will be lost if the user enters the abort command before the commit command.</li> <li>3. The user is allowed to create or delete a template instantly once in the editing mode without the need to enter the commit command. Furthermore, the abort command, if entered, will have no effect on the prior deletion or creation of a template.</li> </ol> <p>Once the commit command is issued, IS-IS or OSPF will re-evaluate the templates and if there are any net changes, it will schedule a new LFA SPF to re-compute the LFA next-hop for the prefixes associated with these templates.</p> |
| <b>Parameters</b>  | <p><i>name</i> — Specifies the name of the template, up to 32 characters.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## exclude-group

|                    |                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] exclude-group</b> <i>ip-admin-group-name</i>                                        |
| <b>Context</b>     | config>router>route-next-hop-policy>template                                                |
| <b>Description</b> | This command configures the admin group constraint into the route next-hop policy template. |

Each group is entered individually. The **include-group** statement instructs the LFA SPF selection algorithm to pick up a subset of LFA next-hops among the links that belong to one or more of the specified admin groups. A link that does not belong to at least one of the admin-groups is excluded. However, a link can still be selected if it belongs to one of the groups in an include-group statement but also belongs to other groups that are not part of any include-group statement in the route next-hop policy.

The **pref** option is used to provide a relative preference for the admin group to select. A lower preference value means that LFA SPF will first attempt to select an LFA backup next-hop that is a member of the corresponding admin group. If none is found, then the admin group with the next highest preference value is evaluated. If no preference is configured for a given admin group name, then it is supposed to be the least preferred, that is, numerically the highest preference value.

When evaluating multiple **include-group** statements within the same preference, any link that belongs to one or more of the included admin groups can be selected as an LFA next-hop. There is no relative preference based on how many of those included admin groups the link is a member of.

The **exclude-group** statement simply prunes all links belonging to the specified admin group before making the LFA backup next-hop selection for a prefix.

If the same group name is part of both include and exclude statements, the exclude statement will win. In other words, the exclude statement can be viewed as having an implicit preference value of zero (0).

The admin-group criteria are applied before running the LFA next-hop selection algorithm.

The **no** form deletes the admin group constraint from the route next-hop policy template.

**Parameters**    *ip-admin-group-name* — Specifies the name of the group, up to 32 characters.

## include-group

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>include-group</b> <i>ip-admin-group-name</i> [ <b>pref</b> <i>preference</i> ]<br><b>no include-group</b> <i>ip-admin-group-name</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>route-next-hop-policy>template                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This command configures the admin group constraint into the route next-hop policy template.</p> <p>Each group is entered individually. The <b>include-group</b> statement instructs the LFA SPF selection algorithm to pick up a subset of LFA next-hops among the links which belong to one or more of the specified admin groups. A link which does not belong to at least one of the admin-groups is excluded. However, a link can still be selected if it belongs to one of the groups in a include-group statement but also belongs to other groups which are not part of any include-group statement in the route next-hop policy.</p> |

The **pref** option is used to provide a relative preference for the admin group to select. A lower preference value means that LFA SPF will first attempt to select a LFA backup next-hop which is a member of the corresponding admin group. If none is found, then the admin group with the next higher preference value is evaluated. If no preference is configured for a given admin group name, then it is supposed to be the least preferred, that is, numerically the highest preference value.

When evaluating multiple **include-group** statements within the same preference, any link which belongs to one or more of the included admin groups can be selected as an LFA next-hop. There is no relative preference based on how many of those included admin groups the link is a member of.

The **exclude-group** statement simply prunes all links belonging to the specified admin group before making the LFA backup next-hop selection for a prefix.

If the same group name is part of both include and exclude statements, the exclude statement will win. In other words, the exclude statement can be viewed as having an implicit preference value of 0.

The admin-group criteria are applied before running the LFA next-hop selection algorithm.

The **no** form deletes the admin group constraint from the route next-hop policy template.

|                   |                                                                                    |
|-------------------|------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>ip-admin-group-name</i> — Specifies the name of the group, up to 32 characters. |
|                   | <i>preference</i> — An integer specifying the relative preference of a group.      |
|                   | <b>Values</b> 1 to 255                                                             |
|                   | <b>Default</b> 255                                                                 |

nh-type

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>nh-type {ip   tunnel}</b><br><b>no nh-type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>route-next-hop-policy>template                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | <p>This command configures the next-hop type constraint into the route next-hop policy template.</p> <p>The user can select if tunnel backup next-hop or IP backup next-hop is preferred. The default in SR OS implementation is to prefer IP next-hop over tunnel next-hop. The implementation will fall back to the other type if no LFA next-hop of the preferred type is found.</p> <p>When the route next-hop policy template is applied to an IP interface, all prefixes using this interface as a primary next-hop will follow the next-hop type preference specified in the template.</p> <p>The <b>no</b> form deletes the next-hop type constraint from the route next-hop policy template.</p> |

---

|                   |                                                                                 |
|-------------------|---------------------------------------------------------------------------------|
| <b>Default</b>    | nh-type ip                                                                      |
| <b>Parameters</b> | <b>{ip   tunnel}</b> — Specifies the two possible values for the next-hop type. |
| <b>Default</b>    | ip                                                                              |

## protection-type

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>protection-type {link   node}</b><br><b>no protection-type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>router>route-next-hop-policy>template                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>This command configures the protection type constraint into the route next-hop policy template.</p> <p>The user can select if link protection or node protection is preferred in the selection of an LFA next-hop for all IP prefixes and LDP FEC prefixes to which a route next-hop policy template is applied. The default in SR OS implementation is node protection. The implementation will fall back to the other type if no LFA next-hop of the preferred type is found.</p> <p>When the route next-hop policy template is applied to an IP interface, all prefixes using this interface as a primary next-hop will follow the protection type preference specified in the template.</p> <p>The <b>no</b> form deletes the protection type constraint from the route next-hop policy template.</p> |
| <b>Default</b>     | protection-type node                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <b>{link   node}</b> — Specifies the two possible values for the protection type.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Default</b>     | node                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## srlg-enable

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] srlg-enable</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>router>route-next-hop-policy>template                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | <p>This command configures the SRLG constraint into the route next-hop policy template.</p> <p>When this command is applied to a prefix, the LFA SPF will attempt to select an LFA next-hop, among the computed ones, which uses an outgoing interface that does not participate in any of the SLRGs of the outgoing interface used by the primary next-hop.</p> <p>The SRLG criterion is applied before running the LFA next-hop selection algorithm.</p> <p>The <b>no</b> form deletes the SRLG constraint from the route next-hop policy template.</p> |
| <b>Default</b>     | no srlg-enable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## 2.13.2.4.1 Router Interface Filter Commands

### egress

|                    |                                                                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>egress</b>                                                                                                                                                               |
| <b>Context</b>     | config>router>if                                                                                                                                                            |
| <b>Description</b> | This command enables access to the context to configure egress network filter policies for the IP interface. If an egress filter is not defined, no filtering is performed. |

### ingress

|                    |                                                                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ingress</b>                                                                                                                                                                |
| <b>Context</b>     | config>router>if                                                                                                                                                              |
| <b>Description</b> | This command enables access to the context to configure ingress network filter policies for the IP interface. If an ingress filter is not defined, no filtering is performed. |

### filter

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>filter ip</b> <i>ip-filter-id</i><br><b>filter ipv6</b> <i>ipv6-filter-id</i><br><b>no filter</b> [ <b>ip</b> <i>ip-filter-id</i> ] [ <b>ipv6</b> <i>ipv6-filter-id</i> ]                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>if>ingress<br>config>router>if>egress                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command associates an IP filter policy with an IP interface.</p> <p>Filter policies control packet forwarding and dropping based on IP match criteria.</p> <p>The <i>ip-filter-id</i> must have been preconfigured before this <b>filter</b> command is executed. If the filter ID does not exist, an error occurs.</p> <p>Only one filter ID can be specified.</p> <p>The <b>no</b> form of the command removes the filter policy association with the IP interface.</p> |
| <b>Default</b>     | no filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <i>ip-filter-id</i> — The filter name acts as the ID for the IP filter policy expressed as a decimal integer. The filter policy must already exist within the <b>config&gt;filter&gt;ip</b> context.<br><b>Values</b> 1 to 16384                                                                                                                                                                                                                                                  |

*ipv6-filter-id* — The filter name acts as the ID for the IPv6 filter policy expressed as a decimal integer. The filter policy must already exist within the **config>filter>ipv6** context. This parameter only applies to the 7750 SR and 7950 XRS.

**Values** 1 to 65535

## 2.13.2.4.2 Router Interface ICMP Commands

### hold-time

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>hold-time</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | <pre>config&gt;router&gt;if config&gt;service&gt;ies&gt;if config&gt;service&gt;ies&gt;subscriber-interface config&gt;service&gt;ies&gt;redundant-interface config&gt;service&gt;vprn&gt;if config&gt;service&gt;vprn&gt;network-interface config&gt;service&gt;vprn&gt;subscriber-interface config&gt;service&gt;vprn&gt;redundant-interface config&gt;service&gt;vpls&gt;if</pre>                                                                                                                                                         |
| <b>Description</b> | <p>This command creates the CLI context to configure interface level hold-up and hold-down timers for the associated IP interface.</p> <p>The <b>up</b> timer controls a delay for the associated IPv4 or IPv6 interface so that the system will delay the deactivation of the associated interface for the specified amount of time.</p> <p>The <b>down</b> timer controls a delay for the associated IPv4 or IPv6 interface so that the system will delay the activation of the associated interface for the specified amount of time</p> |

### down

|                |                                                                                                                                                                                                                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <pre>down ip seconds [init-only] no down ip down ipv6 seconds [init-only] no down ipv6</pre>                                                                                                                                                                                                                                             |
| <b>Context</b> | <pre>config&gt;router&gt;if&gt;hold-time config&gt;service&gt;ies&gt;if&gt;hold-time config&gt;service&gt;ies&gt;sub-if&gt;hold-time config&gt;service&gt;ies&gt;red-if&gt;hold-time config&gt;service&gt;vprn&gt;if&gt;hold-time config&gt;service&gt;vprn&gt;nw-if&gt;hold-time config&gt;service&gt;vprn&gt;sub-if&gt;hold-time</pre> |

```
config>service>vprn>red-if>hold-time
config>service>vpls>if>hold-time
```

**Description** This command will cause a delay in the activation of the associated IP interface by the specified number of seconds. The delay is invoked whenever the system attempts to bring the associated IP interface up, unless the **init-only** option is configured. If the **init-only** option is configured, the delay is only applied when the IP interface is first configured or after a system reboot.

The **no** form of the command removes the command from the active configuration and removes the delay in activating the associated IP interface. If the configuration is removed during a delay period, the currently running delay will continue until it completes.

**Default** no down ip

**Parameters** *seconds* — The time delay, in seconds, to make the interface operational.

**Values** 1 to 1200

**init-only** — Specifies that the **down** delay is only applied when the interface is configured or after a reboot.

**Values** 1 to 1200

up

**Syntax** *up ip seconds*  
*no up ip*  
*up ipv6 seconds*  
*no up ipv6*

**Context** config>router>if>hold-time  
config>service>ies>if>hold-time  
config>service>ies>sub-if>hold-time  
config>service>ies>red-if>hold-time  
config>service>vprn>if>hold-time  
config>service>vprn>nw-if>hold-time  
config>service>vprn>sub-if>hold-time  
config>service>vprn>red-if>hold-time  
config>service>vpls>if>hold-time

**Description** This command will cause a delay in the deactivation of the associated IP interface by the specified number of seconds. The delay is invoked whenever the system attempts to bring the associated IP interface down.

The **no** form of the command removes the command from the active configuration and removes the delay in deactivating the associated IP interface. If the configuration is removed during a delay period, the currently running delay will continue until it expires.

**Default** no up ip

---

|                   |                                                                                 |
|-------------------|---------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>seconds</i> — The time delay, in seconds, to make the interface operational. |
| <b>Values</b>     | 1 to 1200                                                                       |

## icmp

|                    |                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>icmp</b>                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>router>if                                                                                                                                                                                                                                               |
| <b>Description</b> | This command enables access to the context to configure Internet Control Message Protocol (ICMP) parameters on a network IP interface. ICMP is a message control and error reporting protocol that also provides information relevant to IP packet processing. |

## mask-reply

|                    |                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] mask-reply</b>                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>router>if>icmp                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command enables responses to ICMP mask requests on the router interface.</p> <p>If a local node sends an ICMP mask request to the router interface, the <b>mask-reply</b> command configures the router interface to reply to the request.</p> <p>The <b>no</b> form of the command disables replies to ICMP mask requests on the router interface.</p> |
| <b>Default</b>     | mask-reply — Replies to ICMP mask requests.                                                                                                                                                                                                                                                                                                                     |

## param-problem

|                    |                                                                                                                                                                                                                                                                        |               |            |                |     |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|-----|
| <b>Syntax</b>      | <b>param-problem</b> [ <i>number seconds</i> ]<br><b>no param-problem</b>                                                                                                                                                                                              |               |            |                |     |
| <b>Context</b>     | config>router>if>icmp                                                                                                                                                                                                                                                  |               |            |                |     |
| <b>Description</b> | <p>This command specifies whether parameter-problem ICMP messages should be sent. When enabled, parameter-problem ICMP messages are generated by this interface.</p> <p>The <b>no</b> form of the command disables the sending of parameter-problem ICMP messages.</p> |               |            |                |     |
| <b>Parameters</b>  | <p><i>number</i> — Specifies the number of parameter-problem ICMP messages to send in the time frame specified by the <i>seconds</i> parameter.</p> <table><tr><td><b>Values</b></td><td>10 to 1000</td></tr><tr><td><b>Default</b></td><td>100</td></tr></table>      | <b>Values</b> | 10 to 1000 | <b>Default</b> | 100 |
| <b>Values</b>      | 10 to 1000                                                                                                                                                                                                                                                             |               |            |                |     |
| <b>Default</b>     | 100                                                                                                                                                                                                                                                                    |               |            |                |     |



*seconds* — Specifies the time frame, in seconds, that is used to limit the number of parameter-problem ICMP messages issued.

**Values** 1 to 60

**Default** 10

## redirects

**Syntax** **redirects** [*number seconds*]  
**no redirects**

**Context** config>router>if>icmp

**Description** This command enables and configures the rate for ICMP redirect messages issued on the router interface.

When routes are not optimal on this router, and another router on the same subnetwork has a better route, the router can issue an ICMP redirect to alert the sending node that a better route is available.

The **redirects** command enables the generation of ICMP redirects on the router interface. The rate at which ICMP redirects are issued can be controlled with the optional *number* and *time* parameters by indicating the maximum number of redirect messages that can be issued on the interface for a given time interval.

By default, generation of ICMP redirect messages is enabled at a maximum rate of 100 per 10 second time interval.

The **no** form of the command disables the generation of ICMP redirects on the router interface.

**Default** redirects 100 10 — Maximum of 100 redirect messages in 10 seconds.

**Parameters** *number* — The maximum number of ICMP redirect messages to send, expressed as a decimal integer. This parameter must be specified with the *time* parameter.

**Values** 10 to 1000

*seconds* — The time frame, in seconds, used to limit the *number* of ICMP redirect messages that can be issued, expressed as a decimal integer.

**Values** 1 to 60

## ttl-expired

**Syntax** **ttl-expired** [*number seconds*]  
**no ttl-expired**

**Context** config>router>if>icmp

---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command configures the rate that Internet Control Message Protocol (ICMP) Time To Live (TTL) expired messages are issued by the IP interface.</p> <p>By default, generation of ICMP TTL expired messages is enabled at a maximum rate of 100 per 10 second time interval.</p> <p>The <b>no</b> form of the command disables the generation of TTL expired messages.</p>                        |
| <b>Default</b>     | ttl-expired 100 10 — Maximum of 100 TTL expired message in 10 seconds.                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><i>number</i> — The maximum number of ICMP TTL expired messages to send, expressed as a decimal integer. The <i>seconds</i> parameter must also be specified.</p> <p><b>Values</b> 10 to 2000</p> <p><i>seconds</i> — The time frame, in seconds, used to limit the <i>number</i> of ICMP TTL expired messages that can be issued, expressed as a decimal integer.</p> <p><b>Values</b> 1 to 60</p> |

## unreachables

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>unreachables</b> [ <i>number seconds</i> ]<br><b>no unreachables</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>if>icmp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>This command enables and configures the rate for ICMP host and network destination unreachable messages issued on the router interface.</p> <p>The <b>unreachables</b> command enables the generation of ICMP destination unreachables on the router interface. The rate at which ICMP unreachables is issued can be controlled with the optional <i>number</i> and <i>seconds</i> parameters by indicating the maximum number of destination unreachable messages that can be issued on the interface for a given time interval.</p> <p>By default, generation of ICMP destination unreachables messages is enabled at a maximum rate of 100 per 10 second time interval.</p> <p>The <b>no</b> form of the command disables the generation of ICMP destination unreachables on the router interface.</p> |
| <b>Default</b>     | unreachables 100 10 — Maximum of 100 unreachable messages in 10 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <p><i>number</i> — The maximum number of ICMP unreachable messages to send, expressed as a decimal integer. The <i>seconds</i> parameter must also be specified.</p> <p><b>Values</b> 10 to 2000</p> <p><i>seconds</i> — The time frame, in seconds, used to limit the <i>number</i> of ICMP unreachable messages that can be issued, expressed as a decimal integer.</p> <p><b>Values</b> 1 to 60</p>                                                                                                                                                                                                                                                                                                                                                                                                       |

### 2.13.2.4.3 Router Interface IPv6 Commands

#### ipv6

|             |                                                                                                                               |
|-------------|-------------------------------------------------------------------------------------------------------------------------------|
| Syntax      | [no] ipv6                                                                                                                     |
| Context     | config>router>if                                                                                                              |
| Description | This command configures IPv6 for a router interface.<br><br>The <b>no</b> form of the command disables IPv6 on the interface. |
| Default     | no ipv6                                                                                                                       |

#### address

|             |                                                                                                                                                                                                                                                                                                 |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Syntax      | <b>address</b> <i>ipv6-address/prefix-length</i> [ <b>eui-64</b> ] [ <b>track-srrp</b> <i>srrp-instance</i> ] [ <b>modifier</b> <i>cga-modifier</i> ] [ <b>dad-disable</b> ] [ <b>primary-preference</b> <i>primary-preference</i> ]<br><b>no address</b> { <i>ipv6-address/prefix-length</i> } |
| Context     | config>router>if>ipv6                                                                                                                                                                                                                                                                           |
| Description | This command assigns an IPv6 address to the interface. Up to 16 total primary and secondary IPv4 and IPv6 addresses can be assigned to network interfaces, and up to 256 to access interfaces.                                                                                                  |



**Caution:** Configurations must not exceed 16 IPv6 addresses when IPSec, GRE, L2TPv3, or IP in IP protocols are active on an access interface.

|            |                                                                                  |
|------------|----------------------------------------------------------------------------------|
| Parameters | <i>ipv6-address/prefix-length</i> — Specifies the IPv6 address on the interface. |
|------------|----------------------------------------------------------------------------------|

**Values**

|                      |               |                                                                                             |
|----------------------|---------------|---------------------------------------------------------------------------------------------|
| ipv6-address/prefix: | ipv6-address  | x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:d.d.d.d<br>x [0 to FFFF]H<br>d [0 to 255]D |
|                      | prefix-length | 1 to 128                                                                                    |

**eui-64** — When the **eui-64** keyword is specified, a complete IPv6 address from the supplied prefix and 64-bit interface identifier is formed. The 64-bit interface identifier is derived from MAC address on Ethernet interfaces. For interfaces without a MAC address, for example POS interfaces, the Base MAC address of the chassis should be used.

*srrp-instance* — Indicates the unique identifier of the tracked SRRP instance.

**Values** 1 to 4294967295

*cga-modifier* — Sets the modifier for cryptographically-assigned addresses.

**Values** 0x0..0xFFFFFFFF...(32 hex nibbles)

**dad-disable** — Disables Duplicate Address Detection (DAD) and sets the address to preferred, even if there is a duplicated address.

*primary-preference* — Specifies a *primary-preference* index to an IPv6 address of the interface to enforce the order in which the address is used by control plane protocols and applications which require a fixed address of the interface. These include LDP and Segment Routing.

When originating packets from this interface, the source IPv6 address follows the selection rules in RFC 6724 except for the specific cases where a fixed address is required. In the latter case, the IPv6 address with the lowest primary-preference index is selected. If the selected address is removed, the system selects the IPv6 address with the next lowest *primary-preference* index.

The system assigns the next available index value to any IPv6 address of the interface when configured without the *primary-preference* index value specified. The address index space is unique across all addresses of a given interface.

**Values** 1 to 4294967295

## dad-disable

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] dad-disable</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>router>if>ipv6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command disables duplicate address detection (DAD) on a per-interface basis. This prevents the router from performing a DAD check on the interface. All IPv6 addresses of an interface with DAD disabled, immediately enter a preferred state, without checking for uniqueness on the interface. This is useful for interfaces which enter a looped state during troubleshooting and operationally disable themselves when the loop is detected, requiring manual intervention to clear the DAD violation.</p> <p>The <b>no</b> form of the command turns off <b>dad-disable</b> on the interface.</p> |
| <b>Default</b>     | no dad-disable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## forward-ipv4-packets

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] forward-ipv4-packets</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>router>if>ipv6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>This command allows an IPv6-only interface (with no configured IPv4 addresses) to be used for forwarding transit and locally originating and terminating IPv4 packets.</p> <p>The interface will report that its IPv4 operational state is up if its IPv6 operational state is up. Be aware that not all protocols observe the interface as up from an IPv4 perspective. This command is mostly intended to support BGP routing use cases. Refer to RFC 5549, Advertising IPv4 Network Layer Reachability Information with an IPv6 Next Hop, for further information.</p> <p>The <b>no</b> form of the command restores the default behavior and prevents the interface from forwarding IPv4 packets if it has no configured IPv4 subnets.</p> |
| <b>Default</b>     | no forward-ipv4-packets                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## icmp6

|                    |                                                                                    |
|--------------------|------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>icmp6</b>                                                                       |
| <b>Context</b>     | config>router>if>ipv6                                                              |
| <b>Description</b> | This command enables the context to configure ICMPv6 parameters for the interface. |

## packet-too-big

|                    |                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>packet-too-big</b> [ <i>number seconds</i> ]<br><b>no packet-too-big</b>                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>if>ipv6>icmp6                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | This command configures the rate for ICMPv6 packet-too-big messages.                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <p><i>number</i> — Limits the number of packet-too-big messages issued per time frame specified in the <i>seconds</i> parameter.</p> <p><b>Values</b> 10 to 1000</p> <p><i>seconds</i> — Determines the time frame, in seconds, that is used to limit the number of packet-too-big messages issued per time frame.</p> <p><b>Values</b> 1 to 60</p> |

---

## param-problem

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>param-problem</b> [ <i>number seconds</i> ]<br><b>no param-problem</b>                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>if>ipv6>icmp6                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command specifies whether parameter-problem ICMPv6 messages should be sent. When enabled, parameter-problem ICMPv6 messages are generated by this interface.</p> <p>The <b>no</b> form of the command disables the sending of parameter-problem ICMPv6 messages.</p>                                                                                                                                      |
| <b>Parameters</b>  | <p><i>number</i> — Specifies the number of parameter-problem ICMPv6 messages to send in the time frame specified by the <i>seconds</i> parameter.</p> <p><b>Values</b> 10 to 1000</p> <p><b>Default</b> 100</p> <p><i>seconds</i> — Specifies the time frame, in seconds, that is used to limit the number of parameter-problem ICMPv6 messages issued.</p> <p><b>Values</b> 1 to 60</p> <p><b>Default</b> 10</p> |

## redirects

|                    |                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>redirects</b> [ <i>number seconds</i> ]<br><b>no redirects</b>                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>router>if>ipv6>icmp6                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command configures the rate for ICMPv6 redirect messages. When configured, ICMPv6 redirects are generated when routes are not optimal on the router and another router on the same subnetwork has a better route to alert that node that a better route is available.</p> <p>The <b>no</b> form of the command disables ICMPv6 redirects.</p> |
| <b>Default</b>     | redirects 100 10 (when IPv6 is enabled on the interface)                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <p><i>number</i> — Limits the number of redirects issued per the time frame specified in <i>seconds</i> parameter.</p> <p><b>Values</b> 10 to 1000</p> <p><i>seconds</i> — Determines the time frame, in seconds, that is used to limit the number of redirects issued per time frame.</p> <p><b>Values</b> 1 to 60</p>                               |

## time-exceeded

|                    |                                                                                                                                                                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>time-exceeded</b> [ <i>number seconds</i> ]<br><b>no time-exceeded</b>                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>if>ipv6>icmp6                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | This command configures rate for ICMPv6 time-exceeded messages.                                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <i>number</i> — Limits the number of time-exceeded messages issued per the time frame specified in <i>seconds</i> parameter.<br><b>Values</b> 10 to 2000<br><i>seconds</i> — Determines the time frame, in seconds, that is used to limit the number of time-exceeded messages issued per time frame.<br><b>Values</b> 1 to 60 |

## unreachables

|                    |                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>unreachables</b> [ <i>number seconds</i> ]<br><b>no unreachables</b>                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>if>ipv6>icmp6                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | This command configures the rate for ICMPv6 unreachable messages. When enabled, ICMPv6 host and network unreachable messages are generated by this interface.<br><br>The <b>no</b> form of the command disables the generation of ICMPv6 host and network unreachable messages by this interface.                                               |
| <b>Default</b>     | unreachables 100 10 (when IPv6 is enabled on the interface)                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <i>number</i> — Determines the number destination unreachable ICMPv6 messages to issue in the time frame specified in <i>seconds</i> parameter.<br><b>Values</b> 10 to 2000<br><i>seconds</i> — Sets the time frame, in seconds, to limit the number of destination unreachable ICMPv6 messages issued per time frame.<br><b>Values</b> 1 to 60 |

## link-local-address

|                |                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>link-local-address</b> <i>ipv6-address</i> [ <b>dad-disable</b> ]<br><b>no link-local-address</b> |
| <b>Context</b> | config>router>if>ipv6                                                                                |

```
config>service>ies>if>ipv6
config>service>vprn>if>ipv6
```

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command configures the IPv6 link local address.</p> <p>The <b>no</b> form of the command removes the configured link local address, and the router automatically generates a default link local address.</p> <p>Removing a manually configured link local address may impact routing protocols or static routes that have a dependency on that address. It is not recommended to remove a link local address when there are active IPv6 subscriber hosts on an IES or VPRN interface.</p> |
| <b>Parameters</b>  | <p><b>dad-disable</b> — Disables Duplicate Address Detection (DAD) and sets the address to preferred, even if there is a duplicated address.</p>                                                                                                                                                                                                                                                                                                                                                  |

## local-proxy-nd

|                    |                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] local-proxy-nd</b>                                                                                                                                     |
| <b>Context</b>     | config>router>if>ipv6                                                                                                                                          |
| <b>Description</b> | <p>This command enables local proxy neighbor discovery on the interface.</p> <p>The <b>no</b> form of the command disables local proxy neighbor discovery.</p> |

## nd-learn-unsolicited

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>nd-learn-unsolicited {global   link-local   both}</b><br/> <b>no nd-learn-unsolicited</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>router>if>ipv6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command enables the ability to learn neighbor entries out of received unsolicited Neighbor Advertisement messages, with or without the solicited flag set. The command can be enabled for global addresses, link-local addresses, or for both.</p> <p>The <b>no</b> form of the command makes the router follow standard RFC 4861 behavior for learning of neighbor entries.</p> <ul style="list-style-type: none"> <li>• If an unsolicited NA (regardless of the S flag) is received from a neighbor that is not yet in the ND cache, the NA is ignored in line with RFC 4861.</li> <li>• If an NS, RS, RA, or Redirect message with a Link Layer Address (MAC) is received from a neighbor that is not yet in the ND cache, a new neighbor entry is created in the cache to store the received Link Layer MAC. The neighbor is put in the STALE state. This is the standard RFC behavior.</li> </ul> |
| <b>Parameters</b>  | <p><b>global</b> — Learns global neighbor entries out of received unsolicited Neighbor Advertisement messages. This parameter is relevant only to global IPv6 addresses.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |



**link-local** — Learns link local neighbor entries out of received unsolicited Neighbor Advertisement messages. This parameter is relevant only to global IPv6 addresses.

**both** — Learns both global and link local neighbor entries out of received unsolicited Neighbor Advertisement messages. This parameter is relevant only to global IPv6 addresses.

## nd-proactive-refresh

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>nd-proactive-refresh {global   link-local   both}</b><br><b>no nd-proactive-refresh</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>router>if>ipv6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command enables a proactive refresh of the neighbor entries. When enabled, at the stale timer expiration, the router sends an NUD message to the host (regardless of the existence of traffic to the IP address on the IOM), so the entry can be refreshed or removed.</p> <p>This behavior is different from ARP, where the refresh is sent 30 seconds prior to the entry's age out time. The refresh can be optionally enabled for global addresses, link-local addresses, or both.</p> <p>The <b>no</b> form of the command disables the proactive behavior and the router only refreshes an entry if there is traffic that needs to be sent to the IP address.</p> |
| <b>Parameters</b>  | <p><b>global</b> — Refreshes global neighbor entries. This parameter is relevant only to global IPv6 addresses.</p> <p><b>link-local</b> — Refreshes link local neighbor entries. This parameter is relevant only to global IPv6 addresses.</p> <p><b>both</b> — Refreshes both global and link local neighbor entries. This parameter is relevant only to global IPv6 addresses.</p>                                                                                                                                                                                                                                                                                          |

## neighbor

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>neighbor ipv6-address mac-address</b><br><b>no neighbor ipv6-address</b>                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>router>if>ipv6                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This command configures an IPv6-to-MAC address mapping on the interface. Use this command if a directly attached IPv6 node does not support ICMPv6 neighbor discovery, or for some reason, a static address must be used. This command can only be used on Ethernet media.</p> <p>The <i>ipv6-address</i> must be on the subnet that was configured from the IPv6 <b>address</b> command or a link-local address.</p> |



## proxy-nd-policy

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>proxy-nd-policy</b> <i>policy-name</i> [ <i>policy-name</i> ]<br><b>no proxy-nd-policy</b>                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>router>if>ipv6                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | This command configure a proxy neighbor discovery policy for the interface.                                                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <i>policy-name</i> — The neighbor discovery policy name. Allowed values are any string up to 32 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes. A maximum of five policy names can be specified in a single statement. The specified policy names must already be defined. |

## secure-nd

|                    |                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] secure-nd</b>                                                                                                                                           |
| <b>Context</b>     | config>router>if>ipv6                                                                                                                                           |
| <b>Description</b> | This command enables Secure Neighbor Discovery (SeND) on the IPv6 interface.<br><br>The <b>no</b> form of the command reverts to the default and disabled SeND. |

## allow-unsecured-msgs

|                    |                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] allow-unsecured-msgs</b>                                                                                                                                                                                                                |
| <b>Context</b>     | config>router>if>ipv6>secure-nd                                                                                                                                                                                                                 |
| <b>Description</b> | This command specifies whether unsecured messages are accepted. When Secure Neighbor Discovery (SeND) is enabled, only secure messages are accepted by default.<br><br>The <b>no</b> form of the command disables accepting unsecured messages. |

## link-local-modifier

|                    |                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>link-local-modifier</b> <i>modifier</i><br><b>no link-local-modifier</b>                              |
| <b>Context</b>     | config>router>if>ipv6>secure-nd                                                                          |
| <b>Description</b> | This command configures the Cryptographically Generated Address (CGA) modifier for link-local addresses. |

---

**Parameters**    *modifier* — Specifies the modifier in 32 hexadecimal nibbles.  
**Values**        0x0 to 0xFFFFFFFF

## public-key-min-bits

**Syntax**        **public-key-min-bits** *bits*  
                 **no public-key-min-bits**

**Context**        config>router>if>ipv6>secure-nd

**Description**    This command configures the minimum acceptable key length for public keys used in the generation of a Cryptographically Generated Address (CGA).

**Parameters**    *bits* — Specifies the number of bits.  
**Values**        512 to 1024

## security-parameter

**Syntax**        **security-parameter** *sec*  
                 **no security-parameter**

**Context**        config>router>if>ipv6>secure-nd

**Description**    This command configures the security parameter used in the generation of a Cryptographically Generated Address (CGA).

**Parameters**    *sec* — Specifies the security parameter.  
**Values**        0 to 1

## shutdown

**Syntax**        **[no] shutdown**

**Context**        config>router>if>ipv6>secure-nd

**Description**    This command enables or disables Secure Neighbor Discovery (SeND) on the interface.

## stale-time

**Syntax**        **stale-time** *seconds*  
                 **no stale-time**

**Context**        config>router>if>ipv6

---

|                    |                                                                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command configures the time a neighbor discovery cache entry can remain stale before being removed.<br><br>The <b>no</b> form of the command removes the stale-time value. |
| <b>Default</b>     | no stale-time                                                                                                                                                                   |
| <b>Parameters</b>  | <i>seconds</i> — The allowed stale time (in seconds) before a neighbor discovery cache entry is removed.<br><br><b>Values</b> 60 to 65535                                       |

#### 2.13.2.4.4 Router Interface DHCP Commands

##### dhcp

|                    |                                                                |
|--------------------|----------------------------------------------------------------|
| <b>Syntax</b>      | <b>dhcp</b>                                                    |
| <b>Context</b>     | config>router>if                                               |
| <b>Description</b> | This command enables the context to configure DHCP parameters. |

##### gi-address

|                    |                                                                                                                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>gi-address</b> <i>ip-address</i> [ <b>src-ip-addr</b> ]<br><b>no gi-address</b>                                                                                                                                                                              |
| <b>Context</b>     | config>router>if>dhcp                                                                                                                                                                                                                                           |
| <b>Description</b> | This command configures the gateway interface address for the DHCP relay. The GI address is needed, when the router functions as a DHCP relay, to distinguish between the different subscriber interfaces and potentially between the group interfaces defined. |
| <b>Default</b>     | no gi-address                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <i>ip-address</i> — Specifies the host IP address to be used for DHCP relay packets.<br><b>src-ip-addr</b> — Uses the GI address as the source IP.                                                                                                              |

##### option

|                |                             |
|----------------|-----------------------------|
| <b>Syntax</b>  | [ <b>no</b> ] <b>option</b> |
| <b>Context</b> | config>router>if>dhcp       |

**Description** This command enables DHCP Option 82 (Relay Agent Information Option) parameters processing and enters the context for configuring Option 82 sub-options.

The **no** form of this command returns the system to the default.

**Default** no option

## action

**Syntax** **action** {**replace** | **drop** | **keep**}  
**no action**

**Context** config>router>if>dhcp>option

**Description** This command configures the processing required when the SR-Series router receives a DHCP request that already has a Relay Agent Information Option (Option 82) field in the packet.

The **no** form of this command returns the system to the default value.

**Default** Per RFC 3046, DHCP Relay Agent Information Option, section 2.1.1, Reforwarded DHCP requests, the default is to keep the existing information intact. The exception to this is if the GI address of the received packet is the same as the ingress address on the router. In that case the packet is dropped and an error is logged.

**Parameters** **replace** — In the upstream direction (from the user), the existing Option 82 field is replaced with the Option 82 field from the router. In the downstream direction (toward the user) the Option 82 field is stripped (in accordance with RFC 3046).

**drop** — The packet is dropped, and an error is logged.

**keep** — The existing information is kept in the packet and the router does not add any additional information. In the downstream direction the Option 82 field is not stripped and is sent on toward the client.

The behavior is slightly different in case of Vendor Specific Options (VSOs). When the keep parameter is specified, the router will insert his own VSO into the Option 82 field. This will only be done when the incoming message has already an Option 82 field.

If no Option 82 field is present, the router will not create the Option 82 field. In this in that case, no VSO will be added to the message.

## circuit-id

**Syntax** **circuit-id** {**ascii-tuple** | **ifindex** | **if-name** | **port-id** | **vlan-ascii-tuple** | **none**}  
**no circuit-id**

**Context** config>router>if>dhcp>option

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>When enabled, the router sends the interface index (If Index) in the <b>circuit-id</b> suboption of the DHCP packet. The If Index of a router interface can be displayed using the command <b>show&gt;router&gt;if&gt;detail</b>. This option specifies data that must be unique to the router that is relaying the circuit.</p> <p>If disabled, the <b>circuit-id</b> suboption of the DHCP packet will be left empty.</p> <p>The <b>no</b> form of this command returns the system to the default.</p>                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Default</b>     | circuit-id ascii-tuple                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><b>ascii-tuple</b> — Specifies that the ASCII-encoded concatenated tuple will be used which consists of the access-node-identifier, service-id, and interface-name, separated by “ ”.</p> <p><b>ifindex</b> — Specifies that the interface index will be used. The If Index of a router interface can be displayed using the command <b>show&gt;router&gt;if&gt;detail</b>.</p> <p><b>if-name</b> — Specifies the interface name.</p> <p><b>port-id</b> — Specifies the port ID.</p> <p><b>vlan-ascii-tuple</b> — Specifies that the format will include VLAN-id and dot1p bits in addition to what is included in ascii-tuple already. The format is supported on dot1q and qinq ports only. Therefore, when the Option 82 bits are stripped, dot1p bits will be copied to the Ethernet header of an outgoing packet.</p> <p><b>none</b> — Specifies that no circuit should be used.</p> |

## remote-id

|                    |                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>remote-id</b> [{ <b>mac</b>   <b>string</b> <i>string</i> }]<br><b>no remote-id</b>                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>if>dhcp>option                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>When enabled, the router sends the MAC address of the remote end (typically the DHCP client) in the <b>remote-id</b> suboption of the DHCP packet. This command identifies the host at the other end of the circuit. If disabled, the <b>remote-id</b> suboption of the DHCP packet will be left empty.</p> <p>The <b>no</b> form of this command returns the system to the default.</p> |
| <b>Default</b>     | no remote-id                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <p><b>mac</b> — This keyword specifies the MAC address of the remote end is encoded in the suboption.</p> <p><b>string</b> — Specifies the remote ID.</p>                                                                                                                                                                                                                                   |

---

## vendor-specific-option

|                    |                                                                                       |
|--------------------|---------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] vendor-specific-option</b>                                                    |
| <b>Context</b>     | config>router>if>dhcp>option                                                          |
| <b>Description</b> | This command configures the Nokia vendor specific suboption of the DHCP relay packet. |

## client-mac-address

|                    |                                                                                                                                                                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] client-mac-address</b>                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>router>if>dhcp>option                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command enables the sending of the MAC address in the Nokia vendor specific suboption of the DHCP relay packet.</p> <p>The <b>no</b> form of the command disables the sending of the MAC address in the Nokia vendor specific suboption of the DHCP relay packet.</p> |
| <b>Default</b>     | no client-mac-address                                                                                                                                                                                                                                                         |

## pool-name

|                    |                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] pool-name</b>                                                                                                                                                                    |
| <b>Context</b>     | config>router>if>dhcp>option>vendor-specific-option                                                                                                                                      |
| <b>Description</b> | <p>This command enables the sending of the pool name in the Nokia vendor-specific suboption of the DHCP relay packet.</p> <p>The <b>no</b> form of the command disables the feature.</p> |
| <b>Default</b>     | no pool-name                                                                                                                                                                             |

## port-id

|                    |                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] port-id</b>                                                                                                                                                               |
| <b>Context</b>     | config>router>if>dhcp>option>vendor-specific-option                                                                                                                               |
| <b>Description</b> | <p>This command enables sending of the port-id in the Nokia vendor specific suboption of the DHCP relay packet</p> <p>The <b>no</b> form of the command disables the sending.</p> |
| <b>Default</b>     | no port-id                                                                                                                                                                        |



## service-id

|                    |                                                                                                                                                                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] service-id</b>                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>if>dhcp>option>vendor-specific-option                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command enables the sending of the service ID in the Nokia vendor specific suboption of the DHCP relay packet.</p> <p>The <b>no</b> form of the command disables the sending of the service ID in the Nokia vendor specific suboption of the DHCP relay packet.</p> |
| <b>Default</b>     | no service-id                                                                                                                                                                                                                                                               |

## string

|                    |                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] string <i>text</i></b>                                                                                                                                                           |
| <b>Context</b>     | config>router>if>dhcp>option>vendor-specific-option                                                                                                                                      |
| <b>Description</b> | <p>This command specifies the vendor specific suboption string of the DHCP relay packet.</p> <p>The <b>no</b> form of the command returns the default value.</p>                         |
| <b>Default</b>     | no string                                                                                                                                                                                |
| <b>Parameters</b>  | <i>text</i> — The string can be any combination of ASCII characters up to 32 characters in length. If spaces are used in the string, enclose the entire string in quotation marks (" "). |

## system-id

|                    |                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] system-id</b>                                                                                        |
| <b>Context</b>     | config>router>if>dhcp>option>vendor-specific-option                                                          |
| <b>Description</b> | This command specifies whether the system-id is encoded in the Nokia vendor specific suboption of Option 82. |
| <b>Default</b>     | no system-id                                                                                                 |

## python-policy

|                |                                                                           |
|----------------|---------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>python-policy <i>python-policy-name</i></b><br><b>no python-policy</b> |
| <b>Context</b> | config>router>if>dhcp                                                     |

---

|                    |                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command specifies a python policy. Python policies are configured in the <b>config&gt;python&gt; python-policy name</b> context. |
| <b>Default</b>     | no python-policy                                                                                                                      |
| <b>Parameters</b>  | <i>python-policy-name</i> — Specifies the name of an existing python script up to 32 characters in length.                            |

## relay-plain-bootp

|                    |                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] relay-plain-bootp</b>                                                                                                                           |
| <b>Context</b>     | config>router>if>dhcp                                                                                                                                   |
| <b>Description</b> | <p>This command enables the relaying of plain BOOTP packets.</p> <p>The <b>no</b> form of the command disables the relaying of plain BOOTP packets.</p> |
| <b>Default</b>     | no relay-plain-bootp                                                                                                                                    |

## server

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>server server [server]</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>router>if>dhcp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command specifies a list of servers where requests will be forwarded. The list of servers can entered as either IP addresses or fully qualified domain names. There must be at least one server specified for DHCP relay to work. If there are multiple servers then the request is forwarded to all of the servers in the list. There can be a maximum of 8 DHCP servers configured.</p> <p>The flood command is applicable only in the VPLS case. There is a scenario with VPLS where the VPLS node only wants to add Option 82 information to the DHCP request to provider per-subscriber information, but it does not do full DHCP relay. In this case, the server is set to "flood". This means the DHCP request is still a broadcast and is sent through the VPLS domain. A node running at L3 further upstream then can perform the full L3 DHCP relay function.</p> |
| <b>Default</b>     | no server                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <i>server</i> — Specifies the DHCP server IP address. A maximum of eight servers can be specified in a single statement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## trusted

|               |                     |
|---------------|---------------------|
| <b>Syntax</b> | <b>[no] trusted</b> |
|---------------|---------------------|

---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>router>if>dhcp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>According to RFC 3046, <b>DHCP Relay Agent Information Option</b>, a DHCP request where the GI address is 0.0.0.0 and which contains an Option 82 field in the packet, should be discarded, unless it arrives on a "trusted" circuit.</p> <p>If trusted mode is enabled on an IP interface, the relay agent (the SR-Series) will modify the request's GI address to be equal to the ingress interface and forward the request.</p> <p>This behavior only applies when the action in the Relay Agent Information Option is "keep". In the case where the Option 82 field is being replaced by the relay agent (action = "replace"), the original Option 82 information is lost anyway, and there is no reason for enabling the trusted option.</p> <p>The <b>no</b> form of this command returns the system to the default.</p> |
| <b>Default</b>     | no trusted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

### 2.13.2.5 Router Interface Encryption Commands

The following commands are only applicable to platforms that support network group encryption (NGE).

#### group-encryption

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] group-encryption</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>router>interface                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>This command enables NGE on the router interface. When NGE is enabled on the interface, all received Layer 3 packets that have the protocol ID configured as ESP are considered to be NGE packets and must be encrypted using a valid set of keys from any preconfigured key group on the system.</p> <p>The <b>no</b> form of the command disables NGE on the interface. NGE cannot be disabled unless all key groups and IP exception filters are removed.</p> |
| <b>Default</b>     | no group-encryption                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

#### encryption-keygroup

|                |                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>encryption-keygroup</b> <i>keygroup-id</i> <b>direction</b> {inbound   outbound}<br><b>no encryption-keygroup</b> <b>direction</b> {inbound   outbound} |
| <b>Context</b> | config>router>if>group-encryption                                                                                                                          |

---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command is used to bind a key group to a router interface for inbound or outbound packet processing. When configured in the outbound direction, packets egressing the router use the <b>active-outbound-sa</b> associated with the configured key group. When configured in the inbound direction, received packets must be encrypted using one of the valid security associations configured for the key group.</p> <p>The <b>no</b> form of the command removes the key group from the router interface in the specified direction.</p> |
| <b>Default</b>     | <p>no encryption-keygroup direction inbound<br/>no encryption-keygroup direction outbound</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <p><i>keygroup-id</i> — The ID number of the key group being configured.</p> <p><b>Values</b> 1 to 127, <i>keygroup-name</i> (64 characters maximum)</p> <p><b>inbound</b> — Binds the key group in the inbound direction.</p> <p><b>outbound</b> — Binds the key group in the outbound direction.</p>                                                                                                                                                                                                                                            |

## ip-exception

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>ip-exception</b> <i>filter-id</i> <b>direction</b> {<b>inbound</b>   <b>outbound</b>}</p> <p><b>no ip-exception</b> <b>direction</b> {<b>inbound</b>   <b>outbound</b>}</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>router>if>group-encryption                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command associates an IP exception filter policy with an NGE-enabled router interface to allow packets matching the exception criteria to transit the NGE domain as clear text.</p> <p>When an exception filter is added for inbound traffic, packets matching the criteria in the IP exception filter policy are allowed to be received in clear text even if an inbound key group is configured. If no inbound key group is configured, then associated inbound IP exception filter policies will be ignored.</p> <p>When an exception filter is added for outbound traffic, packets matching the criteria in the IP exception filter policy are not encrypted when sent out of the router interface even if an outbound key group is configured. If no outbound key group is configured, then associated outbound IP exception filter policies will be ignored.</p> <p>The <b>no</b> form of the command removes the IP exception filter policy from the specified direction.</p> |
| <b>Default</b>     | <p>no ip-exception direction inbound<br/>no ip-exception direction outbound</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <p><i>filter-id</i> — Specifies the IP exception filter policy. The IP exception ID or exception name must have already been created.</p> <p><b>Values</b> 1 to 6553, <i>filter-name</i> (64 characters maximum)</p> <p><b>inbound</b> — Binds the exception filter policy in the inbound direction.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

---

**outbound** — Binds the exception filter policy in the outbound direction.

## 2.13.2.6 Router Advertisement Commands

### router-advertisement

|                    |                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] router-advertisement</b>                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command configures router advertisement properties. By default, it is disabled for all IPv6 enabled interfaces.</p> <p>The <b>no</b> form of the command disables all IPv6 interface. However, the <b>no interface interface-name</b> command disables a specific interface.</p> |
| <b>Default</b>     | disabled                                                                                                                                                                                                                                                                                 |

### dns-options

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] dns-options</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>router-advert<br>config>router>router-advert>if                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command enables the context for configuration of DNS information for Stateless Address Auto-Configuration (SLAAC) hosts. When specified at the router-advertisement level in the routing context, this command allows configuration of service-wide parameters. These can then be inherited at the interface level by specifying the <b>config&gt;router&gt;router-advert&gt;if&gt;dns-options&gt;include-dns</b> command.</p> <p>The <b>no</b> form of the command disables configuration of DNS information for Stateless Address Auto-Configuration (SLAAC) hosts.</p> |
| <b>Default</b>     | disabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### rdnss-lifetime

|                |                                                                                             |
|----------------|---------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>rdnss-lifetime seconds</b><br><b>rdnss-lifetime infinite</b><br><b>no rdnss-lifetime</b> |
| <b>Context</b> | config>router>router-advert>dns-options<br>config>router>router-advert>if>dns-options       |

---

|                    |                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command specifies the maximum time that the RDNSS address may be used for name resolution by the client. The RDNSS Lifetime must be no more than twice MaxRtrAdvLifetime with a maximum of 3600 seconds. |
| <b>Default</b>     | rdnss-lifetime infinite                                                                                                                                                                                       |
| <b>Parameters</b>  | <i>seconds</i> — Specifies the time in seconds.<br><b>Values</b> 4 to 3600<br><i>infinite</i> — Specifies an infinite RDNSS lifetime.                                                                         |

## server

|                    |                                                                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>server</b> <i>ipv6-address</i> [ <i>ipv6-address</i> ]<br><b>no server</b>                                                                                                                                                                                                                      |
| <b>Context</b>     | config>router>router-advert>dns-options<br>config>router>router-advert>if>dns-options                                                                                                                                                                                                              |
| <b>Description</b> | This command specifies the IPv6 DNS servers to include in the RDNSS option in Router Advertisements. When specified at the router advertisement level this applies to all interfaces that have <b>include-dns</b> enabled, unless the interfaces have more specific <b>dns-options</b> configured. |
| <b>Parameters</b>  | <i>ipv6-address</i> — Specifies the IPv6 address of the DNS servers as eight 16-bit hexadecimal pieces. A maximum of four ipv6 addresses can be specified in a single statement.                                                                                                                   |

## interface

|                    |                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] interface</b> <i>ip-int-name</i>                                                                                                                                          |
| <b>Context</b>     | config>router>router-advert                                                                                                                                                       |
| <b>Description</b> | This command configures router advertisement properties on a specific interface. The interface must already exist in the <b>config&gt;router&gt;if</b> context.                   |
| <b>Default</b>     | No interfaces are configured by default.                                                                                                                                          |
| <b>Parameters</b>  | <i>ip-int-name</i> — Specifies the interface name. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes. |

## current-hop-limit

|               |                                                                       |
|---------------|-----------------------------------------------------------------------|
| <b>Syntax</b> | <b>current-hop-limit</b> <i>number</i><br><b>no current-hop-limit</b> |
|---------------|-----------------------------------------------------------------------|

---

|                    |                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>router>router-advert>if                                                                                                                                            |
| <b>Description</b> | This command configures the current-hop-limit in the router advertisement messages. It informs the nodes on the subnet about the hop-limit when originating IPv6 packets. |
| <b>Default</b>     | current-hop-limit 64                                                                                                                                                      |
| <b>Parameters</b>  | <i>number</i> — Specifies the hop limit.                                                                                                                                  |
| <b>Values</b>      | 0 to 255. A value of zero means there is an unspecified number of hops.                                                                                                   |

## include-dns

|                    |                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] include-dns                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>router-advert>if>dns-options                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>This command enables the Recursive DNS Server (RDNSS) Option in router advertisements. This must be enabled for each interface on which the RDNSS option is required in router advertisement messages.</p> <p>The <b>no</b> form of the command disables the RDNSS option in router advertisements.</p> |
| <b>Default</b>     | disabled                                                                                                                                                                                                                                                                                                   |

## managed-configuration

|                    |                                                                                                                                                                                                                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] managed-configuration                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>router>router-advert>if                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command sets the managed address configuration flag. This flag indicates that DHCPv6 is available for address configuration in addition to any address autoconfigured using stateless address autoconfiguration. See RFC 3315, <i>Dynamic Host Configuration Protocol (DHCP) for IPv6</i>.</p> |
| <b>Default</b>     | no managed-configuration                                                                                                                                                                                                                                                                               |

## max-advertisement-interval

|                    |                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>max-advertisement-interval</b> <i>seconds</i><br><b>no max-advertisement-interval</b>    |
| <b>Context</b>     | config>router>router-advert>if                                                              |
| <b>Description</b> | This command configures the maximum interval between sending router advertisement messages. |

---

|                   |                                                                                                           |
|-------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | max-advertisement-interval 600                                                                            |
| <b>Parameters</b> | <i>seconds</i> — Specifies the maximum interval in seconds between sending router advertisement messages. |
| <b>Values</b>     | 4 to 1800                                                                                                 |

## min-advertisement-interval

|                    |                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>min-advertisement-interval</b> <i>seconds</i><br><b>no min-advertisement-interval</b>                                            |
| <b>Context</b>     | config>router>router-advert>if                                                                                                      |
| <b>Description</b> | This command configures the minimum interval between sending ICMPv6 neighbor discovery router advertisement messages.               |
| <b>Default</b>     | min-advertisement-interval 200                                                                                                      |
| <b>Parameters</b>  | <i>seconds</i> — Specifies the minimum interval in seconds between sending ICMPv6 neighbor discovery router advertisement messages. |
| <b>Values</b>      | 3 to 1350                                                                                                                           |

## mtu

|                    |                                                                                        |
|--------------------|----------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>mtu</b> <i>mtu-bytes</i><br><b>no mtu</b>                                           |
| <b>Context</b>     | config>router>router-advert>if                                                         |
| <b>Description</b> | This command configures the MTU for the nodes to use to send packets on the link.      |
| <b>Default</b>     | no mtu — The MTU option is not sent in the router advertisement messages.              |
| <b>Parameters</b>  | <i>mtu-bytes</i> — Specifies the MTU for the nodes to use to send packets on the link. |
| <b>Values</b>      | 1280 to 9212                                                                           |

## other-stateful-configuration

|                |                                          |
|----------------|------------------------------------------|
| <b>Syntax</b>  | <b>[no] other-stateful-configuration</b> |
| <b>Context</b> | config>router>router-advert>if           |



---

|                    |                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command sets the "Other configuration" flag. This flag indicates that DHCPv6lite is available for autoconfiguration of other (non-address) information such as DNS-related information or information about other servers in the network. See RFC 3736, <i>Stateless Dynamic Host Configuration Protocol (DHCP) for IPv6</i> . |
| <b>Default</b>     | no other-stateful-configuration                                                                                                                                                                                                                                                                                                     |

## prefix

|                    |                                                                                                                                                                                                                              |                                     |              |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------|
| <b>Syntax</b>      | <b>[no] prefix</b> <i>ipv6-prefix</i> / <i>prefix-length</i>                                                                                                                                                                 |                                     |              |
| <b>Context</b>     | config>router>router-advert>if                                                                                                                                                                                               |                                     |              |
| <b>Description</b> | This command configures an IPv6 prefix in the router advertisement messages. To support multiple IPv6 prefixes, use multiple prefix statements. No prefix is advertised until explicitly configured using prefix statements. |                                     |              |
| <b>Parameters</b>  | <i>ipv6-prefix</i> — The IP prefix for prefix list entry in dotted decimal notation.                                                                                                                                         |                                     |              |
|                    | <b>Values</b>                                                                                                                                                                                                                |                                     |              |
|                    | ipv6-prefix                                                                                                                                                                                                                  | x:x:x:x:x:x:x (eight 16-bit pieces) |              |
|                    |                                                                                                                                                                                                                              | x:x:x:x:x:d.d.d.d                   |              |
|                    |                                                                                                                                                                                                                              | x:                                  | [0 to FFFF]H |
|                    |                                                                                                                                                                                                                              | d:                                  | [0 to 255]D  |
|                    | ipv6-prefix-length                                                                                                                                                                                                           | 0 to 128                            |              |
|                    | <i>prefix-length</i> — Specifies a route must match the most significant bits and have a prefix length.                                                                                                                      |                                     |              |
|                    | <b>Values</b>                                                                                                                                                                                                                | 1 to 128                            |              |

## autonomous

|                    |                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] autonomous</b>                                                                         |
| <b>Context</b>     | config>router>router-advert>if>prefix                                                          |
| <b>Description</b> | This command specifies whether the prefix can be used for stateless address autoconfiguration. |
| <b>Default</b>     | autonomous                                                                                     |

---

## on-link

|                    |                                                                                 |
|--------------------|---------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] on-link</b>                                                             |
| <b>Context</b>     | config>router>router-advert>if>prefix                                           |
| <b>Description</b> | This command specifies whether the prefix can be used for onlink determination. |
| <b>Default</b>     | on link                                                                         |

## preferred-lifetime

|                    |                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>preferred-lifetime {seconds   infinite}</b><br><b>no preferred-lifetime</b>                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>router>router-advert>if                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | This command configures the remaining length of time in seconds that this prefix will continue to be preferred, such as, time until deprecation. The address generated from a deprecated prefix should not be used as a source address in new communications, but packets received on such an interface are processed as expected. |
| <b>Default</b>     | preferred-lifetime 604800                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <b>seconds</b> — Specifies the remaining length of time in seconds that this prefix will continue to be preferred.<br><b>infinite</b> — Specifies that the prefix will always be preferred. A value of 4,294,967,295 represents infinity.                                                                                          |

## valid-lifetime

|                    |                                                                                                                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>valid-lifetime {seconds   infinite}</b><br><b>no valid-lifetime</b>                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>router>router-advert>if                                                                                                                                                                                                                                                                                |
| <b>Description</b> | This command specifies the length of time in seconds that the prefix is valid for the purpose of on-link determination. A value of all one bits (0xffffffff) represents infinity.<br><br>The address generated from an invalidated prefix should not appear as the destination or source address of a packet. |
| <b>Default</b>     | valid-lifetime 2592000                                                                                                                                                                                                                                                                                        |
| <b>Parameters</b>  | <b>seconds</b> — Specifies the remaining length of time in seconds that this prefix will continue to be valid.                                                                                                                                                                                                |

**infinite** — Specifies that the prefix will always be valid. A value of 4,294,967,295 represents infinity.

## reachable-time

|                    |                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>reachable-time</b> <i>milli-seconds</i><br><b>no reachable-time</b>                                                                              |
| <b>Context</b>     | config>router>router-advert>if                                                                                                                      |
| <b>Description</b> | This command configures how long this router should be considered reachable by other nodes on the link after receiving a reachability confirmation. |
| <b>Default</b>     | no reachable-time                                                                                                                                   |
| <b>Parameters</b>  | <i>milli-seconds</i> — Specifies the length of time the router should be considered reachable.<br><b>Values</b> 0 to 3600000                        |

## retransmit-time

|                    |                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>retransmit-time</b> <i>milli-seconds</i><br><b>no retransmit-time</b>                                  |
| <b>Context</b>     | config>router>router-advert>if                                                                            |
| <b>Description</b> | This command configures the retransmission frequency of neighbor solicitation messages.                   |
| <b>Default</b>     | no retransmit-time                                                                                        |
| <b>Parameters</b>  | <i>milli-seconds</i> — Specifies how often the retransmission should occur.<br><b>Values</b> 0 to 1800000 |

## router-lifetime

|                    |                                                                    |
|--------------------|--------------------------------------------------------------------|
| <b>Syntax</b>      | <b>router-lifetime</b> <i>seconds</i><br><b>no router-lifetime</b> |
| <b>Context</b>     | config>router>router-advert>if                                     |
| <b>Description</b> | This command sets the router lifetime.                             |
| <b>Default</b>     | router life-time 1800                                              |

---

|                   |                                                                                                                                              |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>seconds</i> — The length of time, in seconds, (relative to the time the packet is sent) that the prefix is valid for route determination. |
| <b>Values</b>     | 0, 4 to 9000 seconds. 0 means that the router is not a default router on this link.                                                          |

## use-virtual-mac

|                    |                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] use-virtual-mac</b>                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>router>router-advert>if                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | <p>This command enables sending router advertisement messages using the VRRP virtual MAC address, provided that the virtual router is currently the master.</p> <p>If the virtual router is not the master, no router advertisement messages are sent.</p> <p>The <b>no</b> form of the command disables sending router advertisement messages.</p> |
| <b>Default</b>     | no use-virtual-mac                                                                                                                                                                                                                                                                                                                                  |

## 2.14 Show, Clear, and Debug Command Reference

- [Command Hierarchies](#)
- [Command Descriptions](#)

### 2.14.1 Command Hierarchies

- [Show Commands](#)
- [Clear Commands](#)
- [Debug Commands](#)
- [Tools Commands](#)

#### 2.14.1.1 Show Commands

The show L2TP commands apply only to the 7750 SR and 7450 ESS.

```
show
 — router [router-instance]
 — router service-name service-name
 — aggregate [family] [active] [detail]
 — arp [{ip-int-name | ip-address [/mask]} | mac ieee-mac-address | summary] [arp-
 type]
 — authentication
 — statistics
 — statistics interface {ip-int-name | ip-address}
 — statistics policy name
 — bfd
 — bfd-template template-name
 — bfd-template
 — interface [interface-name] [family]
 — interface [interface-name] detail
 — interface summary
 — session detail lsp-rsvp {head | tail}
 — session {ipv4 | ipv6} detail [lag lag-id] lag-port port-id
 — session [detail] lsp-ldp head
 — session [src ip-address/link-local-address] [detail] lsp-ldp head prefix ip-
 prefix/prefix-length
 — session [detail] lsp-ldp tail
 — session [dest {ip-address | link-local-address}] [detail] lsp-ldp tail prefix ip-
 prefix/prefix-length
 — session lsp-name lsp-name
 — session lsp-rsvp {head | tail}
```

---

```

— session src ip-address/link-local-address dest [ip-address | link-local-address]
 detail lsp-rsvp {head | tail} tunnel-id tunnel-id lsp-id lsp-id
— session mpls-tp
— session lsp-name lsp-name [link-type {cc-only | cc-cv}] detail
— session p2mp-interface interface-name detail
— session src ip-address/link-local-address detail lsp-rsvp {head | tail} rsvp-
 session-name rsvp-session-name
— session [src ip-address/link-local-address] [{ipv4 | ipv6}]
— session src ip-address/link-local-address {ip-address | link-local-address}
— session src ip-address/link-local-address detail
— session summary
— session type type [{ipv4 | ipv6}]
— dhcp
 — statistics [interface {ip-int-name | ip-address}]
 — summary
— dhcp6
 — statistics
 — summary
— ecmp
— fib slot-number [family] [ip-prefix/prefix-length [longer]] [secondary] [qos]
 [accounting-class] [all]
— fib slot-number extensive [ip-prefix/prefix-length] [family] [all]
— fib slot-number [family] summary
— fib slot-number nh-table-usage
— fp-tunnel-table slot-number [ip-prefix[/prefix-length]]
— fp-tunnel-table slot-number [ipv4 | ipv6]
— icmp
 — interface [interface-name]
— icmp6
 — interface [interface-name]
— if-attribute
 — srlg-group [name]
— interface [{[{ip-address | ip-int-name}] [detail] [family}] | summary | exclude-
 services]
— interface {ip-address | ip-int-name} eth-cfm [detail]
— interface {ip-address | ip-int-name} mac [ieee-address]
— interface {ip-address | ip-int-name} statistics
— interface {ip-address | ip-int-name} dist-cpu-protection [detail]
— interface {ip-address | ip-int-name} policy-accounting [class [index]]
— interface description
— interface global-if-index global-if-index [family] [detail]
— interface global-if-index global-if-index statistics
— l2tp
 — eth-tunnel [group tunnel-group-name] [vc-id vc-id]
 — group [tunnel-group-name [statistics]]
 — peer ip-address [udp-port port] [ip]
 — peer ip-address statistics [udp-port port] [ip]
 — peer [draining] [{blacklisted | selectable | unreachable}]
 — session connection-id connection-id [{detail | ppp-statistics}]
 — session [{detail | ppp-statistics}] [session-id session-id] [state session-state]
 [peer ip-address] [group group-name] [assignment-id assignment-id]
 [local-name local-host-name] [remote-name remote-host-name] [tunnel-
 id tunnel-id] [service service-id] [interface {ip-int-name | ip-address}] [ip-
 prefix ip-prefix/mask]

```

- **session** [{detail | ppp-statistics}] [state session-state] [peer ip-address] [group group-name] [assignment-id assignment-id] [local-name local-host-name] [remote-name remote-host-name] [control-connection-id connection-id] [service service-id] [interface {ip-int-name | ip-address}]
- **statistics**
- **tunnel** [statistics] [detail] [peer ip-address] [state tunnel-state] [remote-tunnel-id remote-tunnel-id] [group group-name] [assignment-id assignment-id] [local-name local-host-name] [remote-name remote-host-name] [radius-accounting-policy policy-name] [blacklist-state bl-state] [failover-state fo-state] [recovery-state recovery-state] [recovery-method {mcs | recovery-tunnel}] [track-srrp srrp-instance] [control-msg-behavior behavior] [transport-type {ip | udp}]
- **tunnel** [statistics] [detail] [peer ip-address] [state tunnel-state] [remote-connection-id remote-connection-id] [group group-name] [assignment-id assignment-id] [local-name local-host-name] [remote-name remote-host-name] [radius-accounting-policy policy-name] [blacklist-state bl-state] [failover-state fo-state] [recovery-state recovery-state] [recovery-method {mcs | recovery-tunnel}] [track-srrp srrp-instance] [control-msg-behavior behavior] [transport-type {ip | udp}]
- **tunnel** tunnel-id tunnel-id [statistics] [detail]
- **tunnel** connection-id connection-id [statistics] [detail]
- **ldp**
  - **bindings** active
- **mvpn**
- **neighbor** [{ip-int-name | ip-address} | mac ieee-mac-address | summary] [{dynamic | static | managed}]
- **network-domains** [detail] [network-domain-name]
- **network-domains** network-domain-name interface-association
- **network-domains** [network-domain-name] mcast-association [state {consistent | inconsistent}]
- **network-domains** network-domain-name sdp-association
- **origin-validation**
  - **database** [family] [ip-prefix/ip-prefix-length] [up to prefix-length] [origin-as as-number]
  - **database** [family] [ip-prefix/ip-prefix-length] {longer}
  - **database** {summary}
  - **database** [family] {static}
  - **rpki-session** [ip-address] [detail]
- **policy** [{plcy-name | damping [damping-profile-name] | prefix-list [prefix-list-name] | as-path [asp-name] | as-path-group [asp-group-name] | community [community-name] | admin | exclusive-access | global-variables]}
- **policy** [plcy-name] [expand-variables]
- **policy** plcy-name sub-policy entry entry-id [name subpol-name]
- **policy** plcy-name sub-policy entry entry-id name subpol-name entry-2 entry-id name-2 subpol-name
- **policy** plcy-name sub-policy entry entry-id name subpol-name entry-2 entry-id name-2 subpol-name entry-3 entry-id name-3 subpol-name
- **policy-edits**
- **route-table** [family] [ip-prefix[/prefix-length]] [{longer | exact | protocol protocol-name}] [all] [next-hop-type type] [qos] [alternative] [accounting-class]
- **route-table** [family] summary
- **route-table** tunnel-endpoints [ip-prefix/prefix-length] [{longer | exact}] [detail]
- **route-table** [family] [ip-prefix[/prefix-length]] [{longer | exact | protocol protocol-name}] extensive [all]

- **rtr-advertisement** [interface *interface-name*] [prefix *ipv6-prefix[/prefix-length]*]
- **rtr-advertisement** [conflicts]
- **service-prefix**
- **sgt-qos**
  - **application** [*app-name*] [{**dscp** | **dot1p**}]
  - **dscp-map** [*dscp-name*]
- **static-arp** [{*ip-int-name* | *ip-address* | **mac** *ieee-mac-address*}]
- **static-route** [*family*] [{*ip-prefix/prefix-length* | **preference** *preference* | **next-hop** *ip-address* | **tag** *tag*}] [**detail**]
- **status**
- **tunnel-table** **summary** [{**ipv4** | **ipv6**}]
- **tunnel-table** [**protocol** *protocol*] [{**ipv4** | **ipv6**}]
- **tunnel-table** [*ip-prefix[/mask]*] [**alternative**] [{**ipv4** | **ipv6**}] **detail**
- **tunnel-table** [*ip-prefix[/mask]*] [**alternative**]
- **tunnel-table** **mpls-tp**
- **tunnel-table** [*ip-prefix[/mask]*] **protocol** *protocol* [**detail**]
- **tunnel-table** [*ip-prefix[/mask]*] **sdp** *sdp-id*
- **eth-cfm**
  - **lbn-svc-act-responder** [**domain** *md-index*] [**association** *ma-index*] [**mep** *mep-id*]

### 2.14.1.2 Clear Commands

- clear**
- **router** [*router-instance*]
  - **router** **service-name** *service-name*
    - **arp** {**all** | *ip-address*}
    - **arp** **interface** {*ip-int-name* | *ip-address*}
    - **bfd**
      - **session** **src-ip** *ip-address* **dst-ip** *ip-address*
      - **statistics** **src-ip** *ip-address* **dst-ip** *ip-address*
      - **statistics** **all**
    - **dhcp**
      - **statistics**
    - **dhcp6**
      - **statistics**
    - **forwarding-table** [*slot-number*]
    - **grt-lookup**
    - **icmp** **all**
    - **icmp** **global**
    - **icmp** **interface** *interface-name*
    - **icmp-redirect-route** {**all** | *ip-address*}
    - **icmp6** **all**
    - **icmp6** **global**
    - **icmp6** **interface** *interface-name*
    - **interface** [{*ip-int-name* | *ip-address*}] [**urpf-stats**] [**statistics**] [**hold-time**]
    - **interface** [{*ip-int-name* | *ip-address*}] **policy-accounting** [**class**] [*index*]
    - **interface** {*ip-int-name* | *ip-address*} **mac** [*ieee-address*]
    - **l2tp**
      - **group** *tunnel-group-name*
        - **statistics**
      - **statistics**



- **tunnel** *connection-id*
  - **statistics**
- **neighbor** {**all** | *ipv6-address* [**interface** *interface-name*]}
- **neighbor interface** {*ip-int-name* | *ipv6-address*}
- **router-advertisement all**
- **router-advertisement interface** *interface-name*

### 2.14.1.3 Debug Commands

- debug**
- **router** [*router-instance*]
  - **router service-name** *service-name*
    - [no] **ip**
      - [no] **arp**
      - [no] **icmp**
      - **icmp6** [*ip-int-name*]
      - **no icmp6**
      - [no] **interface** [{*ip-int-name* | *ip-address*]}
      - **neighbor** [*ip-int-name*]
      - **no neighbor**
      - **packet** [{*ip-int-name* | *ip-address*] [**headers**] [*protocol-id*]
      - **no packet** [{*ip-int-name* | *ip-address*]}
      - **route-table** [*ip-prefix*/*prefix-length*]
      - **route-table** *ip-prefix*/*prefix-length* **longer**
      - **no route-table**
      - **tunnel-table** [*ip-address*] [{**ldp** | **rsvp** [*tunnel-id* *tunnel-id*] | **sdp** [*sdp-id* *sdp-id*]}]
    - **l2tp**
      - **peer** *ip-address* [**udp-port** *port*] [**ip**]
  - [no] **mtrace**
    - [no] **misc**
    - [no] **packet** [{**query** | **request** | **response**]}
  - [no] **mtrace2**
    - [no] **misc**
    - [no] **packet** [{**query** | **request** | **reply**]}

### 2.14.1.4 Tools Commands

- tools**
- **dump**
    - **router**
      - **segment-routing**
        - **tunnel** [*in-label* *in-label*]
  - **perform**
    - **router**
      - **l2tp**
        - **peer** *ip-address* [**udp-port** *port*] [**ip**]

## 2.14.2 Command Descriptions

- [Show Commands](#)
  - [L2TP Show Commands](#)
- [Clear Commands](#)
- [Debug Commands](#)
- [Tools Commands](#)

### 2.14.2.1 Show Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

#### router

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>router</b> [ <i>router-instance</i> ]<br><b>router service-name</b> <i>service-name</i>                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | show                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command enables the context to display various types of information for the specified router instance.                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <i>router-instance</i> — specifies the router name, CPM router instance, or VPRN service ID.<br><br><b>Values</b><br><br><i>router-instance</i> : <i>router name</i>   <i>vprn-svc-id</i><br><div><i>router-name</i>      Base   management   <i>cpm-vr-name</i>   vpls-management</div> <div><i>cpm-vr-name</i>      [32 characters maximum]</div> <div><i>vprn-svc-id</i>        [1..2147483647]</div><br><b>Default</b> Base<br><i>service-name</i> — specifies the service name, up to 64 characters. |
| <b>Output</b>      | The following are examples of router information.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

#### Sample Output: show router with PIM and S-PMSI

```
*A:Dut-D# \show router 100 pim s-pmsi
```

```

=====
PIM RSVP Spmsi tunnels
=====
=====
P2mp ID Tunnel ID Ext Tunnel Adrs SPMSI Index Num VPN State
 SGs

100 61442 10.20.1.4 73919 8 UP
=====
PIM RSVP Spmsi Interfaces : 1
=====
*A:Dut-D# \show router 100 pim s-pmsi detail
=====
PIM RSVP Spmsi tunnels
=====
P2MP ID : 100 Tunnel ID : 61442
Ext Tunnnel Adrs : 10.20.1.4 Spmsi IfIndex : 73919
Number of VPN SGs : 8 Up Time : 0d 00:01:04
VPN Group Address : 203.0.113.0
VPN Source Address : 10.114.1.2
Up Time : 0d 00:01:04 Multistream-Id : 10
State : TX Joined Mdt Threshold : N/A
Join Timer : N/A Holddown Timer : 0d 00:00:54
VPN Group Address : 203.0.113.1
VPN Source Address : 10.114.1.2
Up Time : 0d 00:01:04 Multistream-Id : 10
State : TX Joined Mdt Threshold : N/A
Join Timer : N/A Holddown Timer : 0d 00:00:55
VPN Group Address : 203.0.113.2
VPN Source Address : 10.114.1.2
Up Time : 0d 00:01:04 Multistream-Id : 5
State : TX Joined Mdt Threshold : N/A
Join Timer : N/A Holddown Timer : 0d 00:00:53

```

## aggregate

- Syntax** **aggregate** [*family*] [**active**] [**detail**]
- Context** show>router
- Description** This command displays aggregate routes.
- Parameters** *family* — Specifies whether IPv4 or IPv6 aggregate routes are displayed.
- Values** ipv4, ipv6
- active** — When the active keyword is specified, inactive aggregates are filtered out.
- detail** — Displays detailed aggregate information.
- Output** The following output is an example of aggregate route information.

### Sample Output

```

*A:CPM133>config>router# show router aggregate
=====

```

```

Aggregates (Router: Base)
=====
Prefix Aggr IP-Address Aggr AS
 Summary AS Set State
 NextHop Community NextHopType

10.0.0.0/8 0.0.0.0 0
 False False Inactive
 100:33 Blackhole

No. of Aggregates: 1
=====
*A:CPM133>config>router#

```

## arp

- Syntax** **arp** [{*ip-int-name* | *ip-address[/mask]*} | **mac** *ieee-mac-address* | **summary**] [*arp-type*]
- Context** show>router
- Description** This command displays the router ARP table sorted by IP address. If no command line options are specified, all ARP entries are displayed.
- Parameters**
- ip-int-name* — Only displays ARP entries associated with the specified IP interface name.
  - ip-address[/mask]* — Only displays ARP entries associated with the specified IP address and mask.
  - ieee-mac-address* — Only displays ARP entries associated with the specified MAC address.
  - summary** — Displays an abbreviate list of ARP entries.
  - arp-type* — Only displays ARP information associated with the keyword.
- Values** local, dynamic, static, managed
- Output** **ARP Table Output** — The following output is an example of router ARP table information, and [Table 11](#) describes the ARP table output fields.

### Sample Output

```

*B:7710-Red-RR# show router arp
=====
ARP Table (Router: Base)
=====
IP Address MAC Address Expiry Type Interface

10.20.1.24 00:16:4d:23:91:b8 00h00m00s Oth system
10.10.4.11 00:03:fa:00:d0:c9 00h57m03s Dyn[I] to-core-sr1
10.10.4.24 00:03:fa:41:8d:20 00h00m00s Oth[I] to-core-sr1

No. of ARP Entries: 3
=====

```

```
A:ALA-A# show router ARP 10.10.0.3
=====
ARP Table
=====
IP Address MAC Address Expiry Type Interface

10.10.0.3 04:5d:ff:00:00:00 00:00:00 Oth system
=====

A:ALA-A#

A:ALA-A# show router ARP to-ser1
=====
ARP Table
=====
IP Address MAC Address Expiry Type Interface

10.10.13.1 04:5b:01:01:00:02 03:53:09 Dyn to-ser1
=====

A:ALA-A#
```

**Table 11 ARP Fields**

| Label              | Description                                                                                                                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IP Address         | The IP address of the ARP entry.                                                                                                                                                                                                                      |
| MAC Address        | The MAC address of the ARP entry.                                                                                                                                                                                                                     |
| Expiry             | The age of the ARP entry.                                                                                                                                                                                                                             |
| Type               | <p>Dyn<br/>The ARP entry is a dynamic ARP entry.</p> <p>Inv<br/>The ARP entry is an inactive static ARP entry (invalid).</p> <p>Oth<br/>The ARP entry is a local or system ARP entry.</p> <p>Sta<br/>The ARP entry is an active static ARP entry.</p> |
| *Man               | The ARP entry is a managed ARP entry.                                                                                                                                                                                                                 |
| Int                | The ARP entry is an internal ARP entry.                                                                                                                                                                                                               |
| [I]                | The ARP entry is in use.                                                                                                                                                                                                                              |
| Interface          | The IP interface name associated with the ARP entry.                                                                                                                                                                                                  |
| No. of ARP Entries | The number of ARP entries displayed in the list.                                                                                                                                                                                                      |

authentication

|                    |                                                                        |
|--------------------|------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>authentication</b>                                                  |
| <b>Context</b>     | show>router                                                            |
| <b>Description</b> | This command enables the command to display authentication statistics. |

statistics

|                    |                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>statistics</b><br><b>statistics interface</b> { <i>ip-int-name</i>   <i>ip-address</i> }<br><b>statistics policy</b> <i>name</i>                                                                                                                 |
| <b>Context</b>     | show>router>authentication                                                                                                                                                                                                                          |
| <b>Description</b> | This command displays interface or policy authentication statistics.                                                                                                                                                                                |
| <b>Parameters</b>  | <i>ip-int-name</i>   <i>ip-address</i> — Specifies an existing interface name or IP address.<br><br><b>Values</b> <i>ip-int-name</i> : 32 characters maximum<br><i>ip-address</i> : a.b.c.d<br><br><i>name</i> — Specifies an existing policy name. |

**Output**      **Authentication Statistics Output** — The following output is an example of authentication statistics, and [Table 12](#) describes the fields.

**Sample Output**

```
A:ALU-3>show>router>auth# statistics
=====
Authentication Global Statistics
=====
Client Packets Authenticate Fail : 0
Client Packets Authenticate Ok : 12
=====
```

**Table 12      Authentication Statistics Fields**

| Label                            | Description                                       |
|----------------------------------|---------------------------------------------------|
| Client Packets Authenticate Fail | The number of packets that failed authentication. |
| Client Packets Authenticate Ok   | The number of packets that were authenticated.    |

## bfd

|                    |                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>bfd</b>                                                                                        |
| <b>Context</b>     | show>router                                                                                       |
| <b>Description</b> | This command enables the context to display bidirectional forwarding detection (BFD) information. |
| <b>Output</b>      | The following output is an example of BFD information.                                            |

### Sample Output

```
*A:Dut-D# show router 3 bfd session
=====
BFD Session
=====
InterfaceState Tx Intvl Rx Intvl Multipl
Remote Address Protocols Tx Pkts Rx Pkts Type

ies-3-10.1.3.3 Up (3) 10 10 3
 10.1.3.2 ospf2 N/A N/A cpm-np
ies-3-10.1.4.3 Up (3) 100 100 3
 10.1.4.2 pim 455 464 iom

No. of BFD sessions: 2
=====
*A:Dut-D#

*A:Dut-C# show router bfd session src 10.120.1.4 dest 10.120.1.3
=====
BFD Session
=====
Remote Address : 10.120.1.3
Admin State : Up Oper State : Up (3)
Protocols : static
Rx Interval : 10 Tx Interval : 10
Multiplier : 3 Echo Interval : 0
Up Time : 1d 19:03:28 Up Transitions : 2
Down Time : None Down Transitions : 1
Version Mismatch : 0

Forwarding Information
Local Discr : 19269 Local State : Up (3)
Local Diag : 0 (None) Local Mode : Async
Local Min Tx : 10 Local Mult : 3
Last Sent (ms) : 6 Local Min Rx : 10
Type : cpm-np
Remote Discr : 5101 Remote State : Up (3)
Remote Diag : 0 (None) Remote Mode : Async
Remote Min Tx : 1000 Remote Mult : 3
Last Recv (ms) : 367 Remote Min Rx : 10
=====
*A:Dut-C#
```

## bfd-template

|                    |                                                                            |
|--------------------|----------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>bfd-template</b> <i>template-name</i><br><b>bfd-template</b>            |
| <b>Context</b>     | show>router>bfd                                                            |
| <b>Description</b> | This command displays BFD template information.                            |
| <b>Parameters</b>  | <i>template-name</i> — Displays the BFD template name up to 32 characters. |
| <b>Output</b>      | The following output is an example of BFD template information.            |

### Sample Output

```
*A:mlstp-dutA# show router bfd bfd-template "privatebed-bfd-template"

=====
BFD Template privatebed-bfd-template
=====
Template Name : privatebed-* Template Type : cpmNp
Transmit Timer : 10 msec Receive Timer : 10 msec
CV Transmit Interval : 1000 msec
Template Multiplier : 3 Echo Receive Interval : 100 msec

Mpls-tp Association
privatebed-oam-template
=====
* indicates that the corresponding row element may have been truncated.
*A:mlstp-dutA# show router bfd session

=====
BFD Session
=====
Interface/Lsp Name State Tx Intvl Rx Intvl Multipl
 Remote Address/Info Protocols Tx Pkts Rx Pkts Type

wp::lsp-32 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
wp::lsp-33 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
wp::lsp-34 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
wp::lsp-35 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
wp::lsp-36 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
wp::lsp-37 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
wp::lsp-38 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
wp::lsp-39 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
wp::lsp-40 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
wp::lsp-41 Down (1) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
```



```
pp::lsp-32 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
pp::lsp-33 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
pp::lsp-34 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
pp::lsp-35 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
pp::lsp-36 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
pp::lsp-37 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
pp::lsp-38 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
pp::lsp-39 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
pp::lsp-40 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np
pp::lsp-41 Up (3) 1000 1000 3
 0::0.0.0.0 mplsTp N/A N/A cpm-np

No. of BFD sessions: 20

wp = Working path pp = Protecting path
=====
```

## interface

|                    |                                                                                                                                                                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>interface</b> [ <i>interface-name</i> ] [ <b>family</b> ]<br><b>interface</b> [ <i>interface-name</i> ] <b>detail</b><br><b>interface summary</b>                                                                                                                 |
| <b>Context</b>     | show>router>bfd                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command displays interface information.                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <i>interface-name</i> — Specifies the interface name.<br><b>family</b> — Specifies whether IPv4 or IPv6 routes are displayed.<br><b>detail</b> — Displays detailed interface information.<br><b>summary</b> — Displays summary interface information for the router. |
| <b>Output</b>      | The following output is an example of BFD interface information, and <a href="#">Table 13</a> describes the fields.                                                                                                                                                  |

### Sample Output

```
*A:Dut-B# show router bfd interface
=====
BFD Interface
=====
Interface name Tx Interval Rx Interval Multiplier
```

```

port-1-1 500 500 3
port-1-1 10 10 3
port-1-2 500 500 3
port-1-2 10 10 3
port-1-3 500 500 3
port-1-3 10 10 3
port-1-4 500 500 3
port-1-4 10 10 3
port-1-5 500 500 3
...
=====

```

**Table 13** BFD Interface Fields

| Label       | Description                                                                                                 |
|-------------|-------------------------------------------------------------------------------------------------------------|
| TX Interval | Displays the interval, in milliseconds, between the transmitted BFD messages to maintain the session.       |
| RX Interval | Displays the expected interval, in milliseconds, between the received BFD messages to maintain the session. |
| Multiplier  | Displays the integer used by BFD to declare when the neighbor is down.                                      |

## session

**Syntax**

```

session detail lsp-rsvp {head | tail}
session {ipv4 | ipv6} detail [lag lag-id] lag-port port-id
session [detail] lsp-ldp head
session [src ip-address/link-local-address] [detail] lsp-ldp head prefix ip-prefix/prefix-length
session [detail] lsp-ldp tail
session [dest {ip-address | link-local-address}] [detail] lsp-ldp tail prefix ip-prefix/prefix-length
session lsp-name lsp-name
session lsp-rsvp {head | tail}
session src ip-address/link-local-address dest {ip-address | link-local-address} detail lsp-rsvp {head | tail} tunnel-id tunnel-id lsp-id lsp-id
session mpls-tp
session lsp-name lsp-name [link-type {cc-only | cc-cv}] detail
session p2mp-interface interface-name detail
session src ip-address/link-local-address detail lsp-rsvp {head | tail} rsdp-session-name rsdp-session-name
session [src ip-address/link-local-address] [{ipv4 | ipv6}]
session src ip-address/link-local-address dest {ip-address | link-local-address}

```

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |                               |                    |         |             |                                                                                               |                    |          |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------|--------------------|---------|-------------|-----------------------------------------------------------------------------------------------|--------------------|----------|
|                    | <b>session src</b> <i>ip-address/link-local-address</i> <b>detail</b><br><b>session summary</b><br><b>session type</b> <i>type</i> [{ <b>ipv4</b>   <b>ipv6</b> }]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                               |                    |         |             |                                                                                               |                    |          |
| <b>Context</b>     | show>router>bfd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |                               |                    |         |             |                                                                                               |                    |          |
| <b>Description</b> | This command displays information for existing BFD sessions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                               |                    |         |             |                                                                                               |                    |          |
| <b>Parameters</b>  | <b>detail</b> — Displays detailed session information.<br><b>lsp-rsvp</b> — Displays BFD sessions on an RSVP LSPs.<br><b>head</b> — This optional keyword limits the output to BFD sessions at the head end of LSPs.<br><b>tail</b> — This optional keyword limits the output to BFD sessions at the tail end of LSPs.<br><b>ipv4</b> — This optional keyword limits the output to IPv4-based BFD sessions.<br><b>ipv6</b> — This optional keyword limits the output to IPv6-based BFD sessions.<br><i>lag-id</i> — Limits the output to micro-BFD sessions associated with the specified LAG ID.<br><i>port-id</i> — Limits the output to micro-BFD sessions associated with the specified port ID.<br><b>lsp-ldp</b> — Displays BFD sessions on an LDP LSPs.<br><i>ip-address</i> — Limits the output to BFD sessions with the specified IPv4 or IPv6 addresses.<br><i>link-local-address</i> — Limits the output to BFD sessions with the specified IPv6 link-local addresses.<br><i>ip-prefix/prefix-length</i> — Displays IPv4 or IPv6 addresses of the BFD sessions.<br><b>Values</b> The following values apply to the 7750 SR and 7950 XRS:<br><table><tr><td>ipv4-prefix</td><td>a.b.c.d (host bits must be 0)</td></tr><tr><td>ipv4-prefix-length</td><td>0 to 32</td></tr><tr><td>ipv6-prefix</td><td>x:x:x:x:x:x:x (eight 16-bit pieces)<br/>x:x:x:x:x:d.d.d.d<br/>x: [0 to FFFF]H<br/>d: [0 to 255]D</td></tr><tr><td>ipv6-prefix-length</td><td>0 to 128</td></tr></table><br><i>lsp-name</i> — Limits the output to BFD sessions associated with the specified LSP.<br><i>tunnel-id</i> — Limits the output to BFD sessions associated with the specified tunnel ID.<br><i>lsp-id</i> — Limits the output to BFD sessions associated with the specified LSP ID.<br><b>mpls-tp</b> — This optional keyword limits the output to BFD sessions on MPLS-TP LSPs.<br><b>cc-only</b> — This optional keyword limits the output to CC BFD sessions on MPLS-TP LSPs. | ipv4-prefix | a.b.c.d (host bits must be 0) | ipv4-prefix-length | 0 to 32 | ipv6-prefix | x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:d.d.d.d<br>x: [0 to FFFF]H<br>d: [0 to 255]D | ipv6-prefix-length | 0 to 128 |
| ipv4-prefix        | a.b.c.d (host bits must be 0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |                               |                    |         |             |                                                                                               |                    |          |
| ipv4-prefix-length | 0 to 32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                               |                    |         |             |                                                                                               |                    |          |
| ipv6-prefix        | x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:d.d.d.d<br>x: [0 to FFFF]H<br>d: [0 to 255]D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |                               |                    |         |             |                                                                                               |                    |          |
| ipv6-prefix-length | 0 to 128                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                               |                    |         |             |                                                                                               |                    |          |

**cc-cv** — This optional keyword limits the output to CV BFD sessions on MPLS-TP LSPs.

**interface-name** — Limits the output to the BFD session for the specified interface.

**rsvp-session-name** — Limits the output to the BFD session for the specified RSVP session.

**summary** — Displays summary session information for the router.

**type** — Limits the output to BFD sessions associated with the specified type.

**Values** iom, central, cpm-np

**Output** The following output is an example of BFD session information, and [Table 14](#) describes the fields.

### Sample Output

```
A:Dut-B# show router bfd session
=====
BFD Session
=====
```

| Interface      | State          | Tx Intvl | Rx Intvl | Multipl |
|----------------|----------------|----------|----------|---------|
| Remote Address | Protocols      | Tx Pkts  | Rx Pkts  | Type    |
| port-1-1       | Up (3)         | 500      | 500      | 3       |
| 10.1.1.3       | pim isis       | 50971    | 50718    | iom     |
| port-1-1       | Up (3)         | 10       | 10       | 3       |
| 3ffe::a01:103  | static bgp     | N/A      | N/A      | cpm-np  |
| port-1-1       | Up (3)         | 10       | 10       | 3       |
| fe80::a0a:a03  | pim isis ospf3 | N/A      | N/A      | cpm-np  |
| port-1-2       | Up (3)         | 500      | 500      | 3       |
| 10.2.1.3       | pim isis       | 50968    | 50718    | iom     |
| port-1-2       | Up (3)         | 10       | 10       | 3       |
| 3ffe::a02:103  | static bgp     | N/A      | N/A      | cpm-np  |
| port-1-2       | Up (3)         | 10       | 10       | 3       |
| ...            |                |          |          |         |

```
=====
*A:Dut-B#

A:Dut-B# show router bfd session src 3ffe::a01:102 dest 3ffe::a01:103
=====
BFD Session
=====
Remote Address : 3ffe::a01:103
Admin State : Up Oper State : Up (3)
Protocols : static bgp
Rx Interval : 10 Tx Interval : 10
Multiplier : 3 Echo Interval : 0
Up Time : 0d 07:24:54 Up Transitions : 1
Down Time : None Down Transitions : 0
Version Mismatch : 0

Forwarding Information
Local Discr : 2051 Local State : Up (3)
Local Diag : 0 (None) Local Mode : Async
Local Min Tx : 10 Local Mult : 3
Last Sent (ms) : 5 Local Min Rx : 10
Type : cpm-np
```

```

Remote Discr : 1885 Remote State : Up (3)
Remote Diag : 0 (None) Remote Mode : Async
Remote Min Tx : 10 Remote Mult : 3
Last Recv (ms) : 1 Remote Min Rx : 10
=====
A:Dut-B#

*A:Dut-B# show router bfd session src fe80::a0a:a02-port-1-10 dest fe80::a0a:a03-
port-1-10
=====
BFD Session
=====
Remote Address : 2001:db8::a0a:a03
Admin State : Up Oper State : Up (3)
Protocols : pim isis ospf3
Rx Interval : 10 Tx Interval : 10
Multiplier : 3 Echo Interval : 0
Up Time : 0d 07:10:20 Up Transitions : 3
Down Time : None Down Transitions : 2
 Version Mismatch : 0

Forwarding Information
Local Discr : 42 Local State : Up (3)
Local Diag : 3 (Neighbor signalled s* Local Mode : Async
Local Min Tx : 10 Local Mult : 3
Last Sent (ms) : 6 Local Min Rx : 10
Type : cpm-np
Remote Discr : 270 Remote State : Up (3)
Remote Diag : 0 (None) Remote Mode : Async
Remote Min Tx : 10 Remote Mult : 3
Last Recv (ms) : 8 Remote Min Rx : 10
=====
* indicates that the corresponding row element may have been truncated.
A:Dut-D#

*A:Dut-B# show router bfd session ipv4
=====
BFD Session
=====
Interface State Tx Intvl Rx Intvl Multipl
Remote Address Protocols Tx Pkts Rx Pkts Type

port-1-1 Up (3) 500 500 3
 10.1.1.3 pim isis 51532 51279 iom
port-1-2 Up (3) 500 500 3
 10.2.1.3 pim isis 51529 51279 iom
port-1-3 Up (3) 500 500 3
 10.3.1.3 pim isis 51529 51279 iom
port-1-4 Up (3) 500 500 3
 10.4.1.3 pim isis 51529 51279 iom
port-1-5 Up (3) 500 500 3
 10.5.1.3 pim isis 51529 51279 iom
port-1-6 Up (3) 500 500 3
 10.6.1.3 pim isis 51529 51279 iom
...
=====
A:Dut-B#

```

```
*A:Dut-B# show router bfd session ipv6
=====
BFD Session
=====
```

| Interface      | State          | Tx Intvl | Rx Intvl | Multipl |
|----------------|----------------|----------|----------|---------|
| Remote Address | Protocols      | Tx Pkts  | Rx Pkts  | Type    |
| port-1-1       | Up (3)         | 10       | 10       | 3       |
| 3ffe::a01:103  | static bgp     | N/A      | N/A      | cpm-np  |
| port-1-1       | Up (3)         | 10       | 10       | 3       |
| fe80::a0a:a03  | pim isis ospf3 | N/A      | N/A      | cpm-np  |
| port-1-2       | Up (3)         | 10       | 10       | 3       |
| 3ffe::a02:103  | static bgp     | N/A      | N/A      | cpm-np  |
| port-1-2       | Up (3)         | 10       | 10       | 3       |
| fe80::a0a:a03  | pim isis ospf3 | N/A      | N/A      | cpm-np  |
| port-1-3       | Up (3)         | 10       | 10       | 3       |
| 3ffe::a03:103  | static bgp     | N/A      | N/A      | cpm-np  |
| port-1-3       | Up (3)         | 10       | 10       | 3       |
| fe80::a0a:a03  | pim isis ospf3 | N/A      | N/A      | cpm-np  |
| port-1-4       | Up (3)         | 10       | 10       | 3       |
| 3ffe::a04:103  | static bgp     | N/A      | N/A      | cpm-np  |
| port-1-4       | Up (3)         | 10       | 10       | 3       |
| ...            |                |          |          |         |

```
=====
*A:Dut-B#
```

```
*A:Dut-D# show router bfd session summary
```

```
=====
BFD Session Summary
=====
```

| Termination | Session Count |
|-------------|---------------|
| central     | 0             |
| cpm-np      | 500           |
| iom, slot 1 | 0             |
| iom, slot 2 | 0             |
| iom, slot 3 | 250           |
| iom, slot 4 | 0             |
| iom, slot 5 | 0             |
| Total       | 750           |

```
=====
```

```
*A:Dut-D#
```

```
*A:Dut-B# show router bfd session detail lsp-
rsvp head src 10.20.1.2 dest 10.20.1.5 tunnel-id 1 lsp-id 31744
```

```
=====
BFD On LSP Session
=====
```

```
Rsvp Session Name : lsp1::path1
Remote Address : 10.20.1.5
Lsp Id : 31744 Tunnel Id : 1
Oper State : Up Protocols : lsp
Recd Msgs : 240 Sent Msgs : 240
Up Time : 0d 00:03:58 Up Transitions : 1
Down Time : None Down Transitions : 0
```

Version Mismatch : 0

Forwarding Information

```

Local Discr : 1 Local State : Up
Local Diag : 0 (None)
Local Mode : Async
Local Min Tx : 1000
Last Sent : 07/28/2015 19:05:13 Local Mult : 3
Type : central Local Min Rx : 1000
Remote Discr : 1 Remote State : Up
Remote Diag : 0 (None)
Remote Mode : Async
Remote Min Tx : 1000
Last Recv : 07/28/2015 19:05:13 Remote Mult : 3
Remote Min Rx : 1000

```

**Table 14 BFD Session Field Descriptions**

| Label    | Description                                                                                                 |
|----------|-------------------------------------------------------------------------------------------------------------|
| State    | Displays the administrative state for this BFD session.                                                     |
| Protocol | Displays the active protocol.                                                                               |
| Tx Intvl | Displays the interval, in milliseconds, between the transmitted BFD messages to maintain the session.       |
| Tx Pkts  | Displays the number of transmitted BFD packets.                                                             |
| Rx Intvl | Displays the expected interval, in milliseconds, between the received BFD messages to maintain the session. |
| Rx Pkts  | Displays the number of received packets.                                                                    |
| Mult     | Displays the integer used by BFD to declare when the neighbor is down.                                      |

## dhcp

**Syntax**     **dhcp**

**Context**    show>router

**Description**   This command enables the context to display DHCP related information.

## statistics

**Syntax**     **statistics [interface {ip-int-name | ip-address}]**

|                    |                                                                                                                                                                                                                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | show>router>dhcp                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command displays statistics for DHCP relay and DHCP snooping.</p> <p>If no IP address or interface name is specified, then all configured interfaces are displayed.</p> <p>If an IP address or interface name is specified, then only data regarding the specified interface is displayed.</p> |
| <b>Parameters</b>  | <i>ip-int-name</i>   <i>ip-address</i> — Displays statistics for the specified IP interface.                                                                                                                                                                                                           |
| <b>Output</b>      | The following output is an example of DHCP statistics information, and <a href="#">Table 15</a> describes the output fields.                                                                                                                                                                           |

**Sample Output**

```
A:ALA-1# show router dhcp statistics
=====
DHCP statistics (Router: Base)
=====
Msg-type Rx Tx Dropped

1 SOLICIT 0 0 0
2 ADVERTISE 0 0 0
3 REQUEST 0 0 0
4 CONFIRM 0 0 0
5 RENEW 0 0 0
6 REBIND 0 0 0
7 REPLY 0 0 0
8 RELEASE 0 0 0
9 DECLINE 0 0 0
10 RECONFIGURE 0 0 0
11 INFO_REQUEST 0 0 0
12 RELAY_FORW 0 0 0
13 RELAY_REPLY 0 0 0

Dhcp Drop Reason Counters :

1 Dhcp6 oper state is not Up on src itf 0
2 Dhcp6 oper state is not Up on dst itf 0
3 Relay Reply Msg on Client Itf 0
4 Hop Count Limit reached 0
5 Missing Relay Msg option, or illegal msg type 0
6 Unable to determine destination client Itf 0
7 Out of Memory 0
8 No global Pfx on Client Itf 0
9 Unable to determine src Ip Addr 0
10 No route to server 0
11 Subscr. Mgmt. Update failed 0
12 Received Relay Forw Message 0
13 Packet too small to contain valid dhcp6 msg 0
14 Server cannot respond to this message 0
15 No Server Id option in msg from server 0
16 Missing or illegal Client Id option in client msg 0
17 Server Id option in client msg 0
18 Server DUID in client msg does not match our own 0
19 Client sent message to unicast while not allowed 0
```



```

20 Client sent message with illegal src Ip address 0
21 Client message type not supported in pfx delegation 0
22 Nbr of addrs or pfxs exceeds allowed max (128) in msg 0
23 Unable to resolve client's mac address 0
24 The Client was assigned an illegal address 0
25 Illegal msg encoding 0
=====
A:ALA-1#

```

**Table 15 DHCP Statistics Fields**

| Label                      | Description                                                               |
|----------------------------|---------------------------------------------------------------------------|
| Received Packets           | The number of packets received from the DHCP clients.                     |
| Transmitted Packets        | The number of packets transmitted to the DHCP clients.                    |
| Received Malformed Packets | The number of malformed packets received from the DHCP clients.           |
| Received Untrusted Packets | The number of untrusted packets received from the DHCP clients.           |
| Client Packets Discarded   | The number of packets received from the DHCP clients that were discarded. |
| Client Packets Relayed     | The number of packets received from the DHCP clients that were forwarded. |
| Client Packets Snooped     | The number of packets received from the DHCP clients that were snooped.   |
| Server Packets Discarded   | The number of packets received from the DHCP server that were discarded.  |
| Server Packets Relayed     | The number of packets received from the DHCP server that were forwarded.  |
| Server Packets Snooped     | The number of packets received from the DHCP server that were snooped.    |

## summary

**Syntax** **summary**

**Context** show>router>dhcp  
show>router>dhcp6

**Description** Display the status of the DHCP Relay and DHCP Snooping functions on each interface.

**Output** The following output is an example of DHCP summary information, and [Table 16](#) describes the output fields for DHCP summary.

**Sample Output**

```

A:ALA-1# show router dhcp summary
=====
DHCP6 Summary (Router: Base)
=====
Interface Name Nbr Used/Max Relay Admin Oper Relay
 SapId Resol. Used/Max Server Admin Oper Server

interfaceServiceDefault No 0/0 Up NoServerCo*
 sap:1/2/12:1 0/8000 Up Up
interfaceService No 0/0 Down Down
 sap:1/2/1 0/8000 Down Down
interfaceServiceNonDefault No 0/0 Up NoServerCo*
 sap:1/2/12:2 0/8000 Down Down
ip-10.4.113.4 Yes 575/8000 Up Up
 sap:1/1/1:1 580/8000 Up Up
=====
A:ALA-1#

```

**Table 16** DHCP Summary Field Descriptions

| Label          | Description                                                              |
|----------------|--------------------------------------------------------------------------|
| Interface Name | Name of the router interface.                                            |
| Info Option    | Indicates whether Option 82 processing is enabled on the interface.      |
| Auto Filter    | Indicates whether IP Auto Filter is enabled on the interface.            |
| Snoop          | Indicates whether Auto ARP table population is enabled on the interface. |
| Interfaces     | Indicates the total number of router interfaces on the router.           |

**dhcp6**

**Syntax** **dhcp6**

**Context** show>router

**Description** This command enables the context to display DHCP6 related information.

**statistics**

**Syntax** **statistics**

**Context** show>router>dhcp6

**Description** This command displays statistics for DHCP relay and DHCP snooping.

**Output** The following output is an example of DHCP statistics information.

### Sample Output

```
A:ALA-1# show router dhcp6 statistics
=====
DHCP6 statistics (Router: Base)
=====
Msg-type Rx Tx Dropped

1 SOLICIT 0 0 0
2 ADVERTISE 0 0 0
3 REQUEST 0 0 0
4 CONFIRM 0 0 0
5 RENEW 0 0 0
6 REBIND 0 0 0
7 REPLY 0 0 0
8 RELEASE 0 0 0
9 DECLINE 0 0 0
10 RECONFIGURE 0 0 0
11 INFO_REQUEST 0 0 0
12 RELAY_FORW 0 0 0
13 RELAY_REPLY 0 0 0

Dhcp6 Drop Reason Counters :

1 Dhcp6 oper state is not Up on src itf 0
2 Dhcp6 oper state is not Up on dst itf 0
3 Relay Reply Msg on Client Itf 0
4 Hop Count Limit reached 0
5 Missing Relay Msg option, or illegal msg type 0
6 Unable to determine destination client Itf 0
7 Out of Memory 0
8 No global Pfx on Client Itf 0
9 Unable to determine src Ip Addr 0
10 No route to server 0
11 Subscr. Mgmt. Update failed 0
12 Received Relay Forw Message 0
13 Packet too small to contain valid dhcp6 msg 0
14 Server cannot respond to this message 0
15 No Server Id option in msg from server 0
16 Missing or illegal Client Id option in client msg 0
17 Server Id option in client msg 0
18 Server DUID in client msg does not match our own 0
19 Client sent message to unicast while not allowed 0
20 Client sent message with illegal src Ip address 0
21 Client message type not supported in pfx delegation 0
22 Nbr of addrs or pfxs exceeds allowed max (128) in msg 0
23 Unable to resolve client's mac address 0
24 The Client was assigned an illegal address 0
25 Illegal msg encoding 0
=====
A:ALA-1#
```

## ecmp

|                    |                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ecmp</b>                                                                                                                                             |
| <b>Context</b>     | show>router                                                                                                                                             |
| <b>Description</b> | This command displays the ECMP settings for the router.                                                                                                 |
| <b>Output</b>      | The following output is an example of ECMP settings information, and <a href="#">Table 17</a> describes the output fields for the router ECMP settings. |

### Sample Output

```

A:ALA-A# show router ecmp
=====
Router ECMP
=====
Instance Router Name ECMP Configured-ECMP-Routes

1 Base True 8
=====
A:ALA-A#
*A:Dut-C# show router ecmp

=====
Router ECMP
=====
Instance Router Name ECMP Max-ECMP- Weight ECMP
 Rtes

1 Base True 32 True
=====

```

**Table 17**      **ECMP Fields**

| Label                  | Description                                            |
|------------------------|--------------------------------------------------------|
| Instance               | The router instance number.                            |
| Router Name            | The name of the router instance.                       |
| ECMP                   | False<br>ECMP is disabled for the instance.            |
|                        | True<br>ECMP is enabled for the instance.              |
| Configured-ECMP-Routes | The number of ECMP routes configured for path sharing. |

# \*\*\*\*\*lbm-svc-act-responder

|                    |                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>lbm-svc-act-responder</b> [domain <i>md-index</i> ] [association <i>ma-index</i> ] [mep <i>mep-id</i> ]                                                                                                                                                                                                                                          |
| <b>Context</b>     | show>eth-cfm                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | This command displays all the MEPs that have been created with this optional parameter, which allocates additional resources to facilitate high-speed LBM-to-LBR processing typically used during service activation testing. The optional filters are cumulative. These filters can be used to narrow the focus of the display to a specific area. |
| <b>Parameters</b>  | <p><i>md-index</i> — Displays the MD index.</p> <p><b>Values</b> 1 to 4294967295</p> <p><i>ma-index</i> — Displays the MA index.</p> <p><b>Values</b> 1 to 4294967295</p> <p><i>mep-id</i> — Displays the local MEP ID.</p> <p><b>Values</b> 1 to 8191</p>                                                                                          |
| <b>Output</b>      | The following is an example of ETH CFM <b>lbm-svc-act-responder</b> information.                                                                                                                                                                                                                                                                    |

[Table 18](#) describes the output fields:

## Sample Output

```
show eth-cfm lbm-svc-act-responder
=====
Eth-CFM Local MEP LBM Service Activation Responder Enabled
=====
MdIndex MaIndex MepId SrcMacAddress

14 1000 28 d8:1c:ff:00:00:00

No. of MEPs: 1
=====
```

**Table 18** ETH-CFM lbm-service-act-responder Field Descriptions

| Label         | Description                                              |
|---------------|----------------------------------------------------------|
| MdIndex       | Displays the Maintenance Domain (MD) index value         |
| MaIndex       | Displays the MA index value                              |
| MepId         | Displays the maintenance association endpoint identifier |
| SrcMacAddress | Displays the source MAC address                          |

## fib

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>fib</b> <i>slot-number</i> [ <i>family</i> ] [ <i>ip-prefix/prefix-length</i> [ <b>longer</b> ]] [ <b>secondary</b> ] [ <b>qos</b> ] [ <b>accounting-class</b> ] [ <b>all</b> ]<br><b>fib</b> <i>slot-number</i> <b>extensive</b> [ <i>ip-prefix/prefix-length</i> ] [ <i>family</i> ] [ <b>all</b> ]<br><b>fib</b> <i>slot-number</i> [ <i>family</i> ] <b>summary</b><br><b>fib</b> <i>slot-number</i> <b>nh-table-usage</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | show>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command displays the active FIB entries for a specific IOM or linecard.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <i>slot-number</i> — Displays routes only matching the specified chassis slot number.<br><b>Default</b> all IOMs<br><b>Values</b> 1 to 10<br><i>family</i> — Displays the router IP interface table.<br><b>Values</b> <b>ipv4</b> — Displays only those peers that have the IPv4 family enabled.<br><b>ipv6</b> — Displays the peers that are IPv6-capable.<br><i>ip-prefix/prefix-length</i> — Displays FIB entries only matching the specified <i>ip-prefix</i> and length.<br><b>Values</b> The following values apply to the 7450 ESS:<br>ipv4-prefix:                      a.b.c.d (host bits must be 0)<br>ipv4-prefix-length:                0 to 32<br><br><b>Values</b> The following values apply to the 7750 SR and 7950 XRS:<br>ipv4-prefix:                      a.b.c.d (host bits must be 0)<br>ipv4-prefix-length:                0 to 32<br>ipv6-prefix:                      x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:d.d.d.d<br>x: [0 to FFFF]H<br>d: [0 to 255]D<br>ipv6-prefix-length:                0 to 128<br><br><b>longer</b> — Displays FIB entries matching the <i>ip-prefix/mask</i> and routes with longer masks.<br><b>secondary</b> — Displays secondary VRF ID information.<br><b>qos</b> — Displays the QoS priority and fc values.<br><b>accounting-class</b> — Displays the accounting class information.<br><b>all</b> — Displays all information. |

**summary** — Displays summary FIB information for the specified slot number.

**nh-table-usage** — Displays next-hop table usage.

**Output** The following output is an example of FIB information and [Table 19](#) describes the output fields for the router FIB settings.

### Sample Output

```
show router fib 1 10.132.133.134/32
=====
FIB Display
=====
Prefix Protocol
 NextHop

10.132.133.134/32 OSPF
 10.66.66.66 (loop7)
 Next-hop type: tunneled, Owner: RSVP, Tunnel-ID: <out-ifindex-from-route>

Total Entries : 1
=====

*A:Dut-C# show router fib 1 10.1.1.1/32
=====
FIB Display
=====
Prefix Protocol
 NextHop

10.1.1.1/32 BGP
 10.20.1.1 (Transport:RSVP LSP:1)

Total Entries : 1
=====

*A:Dut-C# show router fib 1
=====
FIB Display
=====
Prefix Protocol
 NextHop

10.1.2.0/24 ISIS
 10.1.3.1 (to_Dut-A)
 10.2.3.2 (to_Dut-B)
10.1.3.0/24 LOCAL
 10.1.3.0 (to_Dut-A)
10.1.9.0/24 ISIS
 10.1.3.1 (to_Dut-A)
10.2.3.0/24 LOCAL
 10.2.3.0 (to_Dut-B)
10.2.9.0/24 ISIS
 10.2.3.2 (to_Dut-B)
10.12.0.0/24 LOCAL
 10.12.0.0 (itfToArborCP_02)
10.20.1.1/32 ISIS
```

```

 10.1.3.1 (to_Dut-A)
10.20.1.2/32
 10.2.3.2 (to_Dut-B)
10.20.1.3/32
 10.20.1.3 (system)
10.12.0.43/32
 vprn1:mda-1-1
10.12.0.44/32
 vprn1:mda-2-1
10.12.0.45/32
 vprn1:mda-2-2
10.12.0.46/32
 vprn1:mda-3-1
10.203.71.202/32
 10.12.0.2 (itfToArborCP_02)

```

```

Total Entries : 15

=====

```

```

*A:Dut-C>config>router>mpls>lsp# show router fib 1 10.3.0.1/32 extensive

```

```

=====
FIB Display (Router: Base)
=====

```

```

Dest Prefix : 10.3.0.1/32
Protocol : BGP
Indirect Next-Hop : 10.0.0.1
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 ECMP-Weight : 1
Resolving Next-Hop : 10.0.0.2 (RSVP tunnel:115)
 ECMP-Weight : 1
Resolving Next-Hop : 10.0.0.2 (RSVP tunnel:61443)
 ECMP-Weight : 1
Indirect Next-Hop : 10.0.1.2
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 ECMP-Weight : 30
Resolving Next-Hop : 10.0.0.3 (RSVP tunnel:94)
 ECMP-Weight : 20
Resolving Next-Hop : 10.0.0.3 (RSVP tunnel:61442)
 ECMP-Weight : 1

```

```

=====
Total Entries : 1
=====

```

```

*A:Dut-C> show router fib 1 10.0.0.2/32 extensive

```

```

=====
FIB Display (Router: Base)
=====

```

```

Dest Prefix : 10.0.0.2/32
Protocol : OSPF
Next-Hop : 10.0.0.3 (RSVP tunnel:94)
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 ECMP-Weight : 20

```



```

Next-Hop : 10.0.0.3 (RSVP tunnel:61442)
QoS : Priority=n/c, FC=n/c
Source-Class : 0
Dest-Class : 0
ECMP-Weight : 1
=====
Total Entries : 1
=====

*A:Dut-C> show router route-table 10.1.0.5/32 extensive
=====
Route Table (Router: Base)
=====
Dest Prefix : 10.1.0.5/32
Protocol : STATIC
Age : 00h01m37s
Preference : 5
Next-Hop : 10.0.0.2 (RSVP tunnel:128)
QoS : Priority=n/c, FC=n/c
Source-Class : 0
Dest-Class : 0
Metric : 1
ECMP-Weight : 10
Next-Hop : 10.0.0.2 (RSVP tunnel:132)
QoS : Priority=n/c, FC=n/c
Source-Class : 0
Dest-Class : 0
Metric : 1
ECMP-Weight : 1

No. of Destinations: 1
=====

*A:Dut-C> show router fib 1 10.1.0.5/32 extensive
=====
FIB Display (Router: Base)
=====
Dest Prefix : 10.1.0.5/32
Protocol : STATIC
Next-Hop : 10.0.0.2 (RSVP tunnel:128)
QoS : Priority=n/c, FC=n/c
Source-Class : 0
Dest-Class : 0
ECMP-Weight : 10
Next-Hop : 10.0.0.2 (RSVP tunnel:132)
QoS : Priority=n/c, FC=n/c
Source-Class : 0
Dest-Class : 0
ECMP-Weight : 1
=====
Total Entries : 1
=====

*A:Dut-B# show router fib 1 10.15.1.0/24
=====
FIB Display
=====
Prefix [Flags] Protocol
NextHop

```

```

10.15.1.0/24 BGP
 10.20.1.3 (Transport:SR)

Total Entries : 1
=====

*A:Dut-B# show router fib 1 10.15.1.0/24 extensive
=====
FIB Display (Router: Base)
=====
Dest Prefix : 10.15.1.0/24
Protocol : BGP
Installed : Y
Indirect Next-Hop : 10.20.1.3
 Label : 262123
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 ECMP-Weight : 1
 Resolving Next-Hop : 10.20.1.3 (SR tunnel)
 ECMP-Weight : 1
=====
Total Entries : 1
=====

*A:Dut-C# show router fib 1 3ffe::100:100:100:6/128
=====
FIB Display
=====
Prefix [Flags] Protocol
 NextHop

3ffe::100:100:100:6/128 OSPF3
10.20.1.4 (Transport:RSVP LSP:1)

Total Entries : 1
=====

*A:Dut-C# show router fib 1 3ffe::100:100:100:6/128 extensive
=====
FIB Display (Router: Base)
=====
Dest Prefix : 3ffe::100:100:100:6/128
Protocol : OSPF3
Installed : Y
Next-Hop : 10.20.1.4 (RSVP tunnel:1)
 Label : 2
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 ECMP-Weight : 1
=====
Total Entries : 1
=====

```

**Table 19 FIB Fields**

| Label          | Description                      |
|----------------|----------------------------------|
| Prefix [Flags] | The prefix.                      |
| Protocol       | The routing protocol.            |
| NextHop        | The next-hop IP address.         |
| Total Entries  | The total number of entries.     |
| Dest Prefix    | The destination prefix.          |
| Installed      | The installed indicator (y   n). |
| Label          | The label number.                |
| QoS            | The QoS value.                   |
| Source-Class   | The source class.                |
| Dest-Class     | The destination class value.     |
| ECMP-Weight    | The ECMP weight value.           |

## fp-tunnel-table

**Syntax** **fp-tunnel-table** *slot-number* [*ip-prefix/prefix-length*]  
**fp-tunnel-table** *slot-number* [**ipv4** | **ipv6**]

**Context** show>router

**Description** This command displays the IOM/IMM label, next-hop and outgoing interface information for BGP, LDP and RSVP tunnels used in any of the following applications:

- BGP shortcut (**config>router>bgp>next-hop-resolution>shortcut-tunnel**)
- IGP shortcut (**config>router>isis[ospf]>igp-shortcut**)
- IGP prefix resolved to an LDP LSP (**config>router>ldp-shortcut**)
- Static route resolved to a LDP or RSVP LSP
- VPRN auto-bind
- 6PE/6VPE.

**Parameters** *slot-number* — Displays information for the specified slot.

**Values** 1 to 10

*ip-prefix[/prefix-length]* — Displays routes only matching the specified *ip-address* and length.

**Values**

```

ipv4-prefix: a.b.c.d (host bits must be set
 to 0)
ipv4-prefix-length: 0 to 32
ipv6 ipv6-prefix[/pref*]: x::x::x::x::x::x (eight 16-bit pieces)
 x::x::x::x::x::d.d.d.d
 x: [0 to FFFF]H
 d: [0 to 255]D
 prefix-length: 1 to 128

```

**ipv4** — Displays the output to IPv4-based FP tunnel tables.

**ipv6** — Displays the output to IPv6-based FP tunnel tables.

**Output** The following output is an example of router FP tunnel information.

### Sample Output

```

*A:Dut-B# show router fp-tunnel-table 1 10.20.1.3/32
=====
Tunnel Table Display

Legend:
B - FRR Backup
=====
Destination Protocol Tunnel-ID
 Lbl NextHop Intf/Tunnel

10.20.1.3/32 LDP -
 262137 10.2.1.3 1/1/3:1
10.20.1.3/32 RSVP 1
 262133 10.2.1.3 1/1/3:1
10.20.1.3/32 SR-ISIS-0 -
 18602 10.2.1.3 1/1/3:1
10.20.1.3/32 SR-OSPF-0 -
 19102 10.2.1.3 1/1/3:1

Total Entries : 4
=====
*A:Dut-B#

*A:Dut-C# show router fp-tunnel-table 1
=====
Tunnel Table Display

Legend:
B - FRR Backup
=====
Destination Protocol Tunnel-ID
 Lbl NextHop Intf/Tunnel

10.0.0.1/32 SR-ISIS-0 -
 20001 10.3.4.4 2/1/3:1

```

```

20001/21005 10.2.3.2(B) 1/1/2
10.20.1.2/32 SR-ISIS-0 -
21002 10.2.3.2 1/1/2
21002/21005 10.3.4.4(B) 2/1/3:1
10.20.1.4/32 SR-ISIS-0 -
21004 10.3.4.4 2/1/3:1
21004/21005 10.2.3.2(B) 1/1/2
10.20.1.5/32 SR-ISIS-0 -
21005 10.2.3.2 1/1/2
21005 10.3.4.4(B) 2/1/3:1

```

-----  
Total Entries : 4  
-----

=====

\*A:Dut-C#

\*A:Dut-C# show router fp-tunnel-table 1

=====

Tunnel Table Display

Legend:

B - FRR Backup

```

=====
Destination NextHop Intf/Tunnel Protocol Tunnel-ID
 Lbl

10.1.3.1/32 3 10.1.3.1 1/1/1 SR -
10.2.3.2/32 3 10.2.3.2 1/1/2:1 SR -
10.3.5.5/32 3 10.3.5.5 2/1/1 SR -
10.2.3.2/32 3 10.2.3.2 1/1/2:2 SR -
10.20.1.1/32 21011 10.1.3.1 1/1/1 SR-OSPF-0 -
 22011 10.2.3.2(B) 1/1/2:1
10.20.1.2/32 22022 10.2.3.2 1/1/2:2 SR-OSPF-0 -
 24022/25044 10.3.5.5(B) 2/1/1
10.20.1.4/32 25044 10.3.5.5 2/1/1 SR-OSPF-0 -
 22044 10.2.3.2 1/1/2:2
10.20.1.5/32 25055 10.3.5.5 2/1/1 SR-OSPF-0 -
 24055/22044 10.2.3.2(B) 1/1/2:2
10.20.1.6/32 25066 10.3.5.5 2/1/1 SR-OSPF-0 -
 24066/22044 10.2.3.2(B) 1/1/2:2

```

-----  
Total Entries : 9  
-----

=====

\*A:Dut-C#

\*A:Dut-F# show router fp-tunnel-table 1

=====

Tunnel Table Display

Legend:

B - FRR Backup

| Destination<br>Lbl | NextHop       | Intf/Tunnel | Protocol  | Tunnel-ID |
|--------------------|---------------|-------------|-----------|-----------|
| 10.0.11.1/32       |               |             | SR-OSPF-0 | -         |
| 30004              | 10.0.26.2     | 1/1/3:1     |           |           |
| 40004              | 10.0.36.3 (B) | 1/1/4:1     |           |           |
| 10.0.22.2/32       |               |             | SR-OSPF-0 | -         |
| 30005              | 10.0.26.2     | 1/1/3:1     |           |           |
| 20005/40004        | 10.0.36.3 (B) | 1/1/4:1     |           |           |
| 10.0.26.2/32       |               |             | SR        | -         |
| 3                  | 10.0.26.2     | 1/1/3:1     |           |           |
| 50011/60001        | 10.0.56.5 (B) | 1/1/2:1     |           |           |
| 10.0.26.2/32       |               |             | SR        | -         |
| 3                  | 10.0.26.2     | 1/1/3:1     |           |           |
| 20005/40004        | 10.0.36.3 (B) | 1/1/4:1     |           |           |
| 10.0.33.3/32       |               |             | SR-OSPF-0 | -         |
| 40000              | 10.0.36.3     | 1/1/4:1     |           |           |
| 30998              | 10.0.26.2 (B) | 1/1/3:1     |           |           |
| 10.0.36.3/32       |               |             | SR        | -         |
| 3                  | 10.0.36.3     | 1/1/4:1     |           |           |
| 10.0.44.4/32       |               |             | SR-OSPF-0 | -         |
| 30001              | 10.0.26.2     | 1/1/3:1     |           |           |
| 60001              | 10.0.56.5 (B) | 1/1/2:1     |           |           |
| 10.0.55.5/32       |               |             | SR-OSPF-0 | -         |
| 60002              | 10.0.56.5     | 1/1/2:1     |           |           |
| 30995              | 10.0.26.2 (B) | 1/1/3:1     |           |           |
| 10.0.56.5/32       |               |             | SR        | -         |
| 3                  | 10.0.56.5     | 1/1/2:1     |           |           |
| 10.20.1.1/32       |               |             | SR-OSPF-0 | -         |
| 30010              | 10.0.26.2     | 1/1/3:1     |           |           |
| 40010              | 10.0.36.3 (B) | 1/1/4:1     |           |           |
| 10.20.1.2/32       |               |             | SR-OSPF-0 | -         |
| 30011              | 10.0.26.2     | 1/1/3:1     |           |           |
| 50011/60001        | 10.0.56.5 (B) | 1/1/2:1     |           |           |
| 10.20.1.3/32       |               |             | SR-OSPF-0 | -         |
| 40006              | 10.0.36.3     | 1/1/4:1     |           |           |
| 20006/30004        | 10.0.26.2 (B) | 1/1/3:1     |           |           |
| 10.20.1.4/32       |               |             | SR-OSPF-0 | -         |
| 30007              | 10.0.26.2     | 1/1/3:1     |           |           |
| 60007              | 10.0.56.5 (B) | 1/1/2:1     |           |           |
| 10.20.1.5/32       |               |             | SR-OSPF-0 | -         |
| 60008              | 10.0.56.5     | 1/1/2:1     |           |           |
| 50008/30001        | 10.0.26.2 (B) | 1/1/3:1     |           |           |

Total Entries : 14

\*A:Dut-F#

\*A:Dut-C# show router fp-tunnel-table 1 10.20.1.5/32

Tunnel Table Display

Legend:

B - FRR Backup

| Destination<br>Lbl | NextHop | Intf/Tunnel | Protocol | Tunnel-ID |
|--------------------|---------|-------------|----------|-----------|
|--------------------|---------|-------------|----------|-----------|

```

10.20.1.5/32 LDP -
 262135 10.10.5.5 2/1/1
 3 10.20.1.5 (B) SR
10.20.1.5/32 SR-ISIS-0 -
 474390 10.10.5.5 2/1/1
 474390/474389 10.10.12.2 (B) lag-1

Total Entries : 2

=====
```

\*A:Dut-C>config>router>ospf3# show router fp-tunnel-table 1 ipv6

=====  
IPv6 Tunnel Table Display

Legend:

B - FRR Backup

```
=====
Destination Protocol Tunnel-ID
 Lbl
 NextHop Intf/Tunnel

3ffe::100:b01/128 SR-OSPF3-0 -
 20004
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" 1/1/1:1
 30004/70005
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" (B) 2/1/2:1
3ffe::100:1602/128 SR-OSPF3-0 -
 20005
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" 1/1/1:1
 70005
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" (B) 2/1/2:1
3ffe::100:2c04/128 SR-OSPF3-0 -
 20001
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" 1/1/1:1
 70001
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" (B) 2/1/2:1
3ffe::100:3705/128 SR-OSPF3-0 -
 70002
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" 2/1/2:1
 30002/20005
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" (B) 1/1/1:1
3ffe::100:4206/128 SR-OSPF3-0 -
 70003
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" 2/1/2:1
 30003/20005
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" (B) 1/1/1:1
3ffe::a14:101/128 SR-OSPF3-0 -
 20010
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" 1/1/1:1
 30010/70005
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" (B) 2/1/2:1
3ffe::a14:102/128 SR-OSPF3-0 -
 20011
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" 1/1/1:1
 70011
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" (B) 2/1/2:1
3ffe::a14:104/128 SR-OSPF3-0 -
 20007
```

```

 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" 1/1/1:1
70007
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" (B) 2/1/2:1
3ffe::a14:105/128 SR-OSPF3-0
70008
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" 2/1/2:1
30008/20005
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" (B) 1/1/1:1
3ffe::a14:106/128 SR-OSPF3-0
70009
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" 2/1/2:1
30009/20005
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" (B) 1/1/1:1
fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0"/128 SR 524325
3
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" 1/1/1:1
30004/70005
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" (B) 2/1/2:1
fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0"/128 SR 524326
3
 fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" 2/1/2:1
30003/20005
 fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" (B) 1/1/1:1

Total Entries : 12

=====

```

## icmp

|                    |                                                                                                                                                                                                                                            |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>icmp</b>                                                                                                                                                                                                                                |
| <b>Context</b>     | show>router                                                                                                                                                                                                                                |
| <b>Description</b> | This command displays Internet Control Message Protocol version 4 (ICMP) statistics. ICMP generates error messages (for example, ICMP destination unreachable messages) to report errors during processing and other diagnostic functions. |
| <b>Output</b>      | The following output is an example of router ICMP statistics, and <a href="#">Table 20</a> describes the fields.                                                                                                                           |

### Sample Output

```

*A:cses-V93# show router icmp
=====
Global ICMP Stats
=====
Received
Total : 0 Error : 0
Destination Unreachable : 0 Redirect : 0
Echo Request : 0 Echo Reply : 0
TTL Expired : 0 Source Quench : 0
Timestamp Request : 0 Timestamp Reply : 0
Address Mask Request : 0 Address Mask Reply : 0
Parameter Problem : 0

```



```

Sent
Total : 0 Error : 0
Destination Unreachable : 0 Redirect : 0
Echo Request : 0 Echo Reply : 0
TTL Expired : 0 Source Quench : 0
Timestamp Request : 0 Timestamp Reply : 0
Address Mask Request : 0 Address Mask Reply : 0
Parameter Problem : 0
=====
*A:cses-V93# show router icmp interface "sample1"
=====
Interface ICMP Stats
=====
Interface "sample1"

Received
Total : 0 Error : 0
Destination Unreachable : 0 Redirect : 0
Echo Request : 0 Echo Reply : 0
TTL Expired : 0 Source Quench : 0
Timestamp Request : 0 Timestamp Reply : 0
Address Mask Request : 0 Address Mask Reply : 0
Parameter Problem : 0 Discarded : 0

Sent
Total : 0 Error : 0
Destination Unreachable : 0 Redirect : 0
Echo Request : 0 Echo Reply : 0
TTL Expired : 0 Source Quench : 0
Timestamp Request : 0 Timestamp Reply : 0
Address Mask Request : 0 Address Mask Reply : 0
Parameter Problem : 0 Discarded : 0
=====

```

**Table 20**      **ICMP Fields**

| Label                   | Description                                                      |
|-------------------------|------------------------------------------------------------------|
| Total                   | The total number of all messages.                                |
| Error                   | The number of error messages.                                    |
| Destination Unreachable | The number of message that did not reach the destination.        |
| Redirect                | The number of packet redirects.                                  |
| Echo Request            | The number of echo requests.                                     |
| Echo Reply              | The number of echo replies.                                      |
| TTL Expired             | The number of messages that exceeded the time to live threshold. |
| Source Quench           | The number of source quench requests (deprecated).               |

**Table 20 ICMP Fields (Continued)**

| Label                | Description                                                                                                                      |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Timestamp Request    | The number of timestamp requests (deprecated). ICMP timestamp requests are counted and dropped on ingress.                       |
| Timestamp Reply      | The number of timestamp replies (deprecated). Sending ICMP timestamp replies is not supported, so this counter will always be 0. |
| Address Mask Request | The number of address mask requests (deprecated).                                                                                |
| Address Mask Reply   | The number of address mask replies (deprecated).                                                                                 |
| Parameter Problem    | The number of packets with a parameter problem in the IP header.                                                                 |
| Discarded            | The number of messages that exceed the configured interface ICMP rate or have an expired TTL.                                    |

## interface

**Syntax** `interface [interface-name]`

**Context** `show>router>icmp`  
`show>router>icmp6`

**Description** This command displays interface ICMP and ICMP6 statistics.

**Parameters** *interface-name* — Only displays entries associated with the specified IP interface name.

**Output** The following output is an example of ICMPv6 interface statistics, and [Table 21](#) describes the fields.

### Sample Output

```
B:CORE2# show router icmp6 interface net1_1_2
=====
Interface ICMPv6 Stats
=====
Interface "net1_1_2"

Received
Total : 41 Errors : 0
Destination Unreachable : 0 Redirects : 0
Time Exceeded : 0 Pkt Too Big : 0
Echo Request : 0 Echo Reply : 0
Router Solicits : 0 Router Advertisements : 0
Neighbor Solicits : 20 Neighbor Advertisements : 21

Sent
Total : 47 Errors : 0
```

```

Destination Unreachable : 0 Redirects : 0
Time Exceeded : 0 Pkt Too Big : 0
Echo Request : 0 Echo Reply : 0
Router Solicits : 0 Router Advertisements : 0
Neighbor Solicits : 27 Neighbor Advertisements : 20
=====

```

B:CORE2#

**Table 21 ICMP6 Interface Fields**

| Label                   | Description                                                      |
|-------------------------|------------------------------------------------------------------|
| Total                   | The total number of all messages.                                |
| Destination Unreachable | The number of message that did not reach the destination.        |
| Time Exceeded           | The number of messages that exceeded the time threshold.         |
| Echo Request            | The number of echo requests.                                     |
| Router Solicits         | The number of times the local router was solicited.              |
| Neighbor Solicits       | The number of times the neighbor router was solicited.           |
| Errors                  | The number of error messages.                                    |
| Redirects               | The number of packet redirects.                                  |
| Pkt Too big             | The number of packets that exceed appropriate size.              |
| Echo Reply              | The number of echo replies.                                      |
| Router Advertisements   | The number of times the router advertised its location.          |
| Neighbor Advertisements | The number of times the neighbor router advertised its location. |

## icmp6

|                    |                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>icmp6</b>                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | show>router                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | This command displays Internet Control Message Protocol Version 6 (ICMPv6) statistics. ICMP generates error messages (for example, ICMP destination unreachable messages) to report errors during processing and other diagnostic functions. ICMPv6 packets can be used in the neighbor discovery protocol and path MTU discovery. |
| <b>Output</b>      | The following output is an example of router ICMPv6 statistics, and <a href="#">Table 22</a> describes the fields.                                                                                                                                                                                                                 |

### Sample Output

```
A:SR-3# show router icmp6
=====
Global ICMPv6 Stats
=====
Received
Total : 0 Errors : 0
Destination Unreachable : 0 Redirects : 0
Time Exceeded : 0 Pkt Too Big : 0
Echo Request : 0 Echo Reply : 0
Router Solicits : 0 Router Advertisements : 0
Neighbor Solicits : 0 Neighbor Advertisements : 0
Parameter Problem : 0

Sent
Total : 2 Errors : 0
Destination Unreachable : 0 Redirects : 0
Time Exceeded : 0 Pkt Too Big : 0
Echo Request : 0 Echo Reply : 0
Router Solicits : 0 Router Advertisements : 0
Neighbor Solicits : 2 Neighbor Advertisements : 0
Parameter Problem : 0 Discarded : 0
=====
A:SR-3#
A:SR-3# show router icmp6 interface "sample1"
=====
Interface ICMPv6 Stats
=====
Interface "sample1"

Received
Total : 0 Errors : 0
Destination Unreachable : 0 Redirects : 0
Time Exceeded : 0 Pkt Too Big : 0
Echo Request : 0 Echo Reply : 0
Router Solicits : 0 Router Advertisements : 0
Neighbor Solicits : 0 Neighbor Advertisements : 0
Parameter Problem : 0

Sent
```

```

Total : 2 Errors : 0
Destination Unreachable : 0 Redirects : 0
Time Exceeded : 0 Pkt Too Big : 0
Echo Request : 0 Echo Reply : 0
Router Solicits : 0 Router Advertisements : 0
Neighbor Solicits : 2 Neighbor Advertisements : 0
Parameter Problem : 0 Discarded : 0
=====
A:SR-3#

```

**Table 22**      **ICMPv6 Fields**

| Label                   | Description                                                                                            |
|-------------------------|--------------------------------------------------------------------------------------------------------|
| Total                   | The total number of all messages.                                                                      |
| Destination Unreachable | The number of message that did not reach the destination.                                              |
| Time Exceeded           | The number of messages that exceeded the time threshold.                                               |
| Echo Request            | The number of echo requests.                                                                           |
| Router Solicits         | The number of times the local router was solicited.                                                    |
| Neighbor Solicits       | The number of times the neighbor router was solicited.                                                 |
| Errors                  | The number of error messages.                                                                          |
| Redirects               | The number of packet redirects.                                                                        |
| Pkt Too big             | The number of packets that exceed appropriate size.                                                    |
| Echo Reply              | The number of echo replies.                                                                            |
| Router Advertisements   | The number of times the router advertised its location.                                                |
| Neighbor Advertisements | The number of times the neighbor router advertised its location.                                       |
| Parameter Problem       | The number of packets with a parameter problem in the IP header.                                       |
| Discarded               | The number of ICMPv6 messages that exceed the configured interface ICMPv6 rate or have an expired TTL. |

## if-attribute

|                    |                                                                                      |
|--------------------|--------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>if-attribute</b>                                                                  |
| <b>Context</b>     | show>router                                                                          |
| <b>Description</b> | This command enables the context to display interface attribute related information. |

## srlg-group

- Syntax** `srlg-group [name]`
- Context** `show>router>if-attribute>srlg-group`
- Description** This command displays SRLG statistics.
- Parameters** *name* — Only displays entries associated with the specified SRLG name up to 32 characters.
- Output** The following output is an example of SRLG statistics, and [Table 23](#) describes the fields.

### Sample Output

```
B:CORE2# show router if-attribute srlg-group
=====
Interface Srlg Groups
=====
Group Name Group Value Penalty Weight

1 1 100
2 2 200
3 3 300

No. of Groups: 3
=====
B:CORE2#
```

**Table 23** SRLG Fields

| Label          | Description                                      |
|----------------|--------------------------------------------------|
| Group Name     | The name of the SRLG.                            |
| Group Value    | The integer value of the SRLG.                   |
| Penalty Weight | The penalty weight that is assigned to the SRLG. |
| No. of Groups  | The total number of displayed SRLGs.             |

## interface

**Syntax**     **interface** {{{*ip-address* | *ip-int-name*}} [**detail**] [**family**]} | **summary** | **exclude-services**}}  
**interface** *ip-address* | *ip-int-name*} **eth-cfm** [**detail**]  
**interface** *ip-address* | *ip-int-name*} **mac** [*ieee-address*]  
**interface** *ip-address* | *ip-int-name*} **statistics**  
**interface** *ip-address* | *ip-int-name*} **dist-cpu-protection** [**detail**]  
**interface** *ip-address* | *ip-int-name*} **policy-accounting** [*class* [*index*]]  
**interface description**  
**interface global-if-index** *global-if-index* [**family**] [**detail**]  
**interface global-if-index** *global-if-index* **statistics**

**Context**     show>router

**Description**     This command displays the router IP interface table sorted by interface index.

**Parameters**     *ip-address* — Displays the interface information associated with the specified IP address.

### Values

|              |                                     |
|--------------|-------------------------------------|
| ipv4-address | a.b.c.d (host bits must be 0)       |
| ipv6-address | x:x:x:x:x:x:x (eight 16-bit pieces) |
|              | x:x:x:x:x.d.d.d.d                   |

where:

x: [0 to FFFF]H

d: [0 to 255]D

*ip-int-name* — Displays the interface information associated with the specified IP interface name, up to 32 characters.

**detail** — Displays detailed IP interface information.

**family** — Specifies the router IP interface family to display.

**Values**     **ipv4** — Displays only those peers that have the IPv4 family enabled.

**ipv6** — Displays the peers that are IPv6-capable.

**summary** — Displays summary IP interface information for the router.

**exclude-services** — Displays IP interface information, excluding IP interfaces configured for customer services. Only core network IP interfaces are displayed.

**eth-cfm** — Displays Ethernet CFM information.

**mac** — Displays information associated with the MAC address.

*ieee-address* — Displays the information associated with the specified IEEE address. The address is in the xx-xx-xx-xx-xx-xx or xx:xx:xx:xx:xx:xx format.

**statistics** — Displays packet statistics for an interface on the router.



**Note:** The **show router interface statistics** command also shows the MPLS statistics that are shown in using the **show router mpls interface statistics** command. This allows the operator to see MPLS statistics from interfaces that are not added to MPLS, such as a carrier's network interfaces. [Sample Output](#) for an example of the MPLS fields that are displayed. These fields are displayed regardless of the state of MPLS.

**dist-cpu-protection** — Displays the distributed CPU protection parameters and status at the interface level.

**class** — Indicates whether to display accounting policy statistics for the source or destination class.

**Values**      source-class, dest-class

**index** — Specifies an integer value for the accounting source or destination class index.

**Values**      1 to 255

**description** — Displays all interfaces in all routing contexts.

**global-if-index** — Specifies the global interface index value.

**Values**      1 to 262144

**Output**      **Standard IP Interface Output**—The following output is an example of standard IP interface information, and [Table 24](#) describes the fields.

**Sample Output**

```
*A:Dut-B# show router Base interface description
=====
Router Interface Summary
=====
Port/SAP Admin Oper Description
 v4/v6

system Up Up/Dn
1/1/2 Up Up/Dn this is the interface towards dut-d
1/1/3 Up Up/Dn
1/1/1 Up Up/Dn
1/1/10 Up Dn/Dn interface_ies_1-with a long
 description that wraps to multiple
 lines.

**A:Dut-B# show router 20 interface description
=====
Router Interface Summary
=====
Port/SAP Admin Oper Description
 v4/v6

1/1/11 Up Dn/Dn This is a very long description
 for the interface vprn_1 which
```



```

 belongs to vprn 1
=====

*A:SwSim100# show router interface "to101port1-1"
=====
Interface Table (Router: Base)
=====
Interface-Name Adm Opr (v4/v6) Mode Port/SapId
IP-Address MACSec admin subport encap ca
status

to101port1-1 Up Up/Down Network 1/1/c1/1
100.101.1.1/24 n/a
Enabled 5 un-tag ca-5

Interfaces : 1
=====

*A:SwSim100# show router interface
=====
Interface Table (Router: Base)
=====
Interface-Name Adm Opr (v4/v6) Mode Port/SapId
IPAddress MACSec sp PfxState

loop1 Up Up/Down Network loopback
100.0.1.100/32 na n/a
loop2 Up Up/Down Network loopback
100.0.2.100/32 na n/a
system Up Up/Down Network system
100.0.0.100/32 na n/a
to101port1-1 Up Up/Down Network 1/1/c1/1
100.101.1.1/24 10 n/a

Interfaces : 4

A:ALA-A# show router interface 10.10.0.3/32
=====
Interface Table
=====
Interface-Name Type IP-Address Adm Opr Mode

system Pri 10.10.0.3/32 Up Up Network
=====
A:ALA-A#

A:ALA-A# show router interface exclude-services
=====
Interface Table
=====
Interface-Name Type IP-Address Adm Opr Mode

system Pri 10.10.0.3/32 Up Up Network
to-ser1 Pri 10.10.13.3/24 Up Up Network
to-ser4 Pri 10.10.34.3/24 Up Up Network

```

```

to-ser5 Pri 10.10.35.3/24 Up Up Network
to-ser6 n/a n/a Up Down Network
management Pri 192.168.2.93/20 Up Up Network
=====
A:ALA-A#

```

**Table 24** Standard IP Interface Field Descriptions

| Label          | Description                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interface-Name | The IP interface name                                                                                                                                                                                                                                                               |
| Type           | n/a — No IP address has been assigned to the IP interface, so the IP address type is not applicable<br>Pri — The IP address for the IP interface is the Primary address on the IP interface<br>Sec — The IP address for the IP interface is a secondary address on the IP interface |
| IP-Address     | The IP address and subnet mask length of the IP interface<br>n/a — Indicates no IP address has been assigned to the IP interface                                                                                                                                                    |
| Adm            | Down — The IP interface is administratively disabled<br>Up — The IP interface is administratively enabled                                                                                                                                                                           |
| Opr            | Down — The IP interface is operationally disabled<br>Up — The IP interface is operationally disabled                                                                                                                                                                                |
| Mode           | Network — The IP interface is a network/core IP interface<br>Service — The IP interface is a service IP interface                                                                                                                                                                   |
| Port/SAP Id    | The physical network port or the SAP identifier associated with the IP interface                                                                                                                                                                                                    |
| MACSec         | Lists the MACSec settings for the IP interface.                                                                                                                                                                                                                                     |

**Detailed IP Interface Output** — The following output is an example of detailed IP interface information, and [Table 25](#) describes the fields.

**Sample Output**

```

*A:SwSim100# show router interface "to101port1-1" detail
=====
Interface Table (Router: Base)
=====

Interface

If Name : to101port1-1

```

```

Admin State : Up
Down Reason V6 : ifProtoOperDown
Protocols : OSPFv2 ISIS LDP
IP Addr/mask : 100.101.1.1/24
IGP Inhibit : Disabled
HoldUp-Time : 0
Oper (v4/v6) : Up/Down
Address Type : Primary
Broadcast Address : Host-ones
Track Srrp Inst : 0

```

#### Details

```

Description : (Not Specified)
If Index : 4
Virt. If Index : 4
Last Oper Chg : 07/23/2018 17:55:49
Global If Index : 3
Lag Link Map Prof: none
Lag Per Link Hash
Class : 1
Weight : 1
Port Id : 1/1/c1/1
Macsec: enabled, subport 5, encap-match un-tag, ca ca-5
TOS Marking : Trusted
If Type : Network

```

\*A:Dut-B>config>router>if# show router interface "to-ASBR-F" detail

#### Interface Table (Router: Base)

#### Interface

```

If Name : to-ASBR-F
Admin State : Up
Down Reason V6 : ifProtoOperDown
Protocols : ISIS MPLS RSVP LDP
IP Addr/mask : 10.10.14.2/24
IGP Inhibit : Disabled
HoldUp-Time : 0
Oper (v4/v6) : Up/Up
Address Type : Primary
Broadcast Address : Host-ones
Track Srrp Inst : 0
IPv6 Address : 3ffe::a0a:e02/120
IPv6 Address Type: Primary
IPv6 Addr State : PREFERRED
CGA modifier : (Not Specified)
HoldUp-Time : 0
Track Srrp Inst : 0
Link Lcl Address : fe80::208b:1ff:fe01:8/64
Link Lcl State : PREFERRED

```

#### Details

```

Description : (Not Specified)
If Index : 4
Virt. If Index : 4
Last Oper Chg : 10/15/2018 15:43:04
Global If Index : 3
Lag Link Map Prof: none
Lag Per Link Hash
Class : 1
Weight : 1
Port Id : 1/1/8
TOS Marking : Trusted
If Type : Network
Egress Filter : none
Ingress Filter : none
Egr IPv6 Flt : none
Ingr IPv6 Flt : none
SNTP B.Cast : False
Network QoS Policy: 1
MAC Address : 22:8b:01:01:00:08
Mac Accounting : Disabled
Ingress stats : Disabled
IPv6 DAD : Enabled
TCP MSS V4 : 0
TCP MSS V6 : 0
ARP Timeout : 14400s
IPv6 Nbr ReachTime: 30s
ARP Retry Timer : 5000ms
IPv6 stale time : 14400s
ARP Limit : Disabled
IPv6 Nbr Limit : Disabled

```

```

ARP Threshold : Disabled
ARP Limit Log On* : Disabled
ARP Learn Unsoli* : Disabled
ARP Proactive Re* : Disabled
IP MTU : (default)
IP Oper MTU : 1500
ARP Populate : Disabled
Cflowd (unicast) : None
LdpSyncTimer : None
LSR Load Balance : system
EGR Load Balance : both
Vas If Type : none
TEID Load Balance : Disabled
SPI Load Balance : Disabled
uRPF Chk : disabled
uRPF Ipv6 Chk : disabled
uRPF Select VPRN : False
PTP HW Assist : Disabled
Rx Pkts : 996
Rx V4 Pkts : N/A
Rx V6 Pkts : N/A
Tx Pkts : 1583
Tx V4 Pkts : 1161
Tx V4 Discard Pk* : 0
Tx V6 Pkts : 422
Tx V6 Discard Pk* : 0
Tx DBcast Dis. P* : 0
Mpls Rx Pkts : 249
Mpls Tx Pkts : 340
GRE Termination : Disabled
Inter-AS selective ILM untrusted : Disabled
Untrusted default forwarding : forward

IPv6 Nbr Threshold: Disabled
IPv6 Nbr Log Only : Disabled
ND Learn Unsolici*: None
ND Proactive Refr*: None

Cflowd (multicast): None
Strip-Label : Disabled

Rx Bytes : 94024
Rx V4 Bytes : N/A
Rx V6 Bytes : N/A
Tx Bytes : 153481
Tx V4 Bytes : 110788
Tx V4 Discard Byt* : 0
Tx V6 Bytes : 42693
Tx V6 Discard Byt* : 0
Tx DBcast Dis. By* : 0
Mpls Rx Bytes : 24301
Mpls Tx Bytes : 32109

```

**Table 25 Detailed IP Interface Field Descriptions**

| Label         | Description                                                                                                                               |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| If Name       | The IP interface name                                                                                                                     |
| Admin State   | Down — The IP interface is administratively disabled<br>Up — The IP interface is administratively enabled                                 |
| Oper (v4/v6)  | Down — The IP interface is operationally disabled<br>Up — The IP interface is operationally enabled                                       |
| IP Addr/mask  | The IP address and subnet mask length of the IP interface<br>Not Assigned — Indicates no IP address has been assigned to the IP interface |
| IPv6 Addr     | The IPv6 address of the interface                                                                                                         |
| If Index      | The interface index of the IP router interface                                                                                            |
| Virt If Index | The virtual interface index of the IP router interface                                                                                    |

**Table 25 Detailed IP Interface Field Descriptions (Continued)**

| Label            | Description                                                                                                                                                                                                                                                   |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Last Oper Change | The last change in operational status                                                                                                                                                                                                                         |
| Global If Index  | The global interface index of the IP router interface                                                                                                                                                                                                         |
| Sap ID           | The SAP identifier                                                                                                                                                                                                                                            |
| TOS Marker       | The TOS byte value in the logged packet                                                                                                                                                                                                                       |
| If Type          | Network — The IP interface is a network/core IP interface<br>Service — The IP interface is a service IP interface                                                                                                                                             |
| SNTP B.cast      | Displays if the <b>broadcast-client</b> global parameter is configured                                                                                                                                                                                        |
| IES ID           | The IES identifier                                                                                                                                                                                                                                            |
| QoS Policy       | The QoS policy ID associated with the IP interface                                                                                                                                                                                                            |
| MAC Address      | The MAC address of the interface                                                                                                                                                                                                                              |
| Arp Timeout      | The ARP timeout for the interface, in seconds, which is the time an ARP entry is maintained in the ARP cache without being refreshed                                                                                                                          |
| ICMP Mask Reply  | False — The IP interface will not reply to a received ICMP mask request<br>True — The IP interface will reply to a received ICMP mask request                                                                                                                 |
| Arp Populate     | Displays whether ARP is enabled or disabled                                                                                                                                                                                                                   |
| Host Conn Verify | The host connectivity verification                                                                                                                                                                                                                            |
| LdpSyncTimer     | Specifies the IGP/LDP sync timer value                                                                                                                                                                                                                        |
| uRPF Chk         | Specifies whether unicast RPF (uRPF) Check is enabled on this interface                                                                                                                                                                                       |
| uRPF Iv6 Chk     | Specifies whether unicast RPF (uRPF) Check IPv6 is enabled on this interface                                                                                                                                                                                  |
| PTP HW Assist    | Specifies whether the PTP Hardware Assist function is enabled on this interface                                                                                                                                                                               |
| cflowd           | Specifies the type of cflowd analysis that is applied to the interface<br>acl — ACL cflowd analysis is applied to the interface<br>interface — Interface cflowd analysis is applied to the interface<br>none — No cflowd analysis is applied to the interface |

**Table 25 Detailed IP Interface Field Descriptions (Continued)**

| Label                            | Description                                                                                  |
|----------------------------------|----------------------------------------------------------------------------------------------|
| Inter-AS selective ILM untrusted | Specifies whether the inter-AS selective ILM untrusted function is enabled on this interface |
| Untrusted default forwarding     | Specifies whether the untrusted default forwarding function is enabled on this interface     |

**Statistics IP Interface Output** — The following output is an example of router IP interface statistics when **enable-interface-statistics** is enabled, and [Table 26](#) describes the fields.

**Sample Output**

```
A:ALA-A# show router interface "to_ixia" statistics
=====
Interface Statistics
=====
If Name : to_Ixia
Admin State : Up
Oper (v4/v6) : Up/Up
Rx Pkts : 6244
Rx Bytes : 599424
Rx V4 Pkts : 3122
Rx V4 Bytes : 299712
Rx V6 Pkts : 3122
Rx V6 Bytes : 299712
Tx Pkts : 0
Tx Bytes : 0
Tx V4 Pkts : 0
Tx V4 Bytes : 0
Tx V4 Discard Pk* : 0
Tx V4 Discard Byt* : 0
Tx V6 Pkts : 0
Tx V6 Bytes : 0
Tx V6 Discard Pk* : 0
Tx V6 Discard Byt* : 0
uRPF Chk Fail Pk* : 6244
uRPF Fail Bytes : 487032
uRPF Fail V4 Pk : 3122
uRPF Fail V4 Byt : 243516
uRPF Fail V6 Pk : 3122
uRPF Fail V6 Byt : 243516
Mpls Rx Pkts : 0
Mpls Rx Bytes : 0
Mpls Tx Pkts : 0
Mpls Tx Bytes : 0
=====
```

**Table 26 Statistics IP Interface Fields**

| Label       | Description                                        |
|-------------|----------------------------------------------------|
| Iframe      | The interface name.                                |
| Admin State | The administrative status of the router interface. |
| Oper        | The operational status of the router instance.     |

**Summary IP Interface Output** — The following output is an example of summary IP information, and [Table 27](#) describes the fields.

**Sample Output**

```
A:ALA-A# show router interface summary
=====
Router Summary (Interfaces)
=====
Instance Router Name Interfaces Admin-Up Oper-Up

1 Base 7 7 5
=====
```

**Table 27** Summary IP Interface Fields

| Label       | Description                                                                  |
|-------------|------------------------------------------------------------------------------|
| Instance    | The router instance number.                                                  |
| Router Name | The name of the router instance.                                             |
| Interfaces  | The number of IP interfaces in the router instance.                          |
| Admin-Up    | The number of administratively enabled IP interfaces in the router instance. |
| Oper-Up     | The number of operationally enabled IP interfaces in the router instance.    |

**Global-if-index Output** — The following output is an example of summary global-if-index information, and [Table 28](#) describes the fields.

### Sample Output

```
*A:SwSim102# show router interface global-if-index 1
=====
Interface Table (Router: Base)
=====
Interface-Name Adm Opr (v4/v6) Mode Port/SapId
IP-Address PfxState

loop1 Up Up/Down Network loopback
100.0.1.2/32 n/a

Interfaces : 1
=====
*A:SwSim102# show router interface global-if-index 1 detail
=====
Interface Table (Router: Base)
=====
Interface

If Name : loop1
Admin State : Up
Down Reason V6 : ifProtoOperDown
Protocols : OSPFv2
Oper (v4/v6) : Up/Down
```

```

IP Addr/mask : 100.0.1.2/32 Address Type : Primary
IGP Inhibit : Disabled Broadcast Address : Host-ones
HoldUp-Time : 0 Track Srrp Inst : 0

```

-----  
Details

```

Description : (Not Specified)
If Index : 2 Virt. If Index : 2
Last Oper Chg : 03/15/2018 01:00:02 Global If Index : 1
Lag Link Map Prof: none
Lag Per Link Hash
Class : 1 Weight : 1
Port Id : loopback
TOS Marking : Trusted If Type : Network
Egress Filter : none Ingress Filter : none
Egr IPv6 Flt : none Ingr IPv6 Flt : none
SNTP B.Cast : False Network QoS Policy: 1
MAC Address : d6:ce:ff:00:00:00 Mac Accounting : Disabled
Ingress stats : Disabled IPv6 DAD : Enabled
TCP MSS V4 : 0 TCP MSS V6 : 0
ARP Timeout : 14400s IPv6 Nbr ReachTime: 30s
ARP Retry Timer : 5000ms IPv6 stale time : 14400s
ARP Limit : Disabled IPv6 Nbr Limit : Disabled
ARP Threshold : Disabled IPv6 Nbr Threshold: Disabled
ARP Limit Log On* : Disabled IPv6 Nbr Log Only : Disabled
ARP Learn Unsoli* : Disabled ND Learn Unsolici*: None
ARP Proactive Re* : Disabled ND Proactive Refr*: None
IP MTU : (default)
IP Oper MTU : 1500
ARP Populate : Disabled
Cflowd (unicast) : None Cflowd (multicast): None
LdpSyncTimer : None Strip-Label : Disabled
LSR Load Balance : system
EGR Load Balance : both
Vas If Type : none
TEID Load Balance: Disabled
SPI Load Balance : Disabled
uRPF Chk : disabled
uRPF Ipv6 Chk : disabled
uRPF Select VPRN : False
Rx Pkts : 0 Rx Bytes : 0
Rx V4 Pkts : N/A Rx V4 Bytes : N/A
Rx DBcast Drop P* : 0 Rx DBcast Drop By*: 0
Rx V6 Pkts : N/A Rx V6 Bytes : N/A
Tx Pkts : 0 Tx Bytes : 0
Tx V4 Pkts : 0 Tx V4 Bytes : 0
Tx V4 Discard Pk* : 0 Tx V4 Discard Byt*: 0
Tx V6 Pkts : 0 Tx V6 Bytes : 0
Tx V6 Discard Pk* : 0 Tx V6 Discard Byt*: 0
Mpls Rx Pkts : 0 Mpls Rx Bytes : 0
Mpls Tx Pkts : 0 Mpls Tx Bytes : 0
OperDCpuProtPlcy : N/A
Proxy ARP Details
Rem Proxy ARP : Disabled Local Proxy ARP : Disabled
Policies : none

```

```

Proxy Neighbor Discovery Details
Local Pxy ND : Disabled
Policies : none

```



```

ICMP Details
Redirects : Number - 100 Time (seconds) - 10
Unreachables : Number - 100 Time (seconds) - 10
TTL Expired : Number - 100 Time (seconds) - 10
Parameter Problem: Number - 100 Time (seconds) - 10
ICMP Mask Reply : True
ICMPv6 Details
Packet Too Big : Number - 100 Time (seconds) - 10
Parameter Problem: Number - 100 Time (seconds) - 10
Redirects : Number - 100 Time (seconds) - 10
Time Exceeded : Number - 100 Time (seconds) - 10
Unreachables : Number - 100 Time (seconds) - 10
IPCP Address Extension Details
Peer IP Addr : Not configured
Peer Pri DNS Addr: Not configured
Peer Sec DNS Addr: Not configured

Network Domains Associated
default

Admin Groups

No Matching Entries

Srlg Groups

No Matching Entries

QoS Queue-Group Redirection Details

Ingress FP QGrp : (none) Egress Port QGrp : (none)
Ing FP QGrp Inst : (none) Egr Port QGrp Inst: (none)
=====
* indicates that the corresponding row element may have been truncated.

```

**Table 28 Global-if-index Interface Field Descriptions**

| Label          | Description                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interface-Name | The IP interface name                                                                                                                                                                                                                                                               |
| Type           | n/a — No IP address has been assigned to the IP interface, so the IP address type is not applicable<br>Pri — The IP address for the IP interface is the Primary address on the IP interface<br>Sec — The IP address for the IP interface is a secondary address on the IP interface |
| IP-Address     | The IP address and subnet mask length of the IP interface<br>n/a — Indicates no IP address has been assigned to the IP interface                                                                                                                                                    |

**Table 28 Global-if-index Interface Field Descriptions (Continued)**

| Label       | Description                                                                                                       |
|-------------|-------------------------------------------------------------------------------------------------------------------|
| Adm         | Down — The IP interface is administratively disabled<br>Up — The IP interface is administratively enabled         |
| Opr         | Down — The IP interface is operationally disabled<br>Up — The IP interface is operationally disabled              |
| Mode        | Network — The IP interface is a network/core IP interface<br>Service — The IP interface is a service IP interface |
| Port/SAP Id | The physical network port or the SAP identifier associated with the IP interface                                  |

## bindings

|                    |                                                                 |
|--------------------|-----------------------------------------------------------------|
| <b>Syntax</b>      | <b>bindings active</b>                                          |
| <b>Context</b>     | show>router>ldp                                                 |
| <b>Description</b> | This command displays LDP bindings information.                 |
| <b>Output</b>      | The following output is an example of LDP bindings information. |

**Sample Output**

```
*A:Dut-A# show router ldp bindings active
=====
Legend: U - Label In Use, N - Label Not In Use, W - Label Withdrawn
 WP - Label Withdraw Pending, BU - Alternate For Fast Re-Route
 (S) - Static (M) - Multi-homed Secondary Support
 (B) - BGP Next Hop (BU) - Alternate Next-hop for Fast Re-Route
=====
LDP IPv4 Prefix Bindings (Active)
=====
Prefix Op IngLbl EgrLbl EgrIntf/LspId EgrNextHop

10.20.1.1/32 Pop 131071 -- -- --
10.20.1.2/32 Push -- 131071 1/1/1 10.10.1.2
10.20.1.2/32 Swap 131070 131071 1/1/1 10.10.1.2
10.20.1.2/32 Push -- 262141BU 1/1/2 10.10.2.3
10.20.1.2/32 Swap 131070 262141BU 1/1/2 10.10.2.3
10.20.1.3/32 Push -- 131069BU 1/1/1 10.10.1.2
10.20.1.3/32 Swap 131069 131069BU 1/1/1 10.10.1.2
10.20.1.3/32 Push -- 262143 1/1/2 10.10.2.3
10.20.1.3/32 Swap 131069 262143 1/1/2 10.10.2.3
10.20.1.4/32 Push -- 131068 1/1/1 10.10.1.2
10.20.1.4/32 Swap 131068 131068 1/1/1 10.10.1.2
10.20.1.4/32 Push -- 262140BU 1/1/2 10.10.2.3
10.20.1.4/32 Swap 131068 262140BU 1/1/2 10.10.2.3
10.20.1.5/32 Push -- 131067BU 1/1/1 10.10.1.2
```

|              |      |        |          |       |           |
|--------------|------|--------|----------|-------|-----------|
| 10.20.1.5/32 | Swap | 131067 | 131067BU | 1/1/1 | 10.10.1.2 |
| 10.20.1.5/32 | Push | --     | 262139   | 1/1/2 | 10.10.2.3 |
| 10.20.1.5/32 | Swap | 131067 | 262139   | 1/1/2 | 10.10.2.3 |
| 10.20.1.6/32 | Push | --     | 131066   | 1/1/1 | 10.10.1.2 |
| 10.20.1.6/32 | Swap | 131066 | 131066   | 1/1/1 | 10.10.1.2 |
| 10.20.1.6/32 | Push | --     | 262138BU | 1/1/2 | 10.10.2.3 |
| 10.20.1.6/32 | Swap | 131066 | 262138BU | 1/1/2 | 10.10.2.3 |

-----  
No. of IPv4 Prefix Active Bindings: 10  
=====

LDP IPv4 Prefix Bindings (Active)  
=====

| Prefix     | Op          | IngLbl | EgrLbl |
|------------|-------------|--------|--------|
| EgrNextHop | EgrIf/LspId |        |        |

-----  
No Matching Entries Found  
=====

LDP Generic IPv4 P2MP Bindings (Active)  
=====

| P2MP-Id  | Interface   |        |        |
|----------|-------------|--------|--------|
| RootAddr | Op          | IngLbl | EgrLbl |
| EgrNH    | EgrIf/LspId |        |        |

-----  
No Matching Entries Found  
=====

LDP Generic IPv6 P2MP Bindings (Active)  
=====

| P2MP-Id  | Interface   |        |        |
|----------|-------------|--------|--------|
| RootAddr | Op          | IngLbl | EgrLbl |
| EgrNH    | EgrIf/LspId |        |        |

-----  
No Matching Entries Found  
=====

LDP In-Band-SSM IPv4 P2MP Bindings (Active)  
=====

| Source   | Interface   |        |        |
|----------|-------------|--------|--------|
| Group    | Op          | IngLbl | EgrLbl |
| RootAddr | EgrIf/LspId |        |        |
| EgrNH    |             |        |        |

-----  
No Matching Entries Found  
=====

LDP In-Band-SSM IPv6 P2MP Bindings (Active)  
=====

| Source   | Interface   |        |        |
|----------|-------------|--------|--------|
| Group    | Op          | IngLbl | EgrLbl |
| RootAddr | EgrIf/LspId |        |        |
| EgrNH    |             |        |        |

-----  
No Matching Entries Found  
=====

LDP In-Band-VPN-SSM IPv4 P2MP Bindings (Active)  
=====

```

=====
Source
Group RD Op
RootAddr Interface IngLbl EgrLbl
EgrNH EgrIf/LspId

No Matching Entries Found
=====

LDP In-Band-VPN-SSM IPv6 P2MP Bindings (Active)
=====
Source
Group RD Op
RootAddr Interface IngLbl EgrLbl
EgrNH EgrIf/LspId

No Matching Entries Found
=====

*A:Dut-A# show router ldp bindings
=====
LDP Bindings (IPv4 LSR ID 10.1.1.1:0)
 (IPv6 LSR ID ::[0])
=====
Legend: U - Label In Use, N - Label Not In Use, W - Label Withdrawn
 S - Status Signaled Up, D - Status Signaled Down
 E - Epipe Service, V - VPLS Service, M - Mirror Service
 A - Apipe Service, F - Fpipe Service, I - IES Service, R - VPRN service
 P - Ipipe Service, WP - Label Withdraw Pending, C - Cpipe Service
 BU - Alternate For Fast Re-Route, TLV - (Type, Length: Value)
=====
LDP IPv4 Prefix Bindings
=====
Prefix Peer IngLbl EgrLbl EgrIntf/ EgrNextHop
 LspId

10.20.1.1/32 10.20.1.2 131071U -- -- --
10.20.1.1/32 10.20.1.3 131071U -- -- --
10.20.1.2/32 10.20.1.2 -- 131071 1/1/1 10.10.1.2
10.20.1.2/32 10.20.1.3 131070U 262141 1/1/2 10.10.2.3
10.20.1.3/32 10.20.1.2 131069U 131069 1/1/1 10.10.1.2
10.20.1.3/32 10.20.1.3 -- 262143 1/1/2 10.10.2.3
10.20.1.4/32 10.20.1.2 131068N 131068 1/1/1 10.10.1.2
10.20.1.4/32 10.20.1.3 131068BU 262140 1/1/2 10.10.2.3
10.20.1.5/32 10.20.1.2 131067U 131067 1/1/1 10.10.1.2
10.20.1.5/32 10.20.1.3 131067N 262139 1/1/2 10.10.2.3
10.20.1.6/32 10.20.1.2 131066N 131066 1/1/1 10.10.1.2
10.20.1.6/32 10.20.1.3 131066BU 262138 1/1/2 10.10.2.3

No. of IPv4 Prefix Bindings: 12
=====

LDP IPv6 Prefix Bindings
=====
Prefix IngLbl EgrLbl
Peer EgrIntf/LspId
EgrNextHop

No Matching Entries Found

```

```

=====
LDP Generic IPv4 P2MP Bindings
=====
P2MP-Id
RootAddr Interface IngLbl EgrLbl
EgrNH EgrIf/LspId
Peer

100
10.1.1.1 Unknw -- 131051
10.90.90.2 1/1/6
10.2.2.2:0

104
10.1.1.1 Unknw -- 131050
10.90.90.2 1/1/6
10.2.2.2:0

600
10.1.1.1 Unknw -- 131049
10.90.90.2 1/1/6
10.2.2.2:0

700
10.1.1.1 Unknw -- 131048
10.90.90.2 1/1/6
10.2.2.2:0

800
10.1.1.1 Unknw -- 131047
10.90.90.2 1/1/6
10.2.2.2:0

900
10.1.1.1 Unknw -- 131046
10.90.90.2 1/1/6
10.2.2.2:0

1500
10.1.1.1 Unknw -- 131045
10.90.90.2 1/1/6
10.2.2.2:0

100
10.6.6.6 Unknw -- 131044
10.90.90.2 1/1/6
10.2.2.2:0

900
10.6.6.6 Unknw -- 131043
10.90.90.2 1/1/6
10.2.2.2:0

No. of Generic IPv4 P2MP Bindings: 9
=====
LDP Generic IPv6 P2MP Bindings
=====

```

```

=====
P2MP-Id
RootAddr Interface IngLbl EgrLbl
EgrNH EgrIf/LspId
Peer

No Matching Entries Found
=====
LDP In-Band-SSM IPv4 P2MP Bindings
=====
Source
Group
RootAddr Interface IngLbl EgrLbl
EgrNH EgrIf/LspId
Peer

No Matching Entries Found
=====
LDP In-Band-SSM IPv6 P2MP Bindings
=====
Source
Group
RootAddr Interface IngLbl EgrLbl
EgrNH EgrIf/LspId
Peer

No Matching Entries Found
=====
LDP In-Band-VPN-SSM IPv4 P2MP Bindings
=====
Source
Group RD
RootAddr Interface IngLbl EgrLbl
EgrNH EgrIf/LspId
Peer

10.1.1.1
10.0.0.1 10.1.1.1:100
10.3.3.3 Unknwn -- 100
10.60.60.1 1/1/1
10.2.2.2:10

10.1.1.1
10.0.0.1 1.1.1.1:100
10.3.3.3 Unknwn -- 100
10.60.60.1 1/1/1
10.2.2.2:10

10.1.1.1
10.0.0.1 1.1.1.1:100
10.3.3.3 Unknwn -- 100
10.60.60.1 1/1/1
10.2.2.2:10

No. of In-Band-VPN-SSM IPv4 P2MP Bindings: 3
=====

```

```

=====
LDP In-Band-VPN-SSM IPv6 P2MP Bindings
=====
Source
Group RD
RootAddr Interface IngLbl EgrLbl
EgrNH EgrIf/LspId
Peer

10.1.1.1
10.0.0.1 1.1.1.1:100
2000::3000 Unknwn -- 100
10.60.60.1 1/1/1
10.2.2.2:10

10.1.1.1
10.0.0.1 1.1.1.1:100
2000::3000 Unknwn -- 100
10.60.60.1 1/1/1
10.2.2.2:10

10.1.1.1
10.0.0.1 1.1.1.1:100
2000::3000 Unknwn -- 100
10.60.60.1 1/1/1
10.2.2.2:10

No. of In-Band-VPN-SSM IPv6 P2MP Bindings: 3
=====
LDP Service FEC 128 Bindings
=====
Type VCId SDPId IngLbl LMTU
Peer SvcId EgrLbl RMTU

?-Eth 100 R. Src -- None
10.2.2.2:0 Ukwn 131023D 986

?-Eth 500 R. Src -- None
10.2.2.2:0 Ukwn 131022D 1386

?-Eth 2001 R. Src -- None
10.2.2.2:0 Ukwn 131019D 986

?-Eth 2003 R. Src -- None
10.2.2.2:0 Ukwn 131017D 986

?-Ipipe 1800 R. Src -- None
10.2.2.2:0 Ukwn 131014D 1486

No. of VC Labels: 5
=====
LDP Service FEC 129 Bindings
=====
SAII AGII IngLbl LMTU

```

```

TAII Type EgrLbl RMTU
Peer SvcId SDPIId

No Matching Entries Found
=====

```

## mvpn

- Syntax** **mvpn**
- Context** show>router router-instance
- Description** This command displays multicast VPN related information. The router instance must be specified.
- Output** The following output is an example of MVPN information for the router-instance.

### Sample Output

```

*A:Dut-C# show router 1 mvpn
=====
MVPN 1 configuration data
=====
signaling : Bgp auto-discovery : Enabled
UMH Selection : Highest-Ip intersite-shared : Enabled
vrf-import : N/A
vrf-export : N/A
vrf-target : target:1:1
C-Mcast Import RT : target:239.20.1.3:2

ipmsi : pim-asm 239.1.1.1
admin status : Up three-way-hello : N/A
hello-interval : N/A hello-multiplier : 35 * 0.1
tracking support : Disabled Improved Assert : N/A

spmsi : pim-ssm 239.0.0.0/32
join-tlv-packing : N/A
data-delay-interval: 3 seconds
data-threshold : 224.0.0.0/4 --> 1 kbps
=====

```

## neighbor

- Syntax** **neighbor** [{*ip-int-name* | *ip-address*} | **mac** *ieee-mac-address* | **summary**] [{**dynamic** | **static** | **managed**}]
- Context** show>router
- Description** This command displays information about the IPv6 neighbor cache.
- Parameters** *ip-int-name* — Specifies the IP interface name.



*ip-address* — Specifies the address of the IPv6 interface address.

*ieee-mac-address* — Specifies the MAC address.

**summary** — Displays summary neighbor information.

**dynamic** — Displays dynamic neighbor information.

**static** — Displays static neighbor information.

**managed** — Displays managed neighbor information.

**Output** **Neighbor Output** — The following output is an example of IPv6 neighbor information, and [Table 29](#) describes the fields.

### Sample Output

```
B:CORE2# show router neighbor
=====
Neighbor Table (Router: Base)
=====
IPv6 Address Interface
 MAC Address State Expiry Type RTR

fe80::203:faff:fe78:5c88 net1_1_2
 00:16:4d:50:17:a3 STALE 03h52m08s Dynamic Yes
fe80::203:faff:fe81:6888 net1_2_3
 00:03:fa:1a:79:22 STALE 03h29m28s Dynamic Yes

No. of Neighbor Entries: 2
=====
B:CORE2#
```

**Table 29** Neighbor Fields

| Label        | Description                                            |
|--------------|--------------------------------------------------------|
| IPv6 Address | Displays the IPv6 address                              |
| Interface    | Displays the name of the IPv6 interface name           |
| MAC Address  | Specifies the link-layer address                       |
| State        | Displays the current administrative state              |
| Exp          | Displays the number of seconds until the entry expires |
| Type         | Displays the type of IPv6 interface                    |
| Interface    | Displays the interface name                            |
| Rtr          | Specifies whether a neighbor is a router               |
| Mtu          | Displays the MTU size                                  |

## network-domains

**Syntax**     **network-domains** [**detail**] [*network-domain-name*]  
**network-domains** *network-domain-name* **interface-association**  
**network-domains** [*network-domain-name*] **mcast-association** [**state** {**consistent** | **inconsistent**}]  
**network-domains** *network-domain-name* **sdp-association**

**Context**     show>router

**Description**     This command displays network-domains information.

**Parameters**     **detail** — Displays detailed network-domains information.  
*network-domain-name* — Displays information for a specific network domain.  
**interface-association** — Displays information for a interface network domain association.  
**mcast-association** — Displays information for a multicast network domain association.  
**state** — Displays information for the state of a network domain.

**Values**     consistent, inconsistent

**sdp-association** — Displays information for an SDP network domain association

**Output**     The following output is an example of network domain information.

### Sample

```
*A:Dut-T>config>router# show router network-domains
=====
Network Domain Table
=====
Network Domain Description

net1 Network domain 1
default Default Network Domain

Network Domains : 2
=====
*A:Dut-T>config>router#

*A:Dut-T>config>router# show router network-domains detail
=====
Network Domain Table (Router: Base)
=====

Network Domain : net1

Description : Network domain 1
No. Of Ifs Associated : 2
No. Of SDPs Associated : 0

```

```
Network Domain : default

Description : Default Network Domain
No. Of Ifs Associated : 3
No. Of SDPs Associated : 0
=====
*A:Dut-T>config>router#

*A:Dut-T>config>router# show router network-domains "net1" interface-association
=====
Interface Network Domain Association Table
=====
Interface Name Port Network Domain

intf1 1/2/2 net1
intf2 6/1/2 net1

Interfaces : 2
=====
*A:Dut-T>config>router#

*A:Dut-T>config>service# show router network-domains "net1" sdp-association
=====
SDP Network Domain Association Table
=====
SDP Id Network Domain

100 net1

SDPs : 1
=====
*A:Dut-T>config>service#
```

origin-validation

|                    |                                                                            |
|--------------------|----------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>origin-validation</b>                                                   |
| <b>Context</b>     | show>router                                                                |
| <b>Description</b> | This command enables the context to display origin validation information. |

database

|                |                                                                                                                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>database</b> [ <i>family</i> ] [ <i>ip-prefix/ip-prefix-length</i> ] [ <b>up to</b> <i>prefix-length</i> ] [ <b>origin-as</b> <i>as-number</i> ]<br><b>database</b> [ <i>family</i> ] [ <i>ip-prefix/ip-prefix-length</i> ] { <b>longer</b> }<br><b>database</b> { <b>summary</b> }<br><b>database</b> [ <i>family</i> ] [{ <b>static</b> } |
| <b>Context</b> | show>router>origin-validation                                                                                                                                                                                                                                                                                                                  |

- Description** This command displays database information.
- Parameters** *family* — Specifies the type of routing information to be displayed.
- Values**     *ipv4* — Displays IPv4 entries.  
                  *ipv6* — Displays IPv6 entries.
- ip-prefix/ip-prefix-length* — Displays routes only matching the specified IP address and length, up to 64 characters.
- prefix-length* — Displays routes matching up to the specified length.
- Values**     1 to 128
- as-number* — Specifies the origin AS number.
- Values**     0 to 4294967295
- longer** — Displays routes matching the *ip-prefix-ip-prefix-length* and routes with longer masks.
- summary** — Displays database summary information.
- static** — Displays static routes.
- Output** The following output is an example of database information.

**Sample Output**

```
A:Dut-C# show router origin-validation database
=====
Static and Dynamic VRP Database Entries
=====
Prefix Range [Flags] Origin AS
 Session IP [Flags]

10.0.0.0/16-24 [Static-V] 65001
-
10.16.0.0/12-12 [Dynamic] 65002
 10.168.1.1 [B]

No. of Vrp Database Entries: 2

Flags: B = Base instance session
 M = Management instance session
 Static-V = Static-Valid; Static-I = Static-Invalid
=====

A:Dut-C# show router origin-validation database summary
=====
Static and Dynamic VRP Database Summary
=====
Type IPv4 Routes IPv6 Routes

10.168.1.1-B 1 0
Static 1 0
=====
```

## rpki-session

|                    |                                                                                     |
|--------------------|-------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>rpki-session</b> [ <i>ip-address</i> ] [ <b>detail</b> ]                         |
| <b>Context</b>     | show>router>origin-validation                                                       |
| <b>Description</b> | This command displays RPKI session information.                                     |
| <b>Parameters</b>  | <i>ip-address</i> — Displays RPKI session information for the specified IP address. |
| <b>Values</b>      |                                                                                     |
| ipv4-address:      | a.b.c.d                                                                             |
| ipv6-address       | x:x:x:x:x:x:x<br>x:x:x:x:x:d.d.d.d                                                  |
|                    | where:                                                                              |
|                    | x: [0 to FFFF]H                                                                     |
|                    | d: [0 to 255]D                                                                      |
|                    | interface: 32 chars max, and mandatory for link local addresses.                    |

**detail** — Displays the longer, more detailed version of the output.

**Output** The following output is an example of RPKI session information.

### Sample Output

```
A:Dut-C# show router origin-validation rpki-session detail
=====
Rpki Session Information
=====
IP Address : 10.168.1.1

Port : 323 Oper State : established
UpTime : 0d 00:57:41 Flaps : 0
Active IPv4 records: 17023 Active IPv6 records: 2515
Admin State : Up Local Address : n/a
Admin State : Up Local Address : 10.0.2.2
Hold Time : 120 Refresh Time : 60
Stale Route Time : 3600 Connect Retry : 120
Serial ID : 41690 Session ID : 1452020198
=====
No. of Rpki-Sessions : 1
=====
```

## policy

**Syntax** **policy** [{*plcy-name* | **damping** [*damping-profile-name*] | **prefix-list** [*prefix-list-name*] | **as-path** [*asp-name*] | **as-path-group** [*asp-group-name*] | **community** [*community-name*] |

```

 admin | exclusive-access | global-variables}}
policy [plcy-name] [expand-variables]
policy plcy-name sub-policy entry entry-id [name subpol-name]
policy plcy-name sub-policy entry entry-id name subpol-name entry-2 entry-id name-2
 subpol-name
policy plcy-name sub-policy entry entry-id name subpol-name entry-2 entry-id name-2
 subpol-name entry-3 entry-id name-3 subpol-name

```

**Context** show>router

**Description** This command displays policy-related information.

**Parameters**

- plcy-name* — Specifies an existing policy-statement name.
- damping-profile-name* — Specifies damping to display route damping profiles.
- prefix-list-name* — Specifies a prefix list name to display the route policy entries.
- asp-name* — Specifies the route policy AS path name to display route policy entries.
- asp-group-name* — Specifies the route policy AS path group name.
- community-name* — Specifies a route policy community name to display information about a specific community member.
- admin** — Specifies the **admin** keyword to display the entities configured in the **config>router>policy-options** context.
- exclusive-access** — Displays the policy that edits exclusive access information.
- exclusive-access** — Displays the policy that edits exclusive access information.
- global-variables** — Displays the global variables.
- expand-variables** — Displays the variables that are replaced with values in main policies or in sub-policies.
- sub-policy** — When this keyword is specified, the configuration of a subroutine policy is displayed.
- entry-id* — Specifies the numeric entry identifier of the policy.

**Values** 1 to 4294967295

*subpol-name* — Specifies the policy name up to 64 characters.

**Output** The following output is an example of router policy information, and [Table 30](#) describes the fields.

### Sample Output

```

B:CORE2# show router policy
=====
Route Policies
=====
Policy Description

fromStatic

```

```

Policies : 1

B: CORE2#
```

**Table 30 Policy Fields**

| Label       | Description                             |
|-------------|-----------------------------------------|
| Policy      | The policy name.                        |
| Description | Displays the description of the policy. |

## policy-edits

|                    |                                                  |
|--------------------|--------------------------------------------------|
| <b>Syntax</b>      | <b>policy-edits</b>                              |
| <b>Context</b>     | show>router                                      |
| <b>Description</b> | This command displays edited policy information. |

## route-table

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>route-table</b> [ <i>family</i> ] [ <i>ip-prefix[/prefix-length]</i> ] [{ <b>longer</b>   <b>exact</b>   <b>protocol</b> <i>protocol-name</i> }] [ <b>all</b> ]<br>[ <b>next-hop-type</b> <i>type</i> ] [ <b>qos</b> ] [ <b>alternative</b> ] [ <b>accounting-class</b> ]<br><b>route-table</b> [ <i>family</i> ] <b>summary</b><br><b>route-table</b> <i>tunnel-endpoints</i> [ <i>ip-prefix[/prefix-length]</i> ] [{ <b>longer</b>   <b>exact</b> }] [ <b>detail</b> ]<br><b>route-table</b> [ <i>family</i> ] [ <i>ip-prefix[/prefix-length]</i> ] [{ <b>longer</b>   <b>exact</b>   <b>protocol</b> <i>protocol-name</i> }]<br><b>extensive</b> [ <b>all</b> ] |
| <b>Context</b>     | show>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | This command displays the active routes in the routing table.<br><br>If no command line arguments are specified, all routes are displayed, sorted by prefix.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <i>family</i> — Specifies the type of routing information to be distributed by this peer group.<br><br><b>Values</b> <ul style="list-style-type: none"> <li><b>ipv4</b> — Displays only those BGP peers that have the IPv4 family enabled and not those capable of exchanging IP-VPN routes.</li> <li><b>ipv6</b> — Displays the BGP peers that are IPv6 capable.</li> <li><b>mcast-ipv4</b> — Displays the BGP peers that are IPv4 multicast capable.</li> <li><b>mcast-ipv6</b> — Displays multicast IPv6 route table.</li> </ul>                                                                                                                                   |

*ip-prefix[/prefix-length]* — Displays routes only matching the specified *ip-address* and length.

**Values** The following values apply to the 7750 SR and 7950 XRS:

|                     |                                                          |
|---------------------|----------------------------------------------------------|
| ipv4-prefix:        | a.b.c.d (host bits must be set to 0)                     |
| ipv4-prefix-length: | 0 to 32                                                  |
| ipv6                | ipv6-prefix[/pref*]: x:x:x:x:x:x:x (eight 16-bit pieces) |
|                     | x:x:x:x:x:d.d.d.d                                        |
|                     | x: [0 to FFFF]H                                          |
|                     | d: [0 to 255]D                                           |
| prefix-length:      | 1 to 128ipv6                                             |

**Values** The following values apply to the 7450 ESS:

|                     |                                      |
|---------------------|--------------------------------------|
| ipv4-prefix:        | a.b.c.d (host bits must be set to 0) |
| ipv4-prefix-length: | 0 to 32                              |

**longer** — Displays routes matching the *ip-prefix/mask* and routes with longer masks.

**exact** — Displays the exact route matching the *ip-prefix/mask* masks.

*protocol-name* — Displays routes learned from the specified protocol.

**Values** local, sub-mgmt, managed, static, ospf, ospf3, isis, rip, aggregate, bgp, bgp-vpn

*type* — Displays only the tunneled next-hops. For each route entry, the tunnel owner and tunnel ID is shown.

**qos** — Displays the QoS priority and FC value information.

**alternative** — Displays backup route details.

**accounting-class** — Displays the accounting class.

**summary** — Displays a route table summary information.

*tunnel-endpoints* — Specifies to include tunnel endpoint information.

**detail** — Displays detailed routing table information.

**extensive** — Displays extensive route table information.

**Output** **Standard Route Table Output** — The following output is an example of standard route table information, and [Table 31](#) describes the fields.

### Sample Output

```
*A:Dut-B#config>service>vprn# show router 1 route-table
```



```
=====
Route Table (Service: 1)
=====
Dest Prefix[Flags] Type Proto Age Pref
 Next Hop[Interface Name] Metric

10.0.0.0/30 Local Local 02h09m23s 0
 to_4007 0
10.0.0.8/30 Remote BGP VPN 00h06m38s 170
 10.1.1.9 (tunneled) 0
10.0.0.8/30 Remote BGP VPN 00h06m38s 170
 10.1.1.9 (tunneled) 0
10.168.0.0/16 [E] Remote BGP VPN 00h06m38s 170
 10.1.1.9 (tunneled) 0
10.168.0.0/16 [E] Remote BGP VPN 00h06m38s 170
 10.1.1.9 (tunneled) 0

No. of Routes: 4
Flags: L = LFA nexthop available B = BGP backup route available
 E = best-external BGP route available
 n = Number of times nexthop is repeated
=====
```

\*A:Dut-B#config>service>vprn# show router 1 route-table alternative

```
=====
Route Table (Service: 1)
=====
Dest Prefix[Flags] Type Proto Age Pref
 Next Hop[Interface Name] Metric
 Alt-NextHop Alt-
 Metric

10.0.0.0/30 Local Local 02h17m23s 0
 to_4007 0
10.0.0.8/30 Remote BGP VPN 00h14m37s 170
 10.1.1.9 (tunneled) 0
10.0.0.8/30 Remote BGP VPN 00h14m37s 170
 10.1.1.9 (tunneled) 0
10.168.0.0/16 Remote BGP VPN 00h14m37s 170
 10.1.1.9 (tunneled) 0
10.168.0.0/16 (Backup) Remote BGP VPN 00h14m37s 170
 10.1.1.9 (tunneled) 0
10.168.0.0/16 (Best-ext) Remote BGP 00h24m37s 170
 10.0.0.9 0

No. of Routes: 5
Flags: Backup = BGP backup route LFA = Loop-Free Alternate nexthop
 Best-ext = best-external BGP route
 n = Number of times nexthop is repeated
=====
```

\*A:Dut-B# show router route-table

```
=====
Route Table (Router: Base)
=====
Dest Prefix[Flags] Type Proto Age Pref
Next Hop[Interface Name] Metric
```

```

10.10.1.0/24 Local Local 00h01m25s 0
ip-10.10.1.2 0
10.10.2.0/24 [L] Remote ISIS 00h00m58s 15
10.10.12.3 13
10.10.3.0/24 Local Local 00h01m25s 0
ip-10.10.3.2 0
10.10.4.0/24 Local Local 00h01m25s 0
ip-10.10.4.2 0
10.10.5.0/24 [L] Remote ISIS 00h00m58s 15
10.10.12.3 13
10.10.6.0/24 [L] Remote ISIS 00h00m58s 15
10.10.4.4 20
10.10.9.0/24 [L] Remote ISIS 00h00m58s 15
10.10.4.4 20
10.10.10.0/24 [L] Remote ISIS 00h00m58s 15
10.10.12.3 23
10.10.11.0/24 [L] Remote ISIS 00h00m58s 15
10.10.12.3 13
10.10.12.0/24 Local Local 00h01m25s 0
ip-10.10.12.2 0
10.20.1.1/32 [L] Remote ISIS 00h00m58s 15
10.10.1.1 10
10.20.1.2/32 Local Local 00h01m25s 0
system 0
10.20.1.3/32 [L] Remote ISIS 00h00m58s 15
10.10.12.3 3
10.20.1.4/32 [L] Remote ISIS 00h00m58s 15
10.10.4.4 10
10.20.1.5/32 [L] Remote ISIS 00h00m58s 15
10.10.12.3 13
10.20.1.6/32 [L] Remote ISIS 00h00m58s 15
10.10.4.4 20

```

No. of Routes: 16

Flags: L = LFA nexthop available B = BGP backup route available

```

=====
*A:Dut-B# show router route-table alternative
=====

```

Route Table (Router: Base)

```

=====
Dest Prefix[Flags] Type Proto Age Pref

```

```

Next Hop[Interface Name] Metric

```

```

Alt-NextHop Alt-Metric

```

```

10.10.1.0/24 Local Local 00h02m28s 0
ip-10.10.1.2 0
10.10.2.0/24 Remote ISIS 00h02m01s 15
10.10.12.3 13
10.10.1.1 (LFA) 20
10.10.3.0/24 Local Local 00h02m27s 0
ip-10.10.3.2 0
10.10.4.0/24 Local Local 00h02m28s 0
ip-10.10.4.2 0
10.10.5.0/24 Remote ISIS 00h02m01s 15
10.10.12.3 13
10.10.1.1 (LFA) 20
10.10.6.0/24 Remote ISIS 00h02m01s 15

```

```
No. of Routes: 16
Flags: Backup = BGP backup routeLFA = Loop-Free Alternate nexthop
```

Route Table (Router: Base)

No. of Routes: 1

Route Table (Router: Base)

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```

10.2.103.0/24 Remote OSPF
00h59m02s 10
 10.2.4.2 2
10.2.103.0/24 Remote OSPF
00h59m02s 10
 10.2.4.2 2
10.2.103.0/24 Remote OSPF
00h59m02s 10
 10.2.4.2 2
10.2.103.0/24 Remote OSPF
00h59m02s 10
 10.0.0.1 2
10.2.103.0/24 Remote OSPF
00h59m02s 10
 10.128.0.1 2
10.4.101.0/24 Local Local 02h14m29s 0
...

A:ALA#

B:ALA-B# show router route-table 10.10.0.0 exact
=====
Dest Address Next Hop Type Proto Age Metric Pref

10.10.0.0/16 Black Hole Remote Static 00h03m17s 1 5

No. of Routes: 1
=====

B:ALA-B#
A:ALA-A# show router route-table 10.10.0.4
=====
Route Table
=====
Dest Address Next Hop Type Protocol Age Metric Pref

10.10.0.4/32 10.10.34.4 Remote OSPF 3523 1001 10

A:ALA-A#

A:ALA-A# show router route-table 10.10.0.4/32 longer
=====
Route Table
=====
Dest Address Next Hop Type Protocol Age Metric Pref

10.10.0.4/32 10.10.34.4 Remote OSPF 3523 1001 10

No. of Routes: 1
=====
+ : indicates that the route matches on a longer prefix
A:ALA-A#

*A:Dut-C# show router route-table
=====
Route Table (Router: Base)
=====
Dest Prefix[Flags] Type Proto Age Pref
 Next Hop[Interface Name] Metric

```

```

10.1.2.0/24 Remote ISIS 00h44m24s 15
 10.1.3.1 20
10.1.2.0/24 Remote ISIS 00h44m24s 15
 10.2.3.2 20
10.1.3.0/24 Local Local 00h44m30s 0
 to_Dut-A 0
10.1.9.0/24 Remote ISIS 00h44m16s 15
 10.1.3.1 20
10.2.3.0/24 Local Local 00h44m30s 0
 to_Dut-B 0
10.2.9.0/24 Remote ISIS 00h43m55s 160
 10.2.3.2 10
10.12.0.0/24 Local Local 00h44m29s 0
 itfToArborCP_02 0
10.20.1.1/32 Remote ISIS 00h44m24s 15
 10.1.3.1 10
10.20.1.2/32 Remote ISIS 00h44m28s 15
 10.2.3.2 10
10.20.1.3/32 Local Local 00h44m32s 0
 system 0
10.12.0.43/32 Remote Static 00h44m31s 5
 vprn1:mda-1-1 1
10.12.0.44/32 Remote Static 00h44m31s 5
 vprn1:mda-2-1 1
10.12.0.45/32 Remote Static 00h44m31s 5
 vprn1:mda-2-2 1
10.12.0.46/32 Remote Static 00h44m30s 5
 vprn1:mda-3-1 1
10.203.71.202/32 Remote Static 00h44m29s 5
 10.12.0.2 1

```

No. of Routes: 17

Flags: L = LFA nexthop available    B = BGP backup route available

      n = Number of times nexthop is repeated

=====

A:ALA-A# show router route-table protocol ospf

=====

Route Table

```

=====
Dest Address Next Hop Type Protocol Age Metric Pref

10.10.0.1/32 10.10.13.1 Remote OSPF 65844 1001 10
10.10.0.2/32 10.10.13.1 Remote OSPF 65844 2001 10
10.10.0.4/32 10.10.34.4 Remote OSPF 3523 1001 10
10.10.0.5/32 10.10.35.5 Remote OSPF 1084022 1001 10
10.10.12.0/24 10.10.13.1 Remote OSPF 65844 2000 10
10.10.15.0/24 10.10.13.1 Remote OSPF 58836 2000 10
10.10.24.0/24 10.10.34.4 Remote OSPF 3523 2000 10
10.10.25.0/24 10.10.35.5 Remote OSPF 399059 2000 10
10.10.45.0/24 10.10.34.4 Remote OSPF 3523 2000 10

```

A:ALA-A#

show router route-table 10.132.133.134/32 next-hop-type tunneled

Route Table (Router: Base)

```

=====
Dest Prefix Type Proto Age Pref

```

```

Next Hop[Interface Name] Metric

10.132.133.134/32 Remote OSPF 00h02m09s 10
10.66.66.66 10
Next-hop type: tunneled, Owner: RSVP, Tunnel-ID: <out-ifindex-from-route>

No. of Routes: 1
=====
*A:Dut-B# show router route-table next-hop-type tunneled
=====
Route Table (Router: Base)
=====
Dest Prefix Next Hop[Interface Name] Type Proto Age Pref

10.10.5.0/24 10.20.1.5 (tunneled:RSVP:1) Remote OSPF 00h02m20s 10
 1100
10.10.10.0/24 10.20.1.5 (tunneled:RSVP:1) Remote OSPF 00h02m20s 10
 1100
10.20.1.5/32 10.20.1.5 (tunneled:RSVP:1) Remote OSPF 00h02m20s 10
 100
10.20.1.6/32 10.20.1.5 (tunneled:RSVP:1) Remote OSPF 00h02m20s 10
 1100

No. of Routes: 4
=====
*A:Dut-B# show router route-table 10.20.1.5/32 next-hop-type tunneled
=====
Route Table (Router: Base)
=====
Dest Prefix Next Hop[Interface Name] Type Proto Age Pref

10.20.1.5/32 10.20.1.5 (tunneled:RSVP:1) Remote OSPF 00h03m55s 10
 100

No. of Routes: 1
=====
*A:Dut-C#
*A:Dut-C# show router route-table summary
=====
Route Table Summary (Router: Base)
=====
Active Available

Static 5 5
Direct 12 12
Host 0 11
BGP 0 0
BGP (Backup) 0 0
VPN Leak 0 0
OSPF 0 0
ISIS 6 6
ISIS (LFA) 0 0
RIP 0 0
LDP 0 0
Aggregate 0 0

```

|          |    |    |
|----------|----|----|
| Sub Mgmt | 0  | 0  |
| Managed  | 0  | 0  |
| NAT      | 0  | 0  |
| -----    |    |    |
| Total    | 24 | 35 |

=====

NOTE: ISIS LFA routes and BGP Backup routes are not counted towards the total.

\*A:Dut-C# show router route-table ipv6

=====

IPv6 Route Table (Router: Base)

| Dest Prefix[Flags]                   | Type   | Proto      | Age       | Pref |
|--------------------------------------|--------|------------|-----------|------|
| Next Hop[Interface Name]             |        |            | Metric    |      |
| -----                                |        |            |           |      |
| 3ffe::10:10:2:0/120                  | Local  | Local      | 00h04m41s | 0    |
| ip-10.10.2.3                         |        |            | 0         |      |
| 3ffe::10:10:3:0/120                  | Local  | Local      | 00h04m41s | 0    |
| ip-10.10.3.3                         |        |            | 0         |      |
| 3ffe::10:10:4:0/120                  | Remote | OSPF3 (31) | 00h03m58s | 10   |
| fe80::2052:1ff:fe01:3-"ip-10.10.3.3" |        |            | 2000      |      |
| 3ffe::10:10:5:0/120                  | Local  | Local      | 00h04m41s | 0    |
| ip-10.10.5.3                         |        |            | 0         |      |
| 3ffe::10:10:6:0/120                  | Remote | OSPF3 (31) | 00h03m57s | 10   |
| fe80::205e:1ff:fe01:1-"ip-10.10.5.3" |        |            | 2000      |      |
| 3ffe::10:10:9:0/120                  | Remote | OSPF3 (31) | 00h03m36s | 10   |
| 10.20.1.4 (tunneled:RSVP:1)          |        |            | 3000      |      |
| 3ffe::10:10:13:0/120                 | Remote | OSPF3 (31) | 00h04m03s | 10   |
| fe80::6628:1ff:fe01:2-"ip-10.10.2.3" |        |            | 2000      |      |
| 3ffe::10:10:14:0/120                 | Remote | OSPF3 (31) | 00h03m36s | 10   |
| 10.20.1.4 (tunneled:RSVP:1)          |        |            | 4000      |      |
| 3ffe::10:20:1:1/128                  | Remote | OSPF3 (31) | 00h04m03s | 10   |
| fe80::6628:1ff:fe01:2-"ip-10.10.2.3" |        |            | 1000      |      |
| 3ffe::10:20:1:2/128                  | Remote | OSPF3 (31) | 00h03m58s | 10   |
| fe80::2052:1ff:fe01:3-"ip-10.10.3.3" |        |            | 1000      |      |
| 3ffe::10:20:1:3/128                  | Local  | Local      | 00h04m42s | 0    |
| system                               |        |            | 0         |      |
| 3ffe::10:20:1:4/128                  | Remote | OSPF3 (31) | 00h03m36s | 10   |
| 10.20.1.4 (tunneled:RSVP:1)          |        |            | 2000      |      |
| 3ffe::10:20:1:5/128                  | Remote | OSPF3 (31) | 00h03m58s | 10   |
| fe80::205e:1ff:fe01:1-"ip-10.10.5.3" |        |            | 1000      |      |
| 3ffe::10:20:1:6/128                  | Remote | OSPF3 (31) | 00h03m36s | 10   |
| 10.20.1.4 (tunneled:RSVP:1)          |        |            | 3000      |      |
| 3ffe::100:100:100:4/128              | Remote | OSPF3 (31) | 00h03m36s | 10   |
| 10.20.1.4 (tunneled:RSVP:1)          |        |            | 2000      |      |
| 3ffe::100:100:100:6/128              | Remote | OSPF3 (31) | 00h03m36s | 10   |
| 10.20.1.4 (tunneled:RSVP:1)          |        |            | 3000      |      |

-----

No. of Routes: 16

Flags: n = Number of times nexthop is repeated

B = BGP backup route available

L = LFA nexthop available

S = Sticky ECMP requested

=====

\*A:Dut-C# show router route-table ipv6 3ffe::100:100:100:6/128

=====

IPv6 Route Table (Router: Base)

| Dest Prefix[Flags]<br>Next Hop[Interface Name]         | Type   | Proto      | Age       | Pref<br>Metric |
|--------------------------------------------------------|--------|------------|-----------|----------------|
| 3ffe::100:100:100:6/128<br>10.20.1.4 (tunneled:RSVP:1) | Remote | OSPF3 (31) | 00h03m47s | 10<br>3000     |

-----

No. of Routes: 1

Flags: n = Number of times nexthop is repeated

B = BGP backup route available

L = LFA nexthop available

S = Sticky ECMP requested

=====

\*A:Dut-C# show router route-table ipv6 3ffe::100:100:100:6/128 extensive

=====

Route Table (Router: Base)

=====

|              |                             |
|--------------|-----------------------------|
| Dest Prefix  | : 3ffe::100:100:100:6/128   |
| Protocol     | : OSPF3 (31)                |
| Age          | : 00h03m49s                 |
| Preference   | : 10                        |
| Next-Hop     | : 10.20.1.4 (RSVP tunnel:1) |
| Label        | : 2                         |
| QoS          | : Priority=n/c, FC=n/c      |
| Source-Class | : 0                         |
| Dest-Class   | : 0                         |
| Metric       | : 3000                      |
| ECMP-Weight  | : N/A                       |

-----

No. of Destinations: 1

=====

\*A:Dut-C# show router route-table ipv6 3ffe::10:20:1:4/128 all

=====

IPv6 Route Table (Router: Base)

=====

| Dest Prefix[Flags]<br>Next Hop[Interface Name] | Type   | Proto<br>Active | Age<br>Metric | Pref |
|------------------------------------------------|--------|-----------------|---------------|------|
| 3ffe::10:20:1:4/128                            | Remote | ISIS            | 00h13m00s     | 15   |
| fe80::205e:1ff:fe01:1-"ip-10.10.5.3"           |        | Y               | 20            |      |
| 3ffe::10:20:1:4/128                            | Remote | ISIS            | 00h13m00s     | 15   |
| fe80::6629:ffff:fe00:141-"ip-10.10.12.3"       |        | Y               | 20            |      |
| 3ffe::10:20:1:4/128                            | Remote | ISIS(1)         | 00h13m09s     | 15   |
| fe80::205e:1ff:fe01:1-"ip-10.10.5.3"           |        | N               | 20            |      |
| 3ffe::10:20:1:4/128                            | Remote | ISIS(1)         | 00h13m09s     | 15   |
| fe80::6629:ffff:fe00:141-"ip-10.10.12.3"       |        | N               | 20            |      |

-----

No. of Routes: 4

Flags: n = Number of times nexthop is repeated

B = BGP backup route available

L = LFA nexthop available

S = Sticky ECMP requested

E = Inactive best-external BGP route

=====

\*A:Dut-C# show router route-table ipv6 3ffe::10:20:1:4/128 all extensive

=====

Route Table (Router: Base)



```

=====
Dest Prefix : 3ffe::10:20:1:4/128
Protocol : ISIS
Age : 00h13m06s
Preference : 15
Next-Hop : fe80::205e:1ff:fe01:1-"ip-10.10.5.3"
 Interface : ip-10.10.5.3
 Active : Yes
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 Metric : 20
 ECMP-Weight : N/A
Next-Hop : fe80::6629:ffff:fe00:141-"ip-10.10.12.3"
 Interface : ip-10.10.12.3
 Active : Yes
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 Metric : 20
 ECMP-Weight : N/A

Dest Prefix : 3ffe::10:20:1:4/128
Protocol : ISIS (1)
Age : 00h13m15s
Preference : 15
Next-Hop : fe80::205e:1ff:fe01:1-"ip-10.10.5.3"
 Interface : ip-10.10.5.3
 Active : No
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 Metric : 20
 ECMP-Weight : N/A
Next-Hop : fe80::6629:ffff:fe00:141-"ip-10.10.12.3"
 Interface : ip-10.10.12.3
 Active : No
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 Metric : 20
 ECMP-Weight : N/A

No. of Destinations: 2
=====

```

**Table 31**      **Standard Route Table Fields**

| Label        | Description                                        |
|--------------|----------------------------------------------------|
| Dest Address | The route destination address and mask.            |
| Next Hop     | The next hop IP address for the route destination. |

**Table 31 Standard Route Table Fields (Continued)**

| Label         | Description                                       |
|---------------|---------------------------------------------------|
| Type          | Local<br>The route is a local route.              |
|               | Remote<br>The route is a remote route.            |
| Protocol      | The protocol through which the route was learned. |
| Age           | The route age in seconds for the route.           |
| Metric        | The route metric value for the route.             |
| Pref          | The route preference value for the route.         |
| No. of Routes | The number of routes displayed in the list.       |

**Summary Route Table Output** — Summary output for the route table displays the number of active routes and the number of routes learned by the router by protocol. Total active and available routes are also displayed.

The following output is an example of summary route table information.

### Sample Output

```
A:ALA-A# show router route-table summary
=====
Route Table Summary
=====

```

|           | Active | Available |
|-----------|--------|-----------|
| Static    | 1      | 1         |
| Direct    | 6      | 6         |
| BGP       | 0      | 0         |
| OSPF      | 9      | 9         |
| ISIS      | 0      | 0         |
| RIP       | 0      | 0         |
| Aggregate | 0      | 0         |
| Total     | 16     | 16        |

```
=====
A:ALA-A#

*A:SRR# show router route-table summary
=====
Route Table Summary (Router: Base)
=====

```

|        | Active | Available |
|--------|--------|-----------|
| Static | 6      | 6         |
| Direct | 1698   | 1698      |
| Host   | 0      | 1477      |

|              |      |      |
|--------------|------|------|
| BGP          | 0    | 0    |
| BGP (Backup) | 0    | 0    |
| VPN Leak     | 0    | 0    |
| OSPF         | 0    | 0    |
| ISIS         | 3296 | 6383 |
| ISIS (LFA)   | 472  | 1499 |
| RIP          | 0    | 0    |
| LDP          | 6    | 6    |
| Aggregate    | 0    | 0    |
| Sub Mgmt     | 0    | 0    |
| Managed      | 0    | 0    |
| NAT          | 0    | 0    |

```

Total 5006 9570
=====
```

NOTE: ISIS LFA routes and BGP Backup routes are not counted towards the total.

\*A:SRR#

\*A:Dut-C>config>router>mpls>lsp# show router route-table 10.0.0.2/32 extensive

```
=====
Route Table (Router: Base)
=====
Dest Prefix : 10.0.0.2/32
Protocol : OSPF (1)
Age : 00h02m40s
Preference : 150
Next-Hop : 10.0.0.3 (RSVP tunnel:94)
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 Metric : 10
 ECMP-Weight : 20
Next-Hop : 10.0.0.3 (RSVP tunnel:61442)
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 Metric : 10
 ECMP-Weight : 1

```

No. of Destinations: 1

```
=====
*A:Dut-C>config>router>static-route-entry>indirect>tunnel-next-
hop# show router route-table 10.1.0.5/32 extensive
```

```
=====
Route Table (Router: Base)
=====
Dest Prefix : 10.1.0.5/32
Protocol : STATIC
Age : 00h00m11s
Preference : 5
Next-Hop : 10.0.0.2 (RSVP tunnel:128)
 QoS : Priority=n/c, FC=n/c
 Source-Class : 0
 Dest-Class : 0
 Metric : 1
 ECMP-Weight : 18
Next-Hop : 10.0.0.2 (RSVP tunnel:132)
 QoS : Priority=n/c, FC=n/c
```

```
Source-Class : 0
Dest-Class : 0
Metric : 1
ECMP-Weight : 2
Next-Hop : 10.0.0.3 (RSVP tunnel:94)
QoS : Priority=n/c, FC=n/c
Source-Class : 0
Dest-Class : 0
Metric : 1
ECMP-Weight : 7
Next-Hop : 10.0.0.3 (RSVP tunnel:61442)
QoS : Priority=n/c, FC=n/c
Source-Class : 0
Dest-Class : 0
Metric : 1
ECMP-Weight : 2

No. of Destinations: 1
=====
```

rtr-advertisement

- Syntax** **rtr-advertisement** [**interface** *interface-name*] [**prefix** *ipv6-prefix[/prefix-length]*]  
**rtr-advertisement** [**conflicts**]
- Context** show>router
- Description** This command displays router advertisement information.  
If no command line arguments are specified, all routes are displayed, sorted by prefix.
- Parameters** *interface-name* — Specifies the interface name, up to 32 characters.  
*ipv6-prefix[/prefix-length]* — Displays routes only matching the specified *ip-address* and length and only applies to the 7750 SR and 7950 XRS.

Values

|      |                     |                                                                                               |
|------|---------------------|-----------------------------------------------------------------------------------------------|
| ipv6 | ipv6-prefix[/pref*: | x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:d.d.d.d<br>x: [0 to FFFF]H<br>d: [0 to 255]D |
|      | prefix-length:      | 1 to 128                                                                                      |

- Output** **Router-Advertisement Table Output** — The following output is an example of router advertisement information, and [Table 32](#) describes the fields.

Sample Output

```
A:Dut-A# show router rtr-advertisement
=====
```

```

Router Advertisement
=====

Interface: interfaceNetworkNonDefault

Rtr Advertisement Tx : 8 Last Sent : 00h01m28s
Nbr Solicitation Tx : 83 Last Sent : 00h00m17s
Nbr Advertisement Tx : 74 Last Sent : 00h00m25s
Rtr Advertisement Rx : 8 Rtr Solicitation Rx : 0
Nbr Advertisement Rx : 83 Nbr Solicitation Rx : 74

Server1 : 2001:db8::1
Server2 : N/A
Server3 : N/A
Server4 : N/A
Rdnss-lifetime : 1200 Include-dns : yes

Max Advert Interval : 601 Min Advert Interval : 201
Managed Config : TRUE Other Config : TRUE
Reachable Time : 00h00m00s400ms Router Lifetime : 00h30m01s
Retransmit Time : 00h00m00s400ms Hop Limit : 63
Link MTU : 1500

Prefix: 211::/120
Autonomous Flag : FALSE On-link flag : FALSE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Prefix: 231::/120
Autonomous Flag : FALSE On-link flag : FALSE
Preferred Lifetime : 49710d06h Valid Lifetime : 49710d06h

Prefix: 241::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 00h00m00s Valid Lifetime : 00h00m00s

Prefix: 251::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Advertisement from: fe80::200:ff:fe00:2
Managed Config : FALSE Other Config : FALSE
Reachable Time : 00h00m00s0ms Router Lifetime : 00h30m00s
Retransmit Time : 00h00m00s0ms Hop Limit : 64
Link MTU : 0

Interface: interfaceServiceNonDefault

Rtr Advertisement Tx : 8 Last Sent : 00h06m41s
Nbr Solicitation Tx : 166 Last Sent : 00h00m04s
Nbr Advertisement Tx : 143 Last Sent : 00h00m05s
Rtr Advertisement Rx : 8 Rtr Solicitation Rx : 0
Nbr Advertisement Rx : 166 Nbr Solicitation Rx : 143

Max Advert Interval : 601 Min Advert Interval : 201
Managed Config : TRUE Other Config : TRUE
Reachable Time : 00h00m00s400ms Router Lifetime : 00h30m01s
Retransmit Time : 00h00m00s400ms Hop Limit : 63
Link MTU : 1500

```

```

Prefix: 23::/120
Autonomous Flag : FALSE On-link flag : FALSE
Preferred Lifetime : infinite Valid Lifetime : infinite

Prefix: 24::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 00h00m00s Valid Lifetime : 00h00m00s

Prefix: 25::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Advertisement from: fe80::200:ff:fe00:2
Managed Config : FALSE Other Config : FALSE
Reachable Time : 00h00m00s0ms Router Lifetime : 00h30m00s
Retransmit Time : 00h00m00s0ms Hop Limit : 64
Link MTU : 0

Prefix: 2::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Prefix: 23::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Prefix: 24::/119
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Prefix: 25::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : infinite

Prefix: 231::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

...
A:Dut-A#

```

**Table 32 Router Advertisement Table Fields**

| Label                              | Description                                                                    |
|------------------------------------|--------------------------------------------------------------------------------|
| Rtr Advertisement Tx/<br>Last Sent | The number of router advertisements sent and time since they were sent         |
| Nbr Solicitation Tx                | The number of neighbor solicitations sent and time since they were sent        |
| Nbr Advertisement Tx               | The number of neighbor advertisements sent and time since they were sent       |
| Rtr Advertisement Rx               | The number of router advertisements received and time since they were received |

**Table 32 Router Advertisement Table Fields (Continued)**

| Label                | Description                                                                                                        |
|----------------------|--------------------------------------------------------------------------------------------------------------------|
| Nbr Advertisement Rx | The number of neighbor advertisements received and time since they were received                                   |
| Max Advert Interval  | The maximum interval between sending router advertisement messages                                                 |
| Managed Config       | True<br>Indicates that DHCPv6 has been configured                                                                  |
|                      | False<br>Indicates that DHCPv6 is not available for address configuration                                          |
| Reachable Time       | The time, in milliseconds, that a node assumes a neighbor is reachable after receiving a reachability confirmation |
| Retransmit Time      | The time, in milliseconds, between retransmitted neighbor solicitation messages                                    |
| Link MTU             | The MTU number the nodes use for sending packets on the link                                                       |
| Rtr Solicitation Rx  | The number of router solicitations received and time since they were received                                      |
| Nbr Solicitation Rx  | The number of neighbor solicitations received and time since they were received                                    |
| Min Advert Interval  | The minimum interval between sending ICMPv6 neighbor discovery router advertisement messages                       |
| Other Config         | True<br>Indicates there are other stateful configurations                                                          |
|                      | False<br>Indicates there are no other stateful configurations                                                      |
| Router Lifetime      | Displays the router lifetime in seconds                                                                            |
| Hop Limit            | Displays the current hop limit                                                                                     |

**Router-Advertisement Conflicts Output** — The following output is an example of router advertisement conflicts, and [Table 33](#) describes the fields.

#### Sample Output

```
A:Dut-A# show>router# rtr-advertisement conflicts
=====
Router Advertisement
=====
Interface: interfaceNetworkNonDefault
```

```

Advertisement from: fe80::200:ff:fe00:2
Managed Config : FALSE [TRUE]
Other Config : FALSE [TRUE]
Reachable Time : 00h00m00s0ms [00h00m00s400ms]
Router Lifetime : 00h30m00s [00h30m01s]
Retransmit Time : 00h00m00s0ms [00h00m00s400ms]
Hop Limit : 64 [63]
Link MTU : 0 [1500]

Prefix not present in neighbor router advertisement
Prefix: 211::/120
Autonomous Flag : FALSE On-link flag : FALSE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Prefix not present in neighbor router advertisement
Prefix: 231::/120
Autonomous Flag : FALSE On-link flag : FALSE
Preferred Lifetime : 49710d06h Valid Lifetime : 49710d06h

Prefix not present in neighbor router advertisement
Prefix: 241::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 00h00m00s Valid Lifetime : 00h00m00s

Prefix not present in neighbor router advertisement
Prefix: 251::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Interface: interfaceServiceNonDefault

Advertisement from: fe80::200:ff:fe00:2
Managed Config : FALSE [TRUE]
Other Config : FALSE [TRUE]
Reachable Time : 00h00m00s0ms [00h00m00s400ms]
Router Lifetime : 00h30m00s [00h30m01s]
Retransmit Time : 00h00m00s0ms [00h00m00s400ms]
Hop Limit : 64 [63]
Link MTU : 0 [1500]

Prefix not present in own router advertisement
Prefix: 2::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Prefix: 23::/120
Autonomous Flag : TRUE [FALSE]
On-link flag : TRUE [FALSE]
Preferred Lifetime : 07d00h00m [infinite]
Valid Lifetime : 30d00h00m [infinite]

Prefix not present in own router advertisement
Prefix: 24::/119
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m

Prefix not present in neighbor router advertisement
Prefix: 24::/120
```



```

Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 00h00m00s Valid Lifetime : 00h00m00s

Prefix: 25::/120
Valid Lifetime : infinite [30d00h00m]

Prefix not present in own router advertisement
Prefix: 231::/120
Autonomous Flag : TRUE On-link flag : TRUE
Preferred Lifetime : 07d00h00m Valid Lifetime : 30d00h00m
=====
A:Dut-A#

```

**Table 33 Router-Advertisement Conflicts Fields**

| Label              | Description                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------|
| Advertisement from | The address of the advertising router                                                                              |
| Reachable Time     | The time, in milliseconds, that a node assumes a neighbor is reachable after receiving a reachability confirmation |
| Router Lifetime    | Displays the router lifetime in seconds                                                                            |
| Retransmit Time    | The time, in milliseconds, between retransmitted neighbor solicitation messages                                    |
| Hop Limit          | Displays the current hop limit                                                                                     |
| Link MTU           | The MTU number the nodes use for sending packets on the link                                                       |

## service-prefix

|                    |                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>service-prefix</b>                                                                                                                               |
| <b>Context</b>     | show>router                                                                                                                                         |
| <b>Description</b> | This command displays the address ranges reserved by this node for services sorted by prefix.                                                       |
| <b>Output</b>      | <b>Service Prefix Output</b> — The following output is an example of service prefix information, and <a href="#">Table 34</a> describes the fields. |

### Sample Output

```

A:ALA-A# show router service-prefix
=====
Address Ranges reserved for Services
=====
IP Prefix Mask Exclusive

172.16.1.0 24 true

```

```

172.16.2.0 24 false
=====
A:ALA-A#

```

**Table 34**      **Service Prefix Fields**

| Label     | Description                                                                                                                                                                                                           |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IP Prefix | The IP prefix of the range of addresses included in the range for services                                                                                                                                            |
| Mask      | The subnet mask length associated with the IP prefix                                                                                                                                                                  |
| Exclusive | False — Addresses in the range are not exclusively for use for service IP addresses<br>True — Addresses in the range are exclusively for use for service IP addresses and cannot be assigned to network IP interfaces |

## sgt-qos

|                    |                                                                                    |
|--------------------|------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sgt-qos</b>                                                                     |
| <b>Context</b>     | show>router                                                                        |
| <b>Description</b> | This command displays DSCP/dot1p remarking information for self-generated traffic. |

## application

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>application</b> [ <i>app-name</i> ] [{ <b>dscp</b>   <b>dot1p</b> }]                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | show>router>sgt-qos                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | This command displays application QoS settings.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><i>app-name</i> — Specifies the application.</p> <p><b>Values</b>      arp, bgp, cflowd, dhcp, diameter, dns, ftp, gtp, icmp, igmp, igmp-reporter, isis, l2tp, ldp, mld, msdp, ndis, ntp, ospf, pcep, pim, pppoe, ptp, radius, rip, rsvp, sflow, snmp, snmp-notification, srrp, ssh, syslog, tacplus, telnet, tftp, traceroute, vrrp</p> <p><b>dscp</b> — Specifies to show DSCP values only.</p> <p><b>dot1p</b> — Specifies to show dot1p values only.</p> |
| <b>Output</b>      | The following output is an example of SGT QoS application information.                                                                                                                                                                                                                                                                                                                                                                                          |

### Sample Output

A:ALA-A# show router sgt-qos application

=====

DSCP Application Values

=====

| Application       | Configured DSCP Value | Default DSCP Value(s) |
|-------------------|-----------------------|-----------------------|
| bgp               | none                  | nc1                   |
| bmp               | none                  | af41                  |
| cflowd            | none                  | nc1                   |
| dhcp              | none                  | nc1, af41, nc2        |
| diameter          | none                  | af41                  |
| dns               | none                  | af41                  |
| ftp               | none                  | af41                  |
| grpc              | none                  | af41                  |
| gtp               | none                  | nc2, nc1              |
| http              | none                  | af41                  |
| icmp              | none                  | be, nc1               |
| igmp              | none                  | nc1                   |
| igmp-reporter     | none                  | nc1                   |
| l2tp              | none                  | nc1                   |
| ldp               | none                  | nc1                   |
| mld               | none                  | nc1                   |
| mpls-udp-return   | none                  | nc1                   |
| msdp              | none                  | nc1                   |
| mtrace2           | none                  | nc1                   |
| ndis              | none                  | nc1, nc2              |
| ntp               | none                  | nc1                   |
| ospf              | none                  | nc1                   |
| pcep              | none                  | nc1                   |
| pim               | none                  | nc1                   |
| ptp               | none                  | nc1                   |
| radius            | none                  | nc1                   |
| rip               | none                  | nc1                   |
| rsvp              | none                  | nc1                   |
| sflow             | none                  | nc1                   |
| snmp              | none                  | af41                  |
| snmp-notification | none                  | af41                  |
| srrp              | none                  | nc1                   |
| ssh               | none                  | af41                  |
| syslog            | none                  | af41                  |
| tacplus           | none                  | af41                  |
| telnet            | none                  | af41                  |
| tftp              | none                  | af41                  |
| traceroute        | none                  | be                    |
| vrrp              | none                  | nc1                   |

=====

Dot1p Application Values

=====

| Application | Configured Dot1p Value | Default Dot1p Value |
|-------------|------------------------|---------------------|
| arp         | none                   | 7                   |
| isis        | none                   | 7                   |
| pppoe       | none                   | 7                   |

=====

A:ALA-A#



**Note:** Some applications have multiple DSCP default values depending on the context or service.

## dscp-map

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dscp-map</b> [ <i>dscp-name</i> ]                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | show>router>sgt-qos                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command displays DSCP to FC mappings.                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <i>dscp-name</i> — Specifies the DSCP name.<br><b>Values</b> be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63 |
| <b>Output</b>      | The following output is an example of DSCP mapping information.                                                                                                                                                                                                                                                                                                                                                                          |

### Sample Output

```
A:ALA-A# show router sgt-qos dscp-map
=====
DSCP to FC Mappings
=====
DSCP Value FC Value Default FC Value

be nc nc
cp1 be be
cp2 be be
cp3 be be
cp4 be be
cp5 be be
cp6 be be
cp7 be be
cs1 be be
cp9 be be
af11 af af
cp11 be be
af12 af af
cp13 be be
af13 af af
cp15 be be
cs2 be be
cp17 be be
af21 11 11
cp19 be be
af22 11 11
cp21 be be
```

```

af23 11 11
cp23 be be
cs3 be be
cp25 be be
af31 11 11
cp27 be be
af32 11 11
cp29 be be
af33 11 11
cp31 be be
cs4 be be
cp33 be be
af41 nc nc
cp35 be be
af42 h2 h2
cp37 be be
af43 h2 h2
cp39 be be
cs5 be be
cp41 be be
cp42 be be
cp43 be be
cp44 be be
cp45 be be
ef ef ef
cp47 be be
nc1 nc nc
cp49 be be
cp50 h2 h2
cp51 be be
cp52 be be
cp53 be be
cp54 be be
cp55 be be
nc2 nc nc
cp57 be be
cp58 be be
cp59 be be
cp60 be be
cp61 be be
cp62 be be
cp63 be be
=====
A:ALA-A#

```

## static-arp

|                    |                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>static-arp</b> [{ <i>ip-int-name</i>   <i>ip-address</i>   <b>mac</b> <i>ieee-mac-address</i> }]                               |
| <b>Context</b>     | show>router                                                                                                                       |
| <b>Description</b> | This command displays the router static ARP table sorted by IP address. If no options are present, all ARP entries are displayed. |
| <b>Parameters</b>  | <i>ip-int-name</i> — Only displays static ARP entries associated with the specified IP interface name.                            |

*ip-address* — Only displays static ARP entries associated with the specified IP address.

*ieee-mac-address* — Only displays static ARP entries associated with the specified MAC address.

**Output**     **Static ARP Table Output** — The following output is an example of static ARP table information, and [Table 35](#) describes the output fields.

### Sample Output

```
A:ALA-A# show router static-arp
=====
ARP Table
=====
IP Address MAC Address Age Type Interface

10.200.0.253 00:00:5a:40:00:01 00:00:00 Sta to-ser1
10.200.1.1 00:00:5a:01:00:33 00:00:00 Inv to-ser1a

No. of ARP Entries: 1
=====
A:ALA-A#

A:ALA-A# show router static-arp 10.200.1.1
=====
ARP Table
=====
IP Address MAC Address Age Type Interface

10.200.1.1 00:00:5a:01:00:33 00:00:00 Inv to-ser1

=====
A:ALA-A#

A:ALA-A# show router static-arp to-ser1
=====
ARP Table
=====
IP Address MAC Address Age Type Interface

10.200.0.253 00:00:5a:40:00:01 00:00:00 Sta to-ser1

=====
A:ALA-A#

A:ALA-A# show router static-arp mac 00:00:5a:40:00:01
=====
ARP Table
=====
IP Address MAC Address Age Type Interface

10.200.0.253 00:00:5a:40:00:01 00:00:00 Sta to-ser1

=====
A:ALA-A#
```

**Table 35 Static ARP Table Fields**

| Label              | Description                                                            |
|--------------------|------------------------------------------------------------------------|
| IP Address         | The IP address of the static ARP entry                                 |
| MAC Address        | The MAC address of the static ARP entry                                |
| Age                | The age of the ARP entry. Static ARPs always have 00:00:00 for the age |
| Type               | Inv<br>The ARP entry is an inactive static ARP entry (invalid)         |
|                    | Sta<br>The ARP entry is an active static ARP entry                     |
| Interface          | The IP interface name associated with the ARP entry                    |
| No. of ARP Entries | The number of ARP entries displayed in the list                        |

## static-route

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>static-route</b> [ <i>family</i> ] [{ <i>ip-prefix/prefix-length</i>   <b>preference</b> <i>preference</i>   [ <b>next-hop</b> <i>ip-address</i>   <b>tag</b> <i>tag</i> ]}] [ <b>detail</b> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | show>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | This command displays the static entries in the routing table. If no options are present, all static routes are displayed sorted by prefix.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>  | <p><i>family</i> — Specifies the type of routing information to be distributed by this peer group.</p> <p><b>Values</b></p> <ul style="list-style-type: none"> <li><b>ipv4</b> — Displays only those BGP peers that have the IPv4 family enabled and not those capable of exchanging IP-VPN routes.</li> <li><b>ipv6</b> — Displays the BGP peers that are IPv6 capable.</li> <li><b>mcast-ipv4</b> — Displays the BGP peers that are IPv4 multicast capable.</li> <li><b>mcast-ipv6</b> — Displays the BGP peers that are IPv6 multicast capable.</li> </ul> <p><i>ip-prefix/prefix-length</i> — Displays static routes only matching the specified <i>ip-prefix</i> and <i>mask</i>.</p> <p><b>Values</b> The following values apply to the 7750 SR and 7950 XRS:</p> |

ipv4-prefix: a.b.c.d (host bits must be 0)  
ipv4-prefix-length: 0 to 32  
ipv6-prefix: x:x:x:x:x:x:x (eight 16-bit pieces)  
x:x:x:x:x:d.d.d.d  
x: [0 to FFFF]H  
d: [0 to 255]D  
ipv6-prefix-length: 0 to 128

**Values** The following values apply to the 7450 ESS:  
ipv4-prefix: a.b.c.d (host bits must be 0)  
ipv4-prefix-length: 0 to 32

*preference* — Only displays static routes with the specified route preference.

**Values** 0 to 65535

*ip-address* — Only displays static routes with the specified next hop IP address.

**Values** The following values apply to the 7750 SR and 7950 XRS:

ipv4-address: a.b.c.d (host bits must be 0)  
ipv6-address: x:x:x:x:x:x:x (eight 16-bit pieces)  
x:x:x:x:x:d.d.d.d  
x: [0 to FFFF]H  
d: [0 to 255]D

**Values** The following values apply to the 7450 ESS:  
ipv4-address: a.b.c.d (host bits must be 0)

*tag* — Displays the tag used to add a 32-bit integer tag to the static route. The tag is used in route policies to control distribution of the route into other protocols.

**Values** 1 to 4294967295

**detail** — Displays detailed static routes information.

**Output** **Static Route Output** — The following output is an example of static route information, and [Table 36](#) describes the fields.

**Sample Output**

```
A:ALA-A# show router static-route
=====
Route Table
=====
IP Addr/mask Pref Metric Type Nexthop Interface Active
```



```

192.168.250.0/24 5 1 ID 10.200.10.1 to-ser1 Y
192.168.252.0/24 5 1 NH 10.10.0.254 n/a N
192.168.253.0/24 5 1 NH to-ser1 n/a N
192.168.253.0/24 5 1 NH 10.10.0.254 n/a N
192.168.254.0/24 4 1 BH black-hole n/a Y
=====
```

A:ALA-A#

A:ALA-A# show router static-route 192.168.250.0/24

```
=====
Route Table
=====
IP Addr/mask Pref Metric Type Nexthop Interface Active

192.168.250.0/24 5 1 ID 10.200.10.1 to-ser1 Y
=====
```

A:ALA-A#

A:ALA-A# show router static-route preference 4

```
=====
Route Table
=====
IP Addr/mask Pref Metric Type Nexthop Interface Active

192.168.254.0/24 4 1 BH black-hole n/a Y
=====
```

A:ALA-A#

A:ALA-A# show router static-route next-hop 10.10.0.254

```
=====
Route Table
=====
IP Addr/mask Pref Metric Type Nexthop Interface Active

192.168.253.0/24 5 1 NH 10.10.0.254 n/a N
=====
```

A:ALA-A#

```
=====
Static Route Table (Router: Base) Family: IPv6
=====
Prefix : 3ffe::10:10:14:0/120
Nexthop : 3ffe::10:20:1:6
Type : Indirect
Interface : n/a
Prefix List : n/a
Metric : 1
Source Class : 0
Admin State : Up
Creation Origin : manual
BFD : disabled
Community :
CPE-check : disabled
Tunnel Resolution: any
Active : Y
Prefix List Type : n/a
Preference : 5
Dest Class : 0
Tag : 0
Disallow-IGP : disabled
```

```

RSVP-TE Tunnels : disabled
SR-ISIS Tunnels : disabled
SR-TE Tunnels : disabled

Prefix : 3ffe::10:10:14:0/120
Nextthop : 3ffe::20:20:1:6
Type : Indirect
Interface : n/a
Prefix List : n/a
Metric : 1
Source Class : 0
Admin State : Up
Creation Origin : manual
BFD : disabled
Community :
CPE-check : disabled
Tunnel Resolution: any
RSVP-TE Tunnels : disabled
SR-ISIS Tunnels : disabled
SR-TE Tunnels : disabled

Prefix : 3ffe::10:10:14:0/120
Nextthop : 3ffe::20:20:1:5
Type : Indirect
Interface : n/a
Prefix List : n/a
Metric : 1
Source Class : 0
Admin State : Up
Creation Origin : manual
BFD : disabled
Community :
CPE-check : disabled
Tunnel Resolution: any
RSVP-TE Tunnels : disabled
SR-ISIS Tunnels : disabled
SR-TE Tunnels : disabled

Prefix : 3ffe::10:10:14:0/120
Nextthop : 3ffe::10:20:1:5
Type : Indirect
Interface : n/a
Prefix List : n/a
Metric : 1
Source Class : 0
Admin State : Up
Creation Origin : manual
BFD : disabled
Community :
CPE-check : disabled
Tunnel Resolution: filter
RSVP-TE Tunnels : disabled
SR-ISIS Tunnels : enabled
SR-TE Tunnels : disabled

No. of Static Routes: 4
=====
*A:Dut-C#

```

**Table 36 Static Route Fields**

| Label         | Description                                                                                                                                                               |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IP Addr/mask  | The static route destination address and mask                                                                                                                             |
| Pref          | The route preference value for the static route                                                                                                                           |
| Metric        | The route metric value for the static route                                                                                                                               |
| Type          | BH<br>The static route is a black hole route. The nexthop for this type of route is black-hole                                                                            |
|               | ID<br>The static route is an indirect route, where the nexthop for this type of route is the non-directly connected next hop                                              |
|               | NH<br>The route is a static route with a directly connected next hop. The Nexthop for this type of route is either the next hop IP address or an egress IP interface name |
| Next Hop      | The next hop for the static route destination                                                                                                                             |
| Protocol      | The protocol through which the route was learned                                                                                                                          |
| Interface     | The egress IP interface name for the static route<br>n/a<br>indicates there is no current egress interface because the static route is inactive or a black hole route     |
| Active        | N<br>The static route is inactive; for example, the static route is disabled or the next hop IP interface is down                                                         |
|               | Y<br>The static route is active                                                                                                                                           |
| No. of Routes | The number of routes displayed in the list                                                                                                                                |

The following output is an example static route information for the 7750 SR and 7950 XRS:

```
*A:sim1# show router static-route 10.10.0.0/16 detail
=====
Static Route Table (Router: Base) Family : [IPv4|MCast-IPv4|IPv6]
=====
Network : 2001:db8:FFFF:FFFF:FFFF:FFFF:FFFF:FFE3/
120 Type : [Nexthop|Indirect|Blackhole]
Nexthop : [address | LSP label & name] Nexthop type: [IP|LDP|RSVP-TE]
Interface :
```

```

Metric : 1 Prefence : 5
Active : [Y|N] Admin State : [Up|Down]
Tag :
BFD: [enable|disabled]

CPE-check: [enabled|disabled] State: [Up|Down]
Target : <address>
Interval : [value | n/a] Drop Count : <value>
Log : [Y|N]
CPE Host Up/Dn Time : 0d 16:32:28
CPE Echo Req Tx : 0 CPE Echo Reply Rx: 0
CPE Up Transitions : 0 CPE Down Transitions : 0
CPE TTL : 13
=====
A:siml#

*A:CPM133>config>router# show router static-route 10.3.3.3/32 detail
=====
Static Route Table (Router: Base) Family: IPv4
=====
Prefix : 10.3.3.3/32
Nexthop : n/a
Type : Blackhole
Interface : n/a
Prefix List : n/a
Metric : 1
Admin State : Up
BFD : disabled
CPE-check : disabled
Nexthop Type : IP
Active : Y
Prefix List Type : n/a
Preference : 5
Tag : 0
Community : 100:33

No. of Static Routes: 1
=====
*A:Dut-C> show router static-route 10.1.0.5/32 detail
=====
Static Route Table (Router: Base) Family: IPv4
=====
Prefix : 10.1.0.5/32
Nexthop : 10.0.0.2
Indirect : Type
Interface : n/a
Prefix List : n/a
Metric : 1
Source Class : 0
Admin State : Up
Creation Origin : manual
BFD : disabled
Community :
CPE-check : disabled
Tunnel Resolution: filter
RSVP-TE Tunnels : enabled
Disallow-IGP : disabled
LDP Tunnels : disabled

No. of Static Routes: 1
=====

```

## status

|                    |                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>status</b>                                                                                                                                     |
| <b>Context</b>     | show>router                                                                                                                                       |
| <b>Description</b> | This command displays the router status.                                                                                                          |
| <b>Output</b>      | <b>Router Status Output</b> — The following output is an example of router status information, and <a href="#">Table 37</a> describes the fields. |

There are multiple instances of OSPF. OSPF-0 is persistent. OSPF-1 through OSPF-31 are present when that specific OSPF instance is configured.

### Sample Output

```
*A:Performance# show router status
=====
Router Status (Router: Base)
=====

Admin State Oper State

Router Up Up
OSPFv2-0 Up Up
RIP Up Up
ISIS Up Up
MPLS Not configured Not configured
RSVP Not configured Not configured
LDP Not configured Not configured
BGP Up Up
IGMP Not configured Not configured
PIM Not configured Not configured
OSPFv3 Not configured Not configured
MSDP Not configured Not configured

Max IPv4 Routes No Limit
Max IPv6 Routes No Limit
Total IPv4 Routes 0
Total IPv6 Routes 0
Max Multicast Routes No Limit
Total IPv4 Mcast Routes PIM not configured
Total IPv6 Mcast Routes PIM not configured
ECMP Max Routes ECMP not configured
Weighted ECMP Disabled
Mcast Info Policy default
Triggered Policies No
Policy reference checks Disabled
LDP Shortcut Disabled
Single SFM Overload Disabled
IP Fast Reroute Disabled
Entropy Label Disabled
ICMP Tunneling Disabled
MSS adjust ISA group Not configured
Reassembly ISA-BB group Not configured
Ipv6 Nbr Reachab. time Not configured
IPv6 Nbr stale time (s) 14400
```

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```

Static Route Hold Down Disabled
TTL Propagate
 VPRN Local vc-only
 VPRN Transit vc-only
 Label Route Local none
 Label Route Transit none
 LSR Label Route none
LSP BFD Tail Sessions Disabled
Class Forwarding Disabled
Mtrace2 Tests Disabled
Leak Export Disabled
Leak Export Limit 5
=====

```

**Table 37 Router Status Fields**

| Label           | Description                                                        |
|-----------------|--------------------------------------------------------------------|
| Router          | The administrative and operational states for the router.          |
| OSPF            | The administrative and operational states for the OSPF protocol.   |
| RIP             | The administrative and operational states for RIP.                 |
| ISIS            | The administrative and operational states for the IS-IS protocol.  |
| MPLS            | The administrative and operational states for the MPLS protocol.   |
| RSVP            | The administrative and operational states for RSVP.                |
| LDP             | The administrative and operational states for LDP.                 |
| BGP             | The administrative and operational states for BGP.                 |
| IGMP            | The administrative and operational states for IGMP.                |
| MLD             | The administrative and operational states for the MLD protocol.    |
| PIM             | The administrative and operational states for the PIM protocol.    |
| PIMv4           | The administrative and operational states for the PIMv4 protocol.  |
| PIMv6           | The administrative and operational states for the PIMv6 protocol.  |
| OSPFv3          | The administrative and operational states for the OSPFv3 protocol. |
| MSDP            | The administrative and operational states for MSDP.                |
| Max Routes      | The maximum number of routes configured for the system.            |
| Max IPv4 Routes | The maximum number of IPv4 routes configured for the system.       |
| Max IPv6 Routes | The maximum number of IPV6 routes configured for the system.       |
| Total Routes    | The total number of routes in the route table.                     |

**Table 37 Router Status Fields (Continued)**

| Label                   | Description                                                                                                                                                                             |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Total IPv4 Routes       | The total number of IPv4 routes in the route table.                                                                                                                                     |
| Total IPv6 Routes       | The total number of IPv6 routes in the route table.                                                                                                                                     |
| Max Multicast Routes    | The maximum number of multicast routes configured for the system.                                                                                                                       |
| Total IPv4 Mcast Routes | The total number of IPv4 multicast routes in the route table.                                                                                                                           |
| Total IPv6 Mcast Routes | The total number of IPv6 multicast routes in the route table.                                                                                                                           |
| ECMP Max Routes         | The number of ECMP routes configured for path sharing.                                                                                                                                  |
| Weighted ECMP           | Enabled — Weighted ECMP is enabled<br>Disabled — Weighted ECMP is disabled                                                                                                              |
| <i>service-id</i>       | state — Current single SFM state<br>start — Last time this vRtr went into overload, after having respected the hold-off time<br>interval — How long the vRtr remained or is in overload |
| LDP Shortcut            | Enabled — LDP Shortcut Overload is enabled<br>Disabled — LDP Shortcut Overload is disabled                                                                                              |
| Single SFM Overload     | Enabled — Single SFM Overload is enabled<br>Disabled — Single SFM Overload is disabled                                                                                                  |
| IP Fast Reroute         | Enabled — IP Fast Reroute is enabled<br>Disabled — IP Fast Reroute is disabled                                                                                                          |
| Entropy Label           | Enabled — Entropy Label is enabled<br>Disabled — Entropy Label is disabled                                                                                                              |
| ICMP Tunneling          | No — ICMP tunneling is disabled.<br>Yes — TICMP tunneling is enabled.                                                                                                                   |
| Static Route Hold Down  | Enabled — Static Route Hold Down is enabled<br>Disabled — Static Route Hold Down is disabled                                                                                            |

**Table 37 Router Status Fields (Continued)**

| Label                    | Description                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VPRN Local TTL Propagate | inherit — VPRN instance is to inherit the global configuration<br>none — TTL of IP packet is not propagated into the VC or transport label stack<br>vc-only — TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack<br>al — TTL of the IP packet is propagated into the VC label and all labels in the transport label stack |
| VPRN Transit TTL Propag* | inherit — VPRN instance is to inherit the global configuration<br>none — TTL of IP packet is not propagated into the VC or transport label stack<br>vc-only — TTL of the IP packet is propagated into the VC label and not into the labels in the transport label stack<br>al — TTL of the IP packet is propagated into the VC label and all labels in the transport label stack |
| Label Route Local TTL P* | all — TTL of the IP packet is propagated into all labels of the transport label stack<br>none — TTL of the IP packet is not propagated into the transport label stack                                                                                                                                                                                                            |
| Label Route Transit TTL* | all — TTL of the IP packet is propagated into all labels of the transport label stack<br>none — TTL of the IP packet is not propagated into the transport label stack                                                                                                                                                                                                            |
| LSR Label Route TTL Pro* | all — TTL of the swapped label is propagated into all labels of the transport label stack<br>none — TTL of the swapped label is not propagated into the transport label stack                                                                                                                                                                                                    |
| Triggered Policies       | No — Triggered route policy re-evaluation is disabled<br>Yes — Triggered route policy re-evaluation is enabled                                                                                                                                                                                                                                                                   |
| Class Forwarding         | Enabled — Class Forwarding is enabled<br>Disabled — Class Forwarding is disabled                                                                                                                                                                                                                                                                                                 |
| Leak Export              | Enabled — Leak exporting is enabled<br>Disabled — Leak exporting is disabled                                                                                                                                                                                                                                                                                                     |
| Leak Export Limit        | The maximum limit on the number of GRT routes that can be leaked into VPRNs                                                                                                                                                                                                                                                                                                      |



**Router Status Output** —The following output is an example of router status information with Mtrace2 enabled.

**Sample Output**

```
=====
Router Status (Router: Base)
=====

Admin State Oper State

Router Up
OSPFv2 Not configured
RIP Not configured
RIP-NG Not configured
ISIS Not configured
MPLS Not configured
RSVP Not configured
LDP Not configured
BGP Not configured
IGMP Not configured
MLD Not configured
PIM Not configured
PIMv4 Not configured
PIMv6 Not configured
OSPFv3 Not configured
MSDP Not configured

Max IPv4 Routes No Limit
Max IPv6 Routes No Limit
Total IPv4 Routes 0
Total IPv6 Routes 0
Max Multicast Routes No Limit
Total IPv4 Mcast Routes PIM not configured
Total IPv6 Mcast Routes PIM not configured
ECMP Max Routes ECMP not configured
Weighted ECMP Disabled
Mcast Info Policy default
Triggered Policies No
LDP Shortcut Disabled
Single SFM Overload Disabled
IP Fast Reroute Disabled
Entropy Label Disabled
ICMP Tunneling Disabled
MSS adjust ISA group Not configured
Reassembly ISA-BB group Not configured
Ipv6 Nbr Reachab. time Not configured
Ipv6 Nbr stale time (s) 14400
Static Route Hold Down Disabled
TTL Propagate
 VPRN Local vc-only
 VPRN Transit vc-only
 Label Route Local none
 Label Route Transit none
 LSR Label Route none
LSP BFD Tail Sessions Disabled
Class Forwarding Disabled
Mtrace2 Tests Enabled on UDP PORT 5001

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```

**7450 ESS Router Status Output**—The following output is an example of router status information for the 7450 ESS:

### Sample Output

```
*A:Performance# configure router ospf [1..31] shutdown
*A:Performance# show router status
=====
Router Status (Router: Base)
=====
```

|                   | Admin State    | Oper State     |
|-------------------|----------------|----------------|
| Router            | Up             | Up             |
| OSPFv2-0          | Up             | Up             |
| OSPFv2-1          | Down           | Down           |
| OSPFv2-2          | Down           | Down           |
| OSPFv2-3          | Down           | Down           |
| OSPFv2-4          | Down           | Down           |
| OSPFv2-5          | Down           | Down           |
| OSPFv2-6          | Down           | Down           |
| OSPFv2-7          | Down           | Down           |
| OSPFv2-8          | Down           | Down           |
| OSPFv2-9          | Down           | Down           |
| OSPFv2-10         | Down           | Down           |
| OSPFv2-11         | Down           | Down           |
| OSPFv2-12         | Down           | Down           |
| OSPFv2-13         | Down           | Down           |
| OSPFv2-14         | Down           | Down           |
| OSPFv2-15         | Down           | Down           |
| OSPFv2-16         | Down           | Down           |
| OSPFv2-17         | Down           | Down           |
| OSPFv2-18         | Down           | Down           |
| OSPFv2-19         | Down           | Down           |
| OSPFv2-20         | Down           | Down           |
| OSPFv2-21         | Down           | Down           |
| OSPFv2-22         | Down           | Down           |
| OSPFv2-23         | Down           | Down           |
| OSPFv2-24         | Down           | Down           |
| OSPFv2-25         | Down           | Down           |
| OSPFv2-26         | Down           | Down           |
| OSPFv2-27         | Down           | Down           |
| OSPFv2-28         | Down           | Down           |
| OSPFv2-29         | Down           | Down           |
| OSPFv2-30         | Down           | Down           |
| OSPFv2-31         | Down           | Down           |
| RIP               | Up             | Up             |
| ISIS              | Up             | Up             |
| MPLS              | Not configured | Not configured |
| RSVP              | Not configured | Not configured |
| LDP               | Not configured | Not configured |
| BGP               | Up             | Up             |
| IGMP              | Not configured | Not configured |
| PIM               | Not configured | Not configured |
| OSPFv3            | Not configured | Not configured |
| MSDP              | Not configured | Not configured |
| Max Routes        | No Limit       |                |
| Total IPv4 Routes | 244277         |                |

```

Max Multicast Routes No Limit
Total Multicast Routes PIM not configured
ECMP Max Routes 1
Single SFM Overload Enabled hold-off 30 sec
Single SFM State normal
Single SFM Start 004 19:03:39.680
Single SFM Interval 0d 00:16:06
Reassembly ISA-BB group Not configured
Ipv6 Nbr Reachab. time Not configured 30
Triggered Policies No
=====
*A:Performance#

```

**Router Status Output for 7750 SR and 7950 XRS**—The following output is an example of router status information for the 7750 SR and 7950 XRS:

### Sample Output

```

*A:Performance# configure router ospf [1..31] shutdown
*A:Performance# show router status
=====
Router Status (Router: Base)
=====

```

|           | Admin State | Oper State |
|-----------|-------------|------------|
| Router    | Up          | Up         |
| OSPFv2-0  | Up          | Up         |
| OSPFv2-1  | Down        | Down       |
| OSPFv2-2  | Down        | Down       |
| OSPFv2-3  | Down        | Down       |
| OSPFv2-4  | Down        | Down       |
| OSPFv2-5  | Down        | Down       |
| OSPFv2-6  | Down        | Down       |
| OSPFv2-7  | Down        | Down       |
| OSPFv2-8  | Down        | Down       |
| OSPFv2-9  | Down        | Down       |
| OSPFv2-10 | Down        | Down       |
| OSPFv2-11 | Down        | Down       |
| OSPFv2-12 | Down        | Down       |
| OSPFv2-13 | Down        | Down       |
| OSPFv2-14 | Down        | Down       |
| OSPFv2-15 | Down        | Down       |
| OSPFv2-16 | Down        | Down       |
| OSPFv2-17 | Down        | Down       |
| OSPFv2-18 | Down        | Down       |
| OSPFv2-19 | Down        | Down       |
| OSPFv2-20 | Down        | Down       |
| OSPFv2-21 | Down        | Down       |
| OSPFv2-22 | Down        | Down       |
| OSPFv2-23 | Down        | Down       |
| OSPFv2-24 | Down        | Down       |
| OSPFv2-25 | Down        | Down       |
| OSPFv2-26 | Down        | Down       |
| OSPFv2-27 | Down        | Down       |
| OSPFv2-28 | Down        | Down       |
| OSPFv2-29 | Down        | Down       |

```

OSPFv2-30 Down Down
OSPFv2-31 Down Down
RIP Up Up
ISIS Up Up
MPLS Not configured Not configured
RSVP Not configured Not configured
LDP Not configured Not configured
BGP Up Up
IGMP Not configured Not configured
PIM Not configured Not configured
OSPFv3 Not configured Not configured
MSDP Not configured Not configured
Max Routes No Limit
Total IPv4 Routes 244277
Total IPv6 Routes 0
Max Multicast Routes No Limit
Total Multicast Routes PIM not configured
ECMP Max Routes 1
Single SFM Overload Enabled hold-off 30 sec
Single SFM State normal
Single SFM Start 004 19:03:39.680
Single SFM Interval 0d 00:16:06
Reassembly ISA-BB group Not configured
Ipv6 Nbr Reachab. time Not configured 30
Triggered Policies No
=====
*A:Performance#

```

**Class Forwarding**—The following output is an example for checking if class-based forwarding is enabled in the global router context.

### Sample Output

```

*A:Dut-B>show>router# show router "Base" status
=====
Router Status (Router: Base)
=====

```

|                 | Admin State    | Oper State     |
|-----------------|----------------|----------------|
| Router          | Up             | Up             |
| OSPFv2          | Not configured | Not configured |
| RIP             | Not configured | Not configured |
| RIP-NG          | Not configured | Not configured |
| ISIS-0          | Up             | Up             |
| MPLS            | Up             | Up             |
| RSVP            | Up             | Up             |
| LDP             | Not configured | Not configured |
| BGP             | Up             | Up             |
| IGMP            | Not configured | Not configured |
| MLD             | Not configured | Not configured |
| PIM             | Not configured | Not configured |
| PIMv4           | Not configured | Not configured |
| PIMv6           | Not configured | Not configured |
| OSPFv3          | Not configured | Not configured |
| MSDP            | Not configured | Not configured |
| Max IPv4 Routes | No Limit       |                |
| Max IPv6 Routes | No Limit       |                |

```

Total IPv4 Routes 262
Total IPv6 Routes 262
Max Multicast Routes No Limit
Total IPv4 Mcast Routes PIM not configured
Total IPv6 Mcast Routes PIM not configured
ECMP Max Routes 64
Weighted ECMP Disabled
Mcast Info Policy default
Triggered Policies No
LDP Shortcut Disabled
Single SFM Overload Disabled
IP Fast Reroute Disabled
Entropy Label Disabled
ICMP Tunneling Enabled
MSS adjust ISA group Not configured
Reassembly ISA-BB group Not configured
Ipv6 Nbr Reachab. time Not configured
IPv6 Nbr stale time (s) 14400
Static Route Hold Down Disabled
TTL Propagate
 VPRN Local vc-only
 VPRN Transit vc-only
 Label Route Local none
 Label Route Transit none
 LSR Label Route none
LSP BFD Tail Sessions Disabled
Class Forwarding Enabled
=====

```

**TTL Propagation and ICMP Tunneling**—The following output is an example of TTL propagation and ICMP tunneling configurations, first in base router and then in a VPRN service.

### Sample Output

```

*A:Performance# show router status
=====
Router Status (Router: Base)
=====

Admin State Oper State

Router Up Up
OSPFv2-0 Up Up
OSPFv2-2 Down
RIP Not configured
RIP-NG Not configured
ISIS-0 Up
ISIS-1024 Down
MPLS Down
RSVP Down
LDP Up
BGP Up
IGMP
MLD
PIM
PIMv4
PIMv6

```

```

OSPFv3
MSDP

Max IPv4 Routes No Limit
Max IPv6 Routes No Limit
Total IPv4 Routes 0
Total IPv6 Routes 0
Max Multicast Routes No Limit
Total IPv4 Mcast Routes PIM not configured
Total IPv6 Mcast Routes PIM not configured
ECMP Max Routes 1
Mcast Info Policy default
Triggered Policies No
LDP Shortcut Disabled
Single SFM Overload Disabled
IP Fast Reroute Disabled
ICMP Tunneling Disabled
Reassembly ISA-BB group Not configured
ICMP Tunneling Disabled
Ipv6 Nbr Reachab. time Not configured 30
IPv6 Nbr stale time (s) 14400
VPRN Local TTL Propagate vc-only
VPRN Transit TTL Propag* vc-only
Label Route Local TTL P* none
Label Route Transit TTL* none
LSR Label Route TTL Pro* none
=====
* indicates that the corresponding row element may have been truncated.
*B:bkvm31#

```

**VPRN TTL Propagation and ICMP Tunneling**—The following output is an example of TTL propagation and ICMP tunneling configurations in a VPRN service. The TTL propagation has been specified as local and all for VPRN service 5001.

### Sample Output

```

*A:Dut-A# configure service vprn 5001 ttl-propagate local all
*A:Dut-A# show router 5001 status

=====
Router Status (Service: 5001)
=====

```

|        | Admin State    | Oper State     |
|--------|----------------|----------------|
| Router | Up             | Up             |
| OSPFv2 | Not configured | Not configured |
| RIP    | Not configured | Not configured |
| RIP-NG | Not configured | Not configured |
| ISIS   | Not configured | Not configured |
| MPLS   | Not configured | Not configured |
| RSVP   | Not configured | Not configured |
| LDP    | Not configured | Not configured |
| BGP    | Not configured | Not configured |
| IGMP   | Not configured | Not configured |
| MLD    | Not configured | Not configured |
| PIM    | Not configured | Not configured |

|        |                |                |
|--------|----------------|----------------|
| PIMv4  | Not configured | Not configured |
| PIMv6  | Not configured | Not configured |
| OSPFv3 | Not configured | Not configured |
| MSDP   | Not configured | Not configured |

|                          |                    |    |
|--------------------------|--------------------|----|
| Max IPv4 Routes          | No Limit           |    |
| Max IPv6 Routes          | No Limit           |    |
| Total IPv4 Routes        | 2                  |    |
| Total IPv6 Routes        | 2                  |    |
| Max Multicast Routes     | No Limit           |    |
| Total IPv4 Mcast Routes  | PIM not configured |    |
| Total IPv6 Mcast Routes  | PIM not configured |    |
| ECMP Max Routes          | 1                  |    |
| Mcast Info Policy        | default            |    |
| Triggered Policies       | No                 |    |
| GRT Lookup               | Disabled           |    |
| Local Management         | Disabled           |    |
| Single SFM Overload      | Disabled           |    |
| IP Fast Reroute          | Disabled           |    |
| ICMP Tunneling           | Disabled           |    |
| Reassembly ISA-BB group  | Not configured     |    |
| ICMP Tunneling           | Disabled           |    |
| Ipv6 Nbr Reachab. time   | Not configured     | 30 |
| VPRN Local TTL Propagate | all                |    |
| VPRN Transit TTL Propag* | inherit (vc-only)  |    |

=====

\* indicates that the corresponding row element may have been truncated.

\*A:Dut-A#

## tunnel-table

**Syntax**

**tunnel-table summary** [{ipv4 | ipv6}]

**tunnel-table** [protocol *protocol*] {ipv4 | ipv6}

**tunnel-table** [*ip-prefix[/mask]*] [alternative] [{ipv4 | ipv6}] **detail**

**tunnel-table** [*ip-prefix[/mask]*] [alternative]

**tunnel-table mpls-tp**

**tunnel-table** [*ip-prefix[/mask]*] **protocol** *protocol* [**detail**]

**tunnel-table** [*ip-prefix[/mask]*] **sdp** *sdp-id*

**Context** show>router

**Description** This command displays tunnel table information. Auto-bind GRE tunnels are not displayed in **show** command output. GRE tunnels are not the same as SDP tunnels that use the GRE encapsulation type. When the **auto-bind-tunnel** command is used when configuring a VPRN service, it means the MP-BGP NH resolution is referring to the core routing instance for IP reachability. For a VPRN service this object specifies the lookup to be used by the routing instance if no SDP to the destination exists.

**Parameters**

**summary** — Displays summary tunnel table information.

**ipv4** — Displays information for IPv4 entries only.

**ipv6** — Displays information for IPv6 entries only.

*protocol* — Displays protocol information.

**Values**      bgp, ldp, rsvp, sdp, ospf, isis, sr-te, fpe

*ip-prefix[/mask]* — Displays the specified tunnel table's destination IP address and mask.

**alternative** — Displays Backup Route details.

**detail** — Displays detailed tunnel table information.

**mpls-tp** — Displays MPLS-TP information.

*sdp-id* — Displays information pertaining to the specified SDP.

**Values**      1 to 17407

**Output**      **Tunnel Table Output** — The following output is an example of tunnel table information, and [Table 38](#) describes the fields.

### Sample Output

```
*A:Dut-D>config>service>vpls# show router tunnel-table sdp 17407
=====
Tunnel Table (Router: Base)
=====
Destination Owner Encap TunnelId Pref Nexthop Metric

10.0.68.0/32 sdp MPLS 17407 5 10.0.68.0 0
=====
*A:Dut-D# show service id 1 sdp 17407:4294967294 detail
=====
Service Destination Point (Sdp Id : 17407:4294967294) Details
=====

Sdp Id 17407:4294967294 -(not applicable)

Description : (Not Specified)
SDP Id : 17407:4294967294 Type : VplsPmsi
Split Horiz Grp : (Not Specified)
VC Type : Ether VC Tag : n/a
Admin Path MTU : 9194 Oper Path MTU : 9194
Delivery : MPLS
Far End : not applicable
Tunnel Far End : n/a LSP Types : None
Hash Label : Disabled Hash Lbl Sig Cap : Disabled
Oper Hash Label : Disabled

Admin State : Up Oper State : Up
Acct. Pol : None Collect Stats : Disabled
Ingress Label : 0 Egress Label : 3
Ingr Mac Fltr-Id : n/a Egr Mac Fltr-Id : n/a
Ingr IP Fltr-Id : n/a Egr IP Fltr-Id : n/a
Ingr IPv6 Fltr-Id : n/a Egr IPv6 Fltr-Id : n/a
Admin ControlWord : Not Preferred Oper ControlWord : False
Last Status Change : 12/14/2012 12:42:22 Signaling : None
Last Mgmt Change : 12/14/2012 12:42:19 Force Vlan-Vc : Disabled
Endpoint : N/A Precedence : 4
PW Status Sig : Enabled
Class Fwding State : Down
```



```

Flags : None
Time to RetryReset : never
Mac Move : Blockable
Local Pw Bits : None
Peer Pw Bits : None
Peer Fault Ip : None
Peer Vccv CV Bits : None
Peer Vccv CC Bits : None
Application Profile: None
Max Nbr of MAC Addr: No Limit
Learned MAC Addr : 0

Retries Left : 3
Blockable Level : Tertiary

MAC Learning : Enabled
MAC Aging : Enabled
BPDU Translation : Disabled
L2PT Termination : Disabled
MAC Pinning : Disabled
Ignore Standby Sig : False
Oper Group : (none)
Rest Prot Src Mac : Disabled
Auto Learn Mac Prot: Disabled

Discard Unkwn Srce: Disabled
Block On Mesh Fail: False
Monitor Oper Grp : (none)
RestProtSrcMacAct : Disable

Ingress Qos Policy : (none)
Ingress FP QGrp : (none)
Ing FP QGrp Inst : (none)

Egress Qos Policy : (none)
Egress Port QGrp : (none)
Egr Port QGrp Inst: (none)

ETH-CFM SDP-Bind specifics

V-MEP Filtering : Disabled

KeepAlive Information :
Admin State : Disabled
Hello Time : 10
Max Drop Count : 3

Oper State : Disabled
Hello Msg Len : 0
Hold Down Time : 10

Statistics :
I. Fwd. Pkts. : 0
I. Fwd. Octs. : 0
E. Fwd. Pkts. : 2979761

I. Dro. Pkts. : 0
I. Dro. Octets : 0
E. Fwd. Octets : 476761760

Control Channel Status

PW Status : disabled
Peer Status Expire : false

Refresh Timer : <none>
Clear On Timeout : true

MCAC Policy Name :
MCAC Max Unconst BW: no limit
MCAC In use Mand BW: 0
MCAC In use Opnl BW: 0

MCAC Max Mand BW : no limit
MCAC Avail Mand BW: unlimited
MCAC Avail Opnl BW: unlimited

RSVP/Static LSPs

Associated LSP List :
No LSPs Associated

Class-based forwarding :

Class forwarding : Disabled
EnforcedSTELspFc : Disabled

```

```

Default LSP : Uknwn Multicast LSP : None
=====
FC Mapping Table
=====
FC Name LSP Name

No FC Mappings

Stp Service Destination Point specifics

Stp Admin State : Down Stp Oper State : Down
Core Connectivity : Down
Port Role : N/A Port State : Forwarding
Port Number : 0 Port Priority : 128
Port Path Cost : 10 Auto Edge : Enabled
Admin Edge : Disabled Oper Edge : N/A
Link Type : Pt-pt BPDU Encap : Dot1d
Root Guard : Disabled Active Protocol : N/A
Last BPDU from : N/A Designated Port Id: N/A
Designated Bridge : N/A

Fwd Transitions : 0 Bad BPDUs rcvd : 0
Cfg BPDUs rcvd : 0 Cfg BPDUs tx : 0
TCN BPDUs rcvd : 0 TCN BPDUs tx : 0
TC bit BPDUs rcvd : 0 TC bit BPDUs tx : 0
RST BPDUs rcvd : 0 RST BPDUs tx : 0

Number of SDPs : 1

=====

*A:Dut-C# show router tunnel-table sdp 17407
=====
Tunnel Table (Router: Base)
=====
Destination Owner Encap TunnelId Pref Nexthop Metric

10.0.68.0/32 sdp MPLS 17407 5 10.0.68.0 0
=====

A:ALA-A>config>service# show router tunnel-table Tunnel Table
=====
DestinationOwnerEncapTunnel IdPrefNexthopMetric

10.0.0.1/32 sdp GRE 10 5 10.0.0.1 0
10.0.0.1/32 sdp GRE 21 5 10.0.0.1 0
10.0.0.1/32 sdp GRE 31 5 10.0.0.1 0
10.0.0.1/32 sdp GRE 41 5 10.0.0.1 0
=====

A:ALA-A>config>service#

A:ALA-A>config>service# show router tunnel-table summary
=====
Tunnel Table Summary (Router: Base)
=====
Active Available

LDP 1 1
SDP 1 1

```

```
=====
A:ALA-A>config>service#

A:Dut-C# show router tunnel-table
=====
Tunnel Table (Router: Base)
=====
Destination Owner Encap TunnelId Pref Nexthop Metric

10.0.0.1/32 isis (0) MPLS 524309 11 1.3.4.4 10
10.20.1.2/32 isis (0) MPLS 524312 11 1.2.3.2 10
10.20.1.4/32 isis (0) MPLS 524310 11 1.3.4.4 10
10.20.1.5/32 isis (0) MPLS 524311 11 1.2.3.2 20

Flags: B = BGP backup route available
 E = inactive best-
external BGP route
=====
A:Dut-C#

*A:Dut-C> show router tunnel-table
=====
IPv4 Tunnel Table (Router: Base)
=====
Destination Owner Encap TunnelId Pref Nexthop Metric

10.20.1.1/32 ldp MPLS 65546 9 10.10.2.1 10
10.20.1.2/32 ldp MPLS 65545 9 10.10.12.2 3
10.20.1.2/32 isis (0) MPLS 524318 11 10.10.12.2 3
10.20.1.4/32 isis (0) MPLS 524316 11 10.10.11.4 10
10.20.1.5/32 ldp MPLS 65547 9 10.10.5.5 10
10.20.1.5/32 isis (0) MPLS 524315 11 10.10.5.5 10
10.20.1.6/32 isis (0) MPLS 524317 11 10.10.11.4 20

Flags: B = BGP backup route available
 E = inactive best-external BGP route
=====

A:Dut-C# show router tunnel-table detail
=====
Tunnel Table (Router: Base)
=====
Destination : 10.1.126.2/32
NextHop : 10.20.1.5
Tunnel Flags : is-over-tunnel
Age : 01h27m59s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 66389 Preference : 9
Tunnel Label : 243909 Tunnel Metric : 1
Tunnel MTU : 9186

Destination : 10.20.1.22/32
NextHop : 10.1.17.7
Tunnel Flags : (Not Specified)
Age : 01h29m15s
CBF Classes : (Not Specified)
```

```

Owner : rsvp Encap : MPLS
Tunnel ID : 13 Preference : 7
Tunnel Label : 249809 Tunnel Metric : 2000
Tunnel MTU : 9190
LSP ID : 44032 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 0

```

```

Destination : 10.20.1.22/32
NextHop : 10.1.18.7
Tunnel Flags : exclude-for-lfa
Age : 00h01m47s
CBF Classes : default-lsp
Owner : rsvp Encap : MPLS
Tunnel ID : 243 Preference : 7
Tunnel Label : 249872 Tunnel Metric : 2000
Tunnel MTU : 9190
LSP ID : 44032 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 0

```

```

Destination : 10.20.1.22/32
NextHop : 10.1.18.7
Tunnel Flags : exclude-for-lfa
Age : 00h00m38s
CBF Classes : af ll ef nc
Owner : rsvp Encap : MPLS
Tunnel ID : 244 Preference : 7
Tunnel Label : 249905 Tunnel Metric : 2000
Tunnel MTU : 9190
LSP ID : 45568 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 0

```

```

Destination : 10.20.1.22/32
NextHop : 10.1.17.7
Tunnel Flags : exclude-for-lfa
Age : 00h00m21s
CBF Classes : h2
Owner : rsvp Encap : MPLS
Tunnel ID : 245 Preference : 7
Tunnel Label : 250063 Tunnel Metric : 2000
Tunnel MTU : 9190
LSP ID : 39936 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 0

```

```

Destination : 10.20.1.22/32
NextHop : 10.1.18.7
Tunnel Flags : exclude-for-lfa
Age : 01h29m40s
CBF Classes : ef default-lsp
Owner : rsvp Encap : MPLS
Tunnel ID : 246 Preference : 7
Tunnel Label : 250024 Tunnel Metric : 2000
Tunnel MTU : 9190
LSP ID : 38400 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 0

```

```

Destination : 10.1.0.254/32
NextHop : 10.20.1.4
Tunnel Flags : is-over-tunnel

```

```

Age : 01h28m38s
CBF Classes : (Not Specified)
Owner : bgp
Tunnel ID : 264115
Tunnel Label : 260512
Tunnel MTU : 9186
Encap : MPLS
Preference : 12
Tunnel Metric : 1000

Number of tunnel-table entries : 2866
Number of tunnel-table entries with LFA : 0
=====
A:Dut-C#

*B:Dut-B>config>router>mpls>lsp# show router tunnel-table ipv6 protocol isis
=====
IPv6 Tunnel Table (Router: Base)
=====
Destination Owner Encap TunnelId Pref
NextHop Metric

2001:db8::a14:103/128 isis (0) MPLS 524355 11
fe80::c7b:1ff:fe01:1-"B_to_D" 20
2001:db8::a14:104/128 isis (0) MPLS 524354 11
fe80::c7b:1ff:fe01:1-"B_to_D" 10
2001:db8::a14:105/128 isis (0) MPLS 524356 11
fe80::c7f:2ff:fe01:1-"B_to_E" 10
2001:db8::a14:106/128 isis (0) MPLS 524357 11
fe80::c7f:1ff:fe01:1-"B_to_D" 20

Flags: B = BGP backup route available
 E = inactive best-external BGP route
=====

*A:Dut-C# show router tunnel-table detail
=====
Tunnel Table (Router: Base)
=====
Destination : 10.20.1.1/32
NextHop : 10.10.2.1
Tunnel Flags : entropy-label-capable
Age : 00h01m03s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65537 Preference : 9
Tunnel Label : 524287 Tunnel Metric : 1000
Tunnel MTU : 1496 Max Label Stack : 1

Destination : 10.20.1.2/32
NextHop : 10.10.12.2
Tunnel Flags : entropy-label-capable
Age : 00h01m03s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65538 Preference : 9
Tunnel Label : 524287 Tunnel Metric : 333
Tunnel MTU : 1496 Max Label Stack : 1

Destination : 10.20.1.4/32
NextHop : 10.10.11.4

```

```
Tunnel Flags : entropy-label-capable
Age : 00h00m55s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65539 Preference : 9
Tunnel Label : 524287 Tunnel Metric : 1000
Tunnel MTU : 1496 Max Label Stack : 1

Destination : 10.20.1.5/32
NextHop : 10.10.5.5
Tunnel Flags : entropy-label-capable
Age : 00h01m03s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65543 Preference : 9
Tunnel Label : 524287 Tunnel Metric : 1000
Tunnel MTU : 1496 Max Label Stack : 1

Destination : 10.20.1.6/32
NextHop : 10.10.12.2
Tunnel Flags : exclude-for-lfa entropy-label-capable
Age : 00h01m03s
CBF Classes : (Not Specified)
Owner : rsvp Encap : MPLS
Tunnel ID : 1 Preference : 7
Tunnel Label : 524271 Tunnel Metric : 2000
Tunnel MTU : 1496 Max Label Stack : 1
LSP ID : 17920 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 4000

Destination : 10.20.1.6/32
NextHop : 10.10.3.2
Tunnel Flags : exclude-for-lfa entropy-label-capable
Age : 00h01m03s
CBF Classes : (Not Specified)
Owner : rsvp Encap : MPLS
Tunnel ID : 2 Preference : 7
Tunnel Label : 524270 Tunnel Metric : 2000
Tunnel MTU : 1496 Max Label Stack : 1
LSP ID : 44032 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 80

Destination : 10.20.1.6/32
NextHop : 10.10.11.4
Tunnel Flags : exclude-for-lfa entropy-label-capable
Age : 00h00m54s
CBF Classes : (Not Specified)
Owner : rsvp Encap : MPLS
Tunnel ID : 3 Preference : 7
Tunnel Label : 524265 Tunnel Metric : 2000
Tunnel MTU : 1496 Max Label Stack : 1
LSP ID : 1536 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 240

Destination : 10.20.1.6/32
NextHop : 10.10.5.5
Tunnel Flags : exclude-for-lfa entropy-label-capable
Age : 00h01m02s
CBF Classes : (Not Specified)
```

```

Owner : rsvp Encap : MPLS
Tunnel ID : 4 Preference : 7
Tunnel Label : 524269 Tunnel Metric : 2000
Tunnel MTU : 1496 Max Label Stack : 1
LSP ID : 1024 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 800

Destination : 10.20.1.6/32
NextHop : 10.20.1.6 (1, rsvp)
NextHop Weight : 22
Tunnel Flags : is-over-tunnel entropy-label-capable
Age : 00h00m55s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65544 Preference : 9
Tunnel Label : 524287 Tunnel Metric : 2000
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 10.20.1.6/32
NextHop : 10.20.1.6 (2, rsvp)
NextHop Weight : 1
Tunnel Flags : is-over-tunnel entropy-label-capable
Age : 00h00m55s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65544 Preference : 9
Tunnel Label : 524287 Tunnel Metric : 2000
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 10.20.1.6/32
NextHop : 10.20.1.6 (3, rsvp)
NextHop Weight : 2
Tunnel Flags : is-over-tunnel entropy-label-capable
Age : 00h00m55s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65544 Preference : 9
Tunnel Label : 524287 Tunnel Metric : 2000
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 10.20.1.6/32
NextHop : 10.20.1.6 (4, rsvp)
NextHop Weight : 5
Tunnel Flags : is-over-tunnel entropy-label-capable
Age : 00h00m55s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65544 Preference : 9
Tunnel Label : 524287 Tunnel Metric : 2000
Tunnel MTU : 1492 Max Label Stack : 2

Number of tunnel-table entries : 12
Number of tunnel-table entries with LFA : 0
=====

*B:Dut-B>config>router>mpls>lsp# show router tunnel-table ipv6 protocol isis
=====
IPv6 Tunnel Table (Router: Base)

```

```

=====
Destination Owner Encap TunnelId Pref
NextHop Metric

2001:db8::a14:103/128 isis (0) MPLS 524355 11
fe80::c7b:1ff:fe01:1-"B_to_D" 20
2001:db8::a14:104/128 isis (0) MPLS 524354 11
fe80::c7b:1ff:fe01:1-"B_to_D" 10
2001:db8::a14:105/128 isis (0) MPLS 524356 11
fe80::c7f:2ff:fe01:1-"B_to_E" 10
2001:db8::a14:106/128 isis (0) MPLS 524357 11
fe80::c7f:1ff:fe01:1-"B_to_D" 20

Flags: B = BGP backup route available
 E = inactive best-external BGP route
=====

*B:Dut-B>config>router>mpls>lsp# show router tunnel-table ipv6 detail
=====
Tunnel Table (Router: Base)
=====
Destination : 2001:db8::a14:103/128
NextHop : 2001:db8::a14:103
Tunnel Flags : (Not Specified)
Age : 00h02m20s
CBF Classes : (Not Specified)
Owner : sdp Encap : MPLS
Tunnel ID : 230 Preference : 5
Tunnel Label : - Tunnel Metric : 0
Tunnel MTU : 1578 Max Label Stack : 1

Destination : 2001:db8::a14:103/128
NextHop : fe80::c7f:1ff:fe01:1-"B_to_D"
Tunnel Flags : (Not Specified)
Age : 00h02m15s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65567 Preference : 9
Tunnel Label : 262136 Tunnel Metric : 200
Tunnel MTU : 1582 Max Label Stack : 1

Destination : 2001:db8::a14:103/128
NextHop : fe80::c7f:1ff:fe01:1-"B_to_D"
Tunnel Flags : exclude-for-igpshortcuts
Age : 00h02m23s
CBF Classes : (Not Specified)
Owner : isis (0) Encap : MPLS
Tunnel ID : 524355 Preference : 11
Tunnel Label : 18563 Tunnel Metric : 20
Tunnel MTU : 1582 Max Label Stack : 1

Destination : 2001:db8::a14:104/128
NextHop : fe80::c7f:1ff:fe01:1-"B_to_D"
Tunnel Flags : (Not Specified)
Age : 00h02m20s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65568 Preference : 9
Tunnel Label : 262143 Tunnel Metric : 100

```



```

Tunnel MTU : 1582 Max Label Stack : 1

Destination : 2001:db8::a14:104/128
NextHop : fe80::c7f:1ff:fe01:1-"B_to_D"
Tunnel Flags : exclude-for-igpshortcuts
Age : 00h02m32s
CBF Classes : (Not Specified)
Owner : isis (0) Encap : MPLS
Tunnel ID : 524354 Preference : 11
Tunnel Label : 18564 Tunnel Metric : 10
Tunnel MTU : 1582 Max Label Stack : 1

Destination : 2001:db8::a14:105/128
NextHop : fe80::c7f:2ff:fe01:1-"B_to_E"
Tunnel Flags : (Not Specified)
Age : 00h02m15s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65569 Preference : 9
Tunnel Label : 262143 Tunnel Metric : 100
Tunnel MTU : 1582 Max Label Stack : 1

Destination : 2001:db8::a14:105/128
NextHop : fe80::c7f:2ff:fe01:1-"B_to_E"
Tunnel Flags : exclude-for-igpshortcuts
Age : 00h02m32s
CBF Classes : (Not Specified)
Owner : isis (0) Encap : MPLS
Tunnel ID : 524356 Preference : 11
Tunnel Label : 18565 Tunnel Metric : 10
Tunnel MTU : 1582 Max Label Stack : 1

Destination : 2001:db8::a14:106/128
NextHop : fe80::c7b:1ff:fe01:1-"B_to_D"
Tunnel Flags : (Not Specified)
Age : 00h02m16s
CBF Classes : (Not Specified)
Owner : ldp Encap : MPLS
Tunnel ID : 65570 Preference : 9
Tunnel Label : 262133 Tunnel Metric : 200
Tunnel MTU : 1582 Max Label Stack : 1

Destination : 2001:db8::a14:106/128
NextHop : fe80::c7b:1ff:fe01:1-"B_to_D"
Tunnel Flags : exclude-for-igpshortcuts
Age : 00h02m24s
CBF Classes : (Not Specified)
Owner : isis (0) Encap : MPLS
Tunnel ID : 524357 Preference : 11
Tunnel Label : 18566 Tunnel Metric : 20
Tunnel MTU : 1582 Max Label Stack : 1

Number of tunnel-table entries : 9
Number of tunnel-table entries with LFA : 0
=====

*A:Dut-C>config>router>ospf3# show router tunnel-table ipv6 detail
=====
Tunnel Table (Router: Base)

```

```

=====
Destination : 3ffe::100:b01/128
NextHop : fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m52s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524329 Preference : 10
Tunnel Label : 20004 Tunnel Metric : 100
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 3ffe::100:1602/128
NextHop : fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m53s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524328 Preference : 10
Tunnel Label : 20005 Tunnel Metric : 200
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 3ffe::100:2c04/128
NextHop : fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m51s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524336 Preference : 10
Tunnel Label : 20001 Tunnel Metric : 300
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 3ffe::100:3705/128
NextHop : fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m51s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524334 Preference : 10
Tunnel Label : 70002 Tunnel Metric : 200
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 3ffe::100:4206/128
NextHop : fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m53s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524330 Preference : 10
Tunnel Label : 70003 Tunnel Metric : 100
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 3ffe::a14:101/128
NextHop : fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m53s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524332 Preference : 10
Tunnel Label : 20010 Tunnel Metric : 100

```

```

Tunnel MTU : 1492 Max Label Stack : 2

Destination : 3ffe::a14:102/128
NextHop : fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m53s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524327 Preference : 10
Tunnel Label : 20011 Tunnel Metric : 200
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 3ffe::a14:104/128
NextHop : fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m53s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524333 Preference : 10
Tunnel Label : 20007 Tunnel Metric : 300
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 3ffe::a14:105/128
NextHop : fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m52s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524335 Preference : 10
Tunnel Label : 70008 Tunnel Metric : 200
Tunnel MTU : 1492 Max Label Stack : 2

Destination : 3ffe::a14:106/128
NextHop : fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0"
Tunnel Flags : has-lfa entropy-label-capable
Age : 00h03m54s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524331 Preference : 10
Tunnel Label : 70009 Tunnel Metric : 100
Tunnel MTU : 1492 Max Label Stack : 2

Destination : fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0"/128
NextHop : fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0"
Tunnel Flags : has-lfa is-adjacency-tunnel
Age : 00h03m53s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524325 Preference : 10
Tunnel Label : 3 Tunnel Metric : 0
Tunnel MTU : 1492 Max Label Stack : 2

Destination : fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0"/128
NextHop : fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0"
Tunnel Flags : has-lfa is-adjacency-tunnel
Age : 00h03m54s
CBF Classes : (Not Specified)
Owner : ospf3 (0) Encap : MPLS
Tunnel ID : 524326 Preference : 10

```

```

Tunnel Label : 3 Tunnel Metric : 0
Tunnel MTU : 1492 Max Label Stack : 2

Number of tunnel-table entries : 12
Number of tunnel-table entries with LFA : 12
=====

```

**Table 38** Tunnel Table Fields

| Label       | Description                                                                      |
|-------------|----------------------------------------------------------------------------------|
| Destination | The route's destination address and mask.                                        |
| Owner       | Specifies the tunnel owner.                                                      |
| Encap       | Specifies the tunnel's encapsulation type.                                       |
| Tunnel ID   | Specifies the tunnel (SDP) identifier.                                           |
| Pref        | Specifies the route preference for routes learned from the configured peers.     |
| Nexthop     | The next hop for the route's destination.                                        |
| Metric      | The route metric value for the route.                                            |
| CBF Classes | The forwarding classes and/or <b>default-lsp</b> option assigned to this tunnel. |

**CBF Info**—The following output is an example for checking the CBF info of a tunnel in TTM.

**Sample Output**

```

*A:Dut-B>show>router# show router tunnel-table 10.20.1.5/32 protocol rsvp detail
=====
Tunnel Table (Router: Base)
=====
Destination : 10.20.1.5/32
NextHop : 10.11.18.3
Tunnel Flags : exclude-for-lfa entropy-label-capable
Age : 00h17m17s
CBF Classes : (Not Specified)
Owner : rsvp Encap : MPLS
Tunnel ID : 35 Preference : 7
Tunnel Label : 262142 Tunnel Metric : 2000
Tunnel MTU : 1496 Max Label Stack : 1
LSP ID : 15872 Bypass Label : 0
LSP Bandwidth : 0 LSP Weight : 0

.
.

Destination : 10.20.1.5/32
NextHop : 10.11.20.3
Tunnel Flags : exclude-for-lfa entropy-label-capable

```

```

Age : 00h17m18s
CBF Classes : be l2
Owner : rsvp
Tunnel ID : 47
Tunnel Label : 262070
Tunnel MTU : 1496
LSP ID : 15360
LSP Bandwidth : 0
Encap : MPLS
Preference : 7
Tunnel Metric : 2000
Max Label Stack : 1
Bypass Label : 0
LSP Weight : 0

```

```

.
.
.

```

```

Destination : 10.20.1.5/32
NextHop : 10.11.7.3
Tunnel Flags : exclude-for-lfa entropy-label-capable
Age : 00h17m18s
CBF Classes : af l1
Owner : rsvp
Tunnel ID : 60
Tunnel Label : 262063
Tunnel MTU : 1496
LSP ID : 16384
LSP Bandwidth : 0
Encap : MPLS
Preference : 7
Tunnel Metric : 2000
Max Label Stack : 1
Bypass Label : 0
LSP Weight : 0

```

```

.
.
.

```

```

Destination : 10.20.1.5/32
NextHop : 10.11.1.3
Tunnel Flags : exclude-for-lfa entropy-label-capable
Age : 00h17m19s
CBF Classes : h2 ef default-lsp
Owner : rsvp
Tunnel ID : 76
Tunnel Label : 262053
Tunnel MTU : 1496
LSP ID : 36352
LSP Bandwidth : 0
Encap : MPLS
Preference : 7
Tunnel Metric : 2000
Max Label Stack : 1
Bypass Label : 0
LSP Weight : 0

```

```

.
.
.

```

```

Number of tunnel-table entries : 64
Number of tunnel-table entries with LFA : 0
=====

```

## lbm-svc-act-responder

|                    |                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>lbm-svc-act-responder</b> [domain <i>md-index</i> ] [association <i>ma-index</i> ] [mep <i>mep-id</i> ]                                                                                                                                                                                                                                          |
| <b>Context</b>     | show>eth-cfm                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | This command displays all the MEPs that have been created with this optional parameter, which allocates additional resources to facilitate high-speed LBM-to-LBR processing typically used during service activation testing. The optional filters are cumulative. These filters can be used to narrow the focus of the display to a specific area. |
| <b>Parameters</b>  | <p><i>md-index</i> — Displays the MD index.</p> <p><b>Values</b> 1 to 4294967295</p> <p><i>ma-index</i> — Displays the MA index.</p> <p><b>Values</b> 1 to 4294967295</p> <p><i>mep-id</i> — Displays the local MEP ID.</p> <p><b>Values</b> 1 to 8191</p>                                                                                          |
| <b>Output</b>      | The following is an example of ETH CFM <b>lbm-svc-act-responder</b> information.                                                                                                                                                                                                                                                                    |

[Table 18](#) describes the output fields:

### Sample Output

```
*A:PE-2# show eth-cfm lbm-svc-act-responder
=====
Eth-CFM SAP Local MEP LBM Service Activation Responder Enabled
=====
Sap Lvl Dir MdIndex MaIndex MepId SrcMacAddress

1/1/9:1.* 4 D 14 1 2 00:10:11:00:00:1f

No. of MEPs: 1
=====
Eth-CFM Facility Interface Local MEP LBM Service Activation Responder Enabled
=====
Interface Lvl Dir MdIndex MaIndex MepId SrcMacAddress

int-PE-2-P-3 3 D 13 1 2 d8:1f:01:01:00:02

No. of MEPs: 1
=====
Eth-CFM SAP Primary VLAN Local MEP LBM Service Activation Responder Enabled
=====
Sap Lvl Dir MdIndex MaIndex MepId SrcMacAddress
Primary VlanId

No Matching Entries

No. of MEPs: 0
```

```

=====
Eth-CFM SDP Local MEP LBM Service Activation Responder Enabled
=====
Sdp Lvl Dir MdIndex MaIndex MepId SrcMacAddress

No Matching Entries

No. of MEPS: 0
=====
Eth-CFM SDP Primary VLAN Local MEP LBM Service Activation Responder Enabled
=====
Sdp Lvl Dir MdIndex MaIndex MepId SrcMacAddress
Primary VlanId

No Matching Entries

No. of MEPS: 0
=====

```

**Table 39**      **ETH-CFM Ibm-service-act-responder Field Descriptions**

| Label         | Description                                              |
|---------------|----------------------------------------------------------|
| MdIndex       | Displays the Maintenance Domain (MD) index value         |
| MaIndex       | Displays the MA index value                              |
| MepId         | Displays the maintenance association endpoint identifier |
| SrcMacAddress | Displays the source MAC address                          |

### 2.14.2.1.1 L2TP Show Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

**l2tp**

|                    |                                                                       |
|--------------------|-----------------------------------------------------------------------|
| <b>Syntax</b>      | <b>l2tp</b>                                                           |
| <b>Context</b>     | show>router                                                           |
| <b>Description</b> | This command enables the context to display L2TP related information. |

## eth-tunnel

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>eth-tunnel</b> [ <b>group</b> <i>tunnel-group-name</i> ] [ <b>vc-id</b> <i>vc-id</i> ]                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | show>router>l2tp                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command displays information about configured L2TPv3 Ethernet tunnels. These Ethernet tunnels are the L2TPv3 sessions setup between the local private L2 SAP and the far end device.</p> <p>If this command is executed without any parameters, then a list of all configured Ethernet tunnels are displayed.</p> <p>If this command is executed with a tunnel group name or a VC-ID, then a detailed view of the associated Ethernet tunnel is displayed.</p> |
| <b>Parameters</b>  | <p><i>tunnel-group-name</i> — Specifies the configured tunnel group name used for the associated Ethernet tunnel.</p> <p><i>vc-id</i> — Specifies the VC ID for the L2TPv3 Ethernet tunnel.</p> <p><b>Values</b>      0 to 4294967295</p>                                                                                                                                                                                                                              |
| <b>Output</b>      | The following output is an example of L2TPv3 Ethernet tunnel information                                                                                                                                                                                                                                                                                                                                                                                               |

### Sample Output

```

A:Dut-A# show router 200 l2tp eth-tunnel
=====
L2TPv3 Ethernet Tunnel Summary
=====
Tunnel Group name VC ID

v3-group-1 100

No. of ethernet tunnels: 1
=====

A:Dut-A# show router 200 l2tp eth-tunnel group "v3-group-1"
=====
L2TPv3 Ethernet Tunnel Status
=====
Group Name : v3-group-1
VC ID : 100
Local Conn ID : 221122308
Ctrl Conn ID : 221118464
Matches Cfg : true
Down Reason : N/A
Reconnect Time (s) : N/A
Remaining Time (s) : N/A
SAP ID : tunnel-1.private:100
SAP Service ID : 100

No. of ethernet tunnels: 1
=====

```



## group

|                    |                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>group</b> [ <i>tunnel-group-name</i> [ <b>statistics</b> ]]                                                                                             |
| <b>Context</b>     | show>router>l2tp                                                                                                                                           |
| <b>Description</b> | This command displays L2TP group operational information.                                                                                                  |
| <b>Parameters</b>  | <i>tunnel-group-name</i> — Displays information for the specified tunnel group.<br><b>statistics</b> — Displays statistics for the specified tunnel group. |
| <b>Output</b>      | The following output is an example of L2TP group operational information.                                                                                  |

### Sample Output

```
*A:Dut-C# show router l2tp group
=====
L2TP Groups
=====
Group Name Ses Limit Ses Assign State Tun Active Ses Active
 Tun Total Ses Total

isp1.group-1
 131071 existingFirst active 1 1
 1 1
isp1.group-2
 131071 weighted active 2 5
 3 8

No. of L2TP Groups: 2
=====
*A:Dut-C#

*A:Dut-C# show router l2tp group isp1.group-2
=====
Group Name: isp1.group-2
=====
Conn ID Loc-Tu-ID Rem-Tu-ID State Ses Active
 Group Assignment Ses Total

143523840 2190 17525 established 2
 isp1.group-2 3
 isp1.tunnel-3
236912640 3615 58919 closedByPeer 0
 isp1.group-2 2
 isp1.tunnel-2
658178048 10043 33762 draining 3
 isp1.group-2 3
 isp1.tunnel-2

No. of tunnels: 3
=====
*A:Dut-C#

*A:Dut-C# show router l2tp group isp1.group-2 statistics
```

```

Group Name: ispl.group-2

 Attempts Failed Failed-Aut Active Total

Tunnels 3 0 0 2 3
Sessions 8 0 N/A 5 8

 Pkt-Ctl Pkt-Err Octets

Rx 51 0 1224
Tx 51 0 2796

*A:Dut-C#

```

## peer

**Syntax** **peer** *ip-address* [**udp-port** *port*] [**ip**]  
**peer** *ip-address* **statistics** [**udp-port** *port*] [**ip**]  
**peer** [**draining**] [{**blacklisted** | **selectable** | **unreachable**}]

**Context** show>router>l2tp

**Description** This command displays information regarding all configured L2TP peers.

If this command is executed without specifying a peer IP address, then a list of all L2TP peers are listed along with the type of transport used and statistics on the total number of tunnels and sessions, as well as the number of active tunnels and sessions.

If this command is executed with a specific peer IP address, then a detailed view for that peer is displayed.

**Parameters** *ip-address* — Specifies the L2TP peer address.  
*port* — Specifies the UDP port for the L2TP peer. This parameter is only supported with L2TPv2 peers.  
**ip** — Displays peers using IP transport.  
**statistics** — Displays the statistics for the given IP address.  
**draining** — Displays only peers with draining tunnels.  
**blacklisted** — Displays peers that are blacklisted.  
**selectable** — Displays peers that are selectable.  
**unreachable** — Displays peers that are deemed unreachable.

**Output** The following output is an example of L2TP peer operational information.

### Sample Output

```

A:Dut-A# show router 200 l2tp peer
=====

```

```
L2TP Peers
=====
Peer IP Port Tun Active Ses Active
 Drain Reachability Tun Total Ses Total

10.1.1.2 ip 1 1
 1 1

No. of peers: 1
=====
```

```
A:Dut-A# show router 200 l2tp peer 10.1.1.2 ip
=====
Peer IP: 10.1.1.2
=====
Roles capab/actual: LAC LNS / - - Draining : false
Tunnels : 1 Tunnels Active : 1
Sessions : 1 Sessions Active : 1
Reachability : reachable Time Unreachable : N/A
=====
Conn ID Loc-Tu-ID Rem-Tu-ID State Blacklist-state Ses Active
Group Ses Total
Assignment

221118464 3374 0 established not-blacklisted 1
v3-group-1 1
tun-1-l2tp-v3

No. of tunnels: 1
=====
```

```
*A:Fden-Dut2-BSA2# show router l2tp peer 10.0.0.1 statistics
=====
Peer IP: 10.0.0.1
=====
tunnels : 1
tunnels active : 1
sessions : 1
sessions active : 1

rx ctrl octets : 541
rx ctrl packets : 5
tx ctrl octets : 272
tx ctrl packets : 5
tx error packets : 0
rx error packets : 0
rx accepted msg : 4
rx duplicate msg : 0
rx out of window msg : 0

acceptedMsgType
 StartControlConnectionRequest : 1
 StartControlConnectionConnected : 1
 IncomingCallRequest : 1
 IncomingCallConnected : 1
 ZeroLengthBody : 1
originalTransmittedMsgType
 StartControlConnectionReply : 1
 IncomingCallReply : 1
```

```
ZeroLengthBody : 3
last cleared time : N/A
=====
```

## session

- Syntax** **session connection-id** *connection-id* [{**detail** | **ppp-statistics**}]  
**session** [{**detail** | **ppp-statistics**}] [**session-id** *session-id*] [**state** *session-state*] [**peer** *ip-address*] [**group** *group-name*] [**assignment-id** *assignment-id*] [**local-name** *local-host-name*] [**remote-name** *remote-host-name*] [**tunnel-id** *tunnel-id*] [**service** *service-id*] [**interface** {*ip-int-name* | *ip-address*}] [**ip-prefix** *ip-prefix/mask*]  
**session** [{**detail** | **ppp-statistics**}] [**state** *session-state*] [**peer** *ip-address*] [**group** *group-name*] [**assignment-id** *assignment-id*] [**local-name** *local-host-name*] [**remote-name** *remote-host-name*] [**control-connection-id** *connection-id*] [**service** *service-id*] [**interface** {*ip-int-name* | *ip-address*}]
- Context** show>router>l2tp
- Description** This command displays L2TP session operational information.
- Parameters** *connection-id* — Specifies the identification number for a Layer Two Tunneling Protocol connection.  
**Values** 1 to 429496729  
*detail* — Displays detailed L2TP session information.  
**ppp-statistics** — Displays PPP statistics for the session.  
*session-id* — Specifies the identification number for a Layer Two Tunneling Protocol session.  
**Values** 1 to 65535  
*session-state* — Specifies the values to identify the operational state of the L2TP session.  
**Values** closed, closed-by-peer, established, idle, wait-reply, wait-tunnel  
*ip-address* — Specifies the IP address of the peer.  
**Values** The following values apply to the 7750 SR:

|              |                                                                                                                                                                              |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ipv4-address | a.b.c.d (host bits must be 0)                                                                                                                                                |
| ipv6-address | x:x:x:x:x:x:x[-interface]<br>x:x:x:x:x:x:d.d.d.d[-interface]<br>x: [0 to FFFF]H<br>d: [0 to 255]D<br>interface: 32 characters maximum, mandatory for<br>link local addresses |

**Values** The following values apply to the 7450 ESS:

ipv4-address: a.b.c.d (host bits must be 0)

*group-name* — Specifies a string to identify a Layer Two Tunneling Protocol Tunnel group.

*assignment-id* — Specifies a string that distinguishes this Layer Two Tunneling Protocol tunnel.

*local-host-name* — Specifies the host name used by this system during the authentication phase of tunnel establishment.

*remote-host-name* — Specifies a string that is compared to the host name used by the tunnel peer during the authentication phase of tunnel establishment.

*tunnel-id* — Specifies the local identifier of this Layer Two Tunneling Protocol tunnel, when L2TP version 2 is used.

**Values** 1 to 65535

*service-id* — Specifies the service identification number.

*ip-int-name* — Specifies the IP interface name.

*ip-address* — Specifies the IPv4 or IPv6 addresses.

*ip-prefix/mask* — Specifies information for the specified IP prefix and mask length.

*connection-id* — Specifies an identification number for a Layer Two Tunneling Protocol session.

**Values** 1 to 429496729

**Output** The following output is an example of L2TP session operational information.

### Sample Output

```
*A:Dut-C# show router l2tp session
=====
L2TP Session Summary
=====
```

| ID        | Control Conn ID | Tunnel-ID | Session-ID | State       |
|-----------|-----------------|-----------|------------|-------------|
| 143524786 | 143523840       | 2190      | 946        | established |
| 143526923 | 143523840       | 2190      | 3083       | established |
| 143531662 | 143523840       | 2190      | 7822       | closed      |

```

236926987 236912640 3615 14347 closed
236927915 236912640 3615 15275 closed
379407426 379387904 5789 19522 established
658187773 658178048 10043 9725 established
658198275 658178048 10043 20227 established
658210606 658178048 10043 32558 established

```

```

No. of sessions: 9
=====

```

```

*A:Dut-C#

```

```

*A:Dut-C# show router l2tp session state established

```

```

=====
L2TP Session Summary
=====

```

| ID        | Control Conn ID | Tunnel-ID | Session-ID | State       |
|-----------|-----------------|-----------|------------|-------------|
| 143524786 | 143523840       | 2190      | 946        | established |
| 143526923 | 143523840       | 2190      | 3083       | established |
| 379407426 | 379387904       | 5789      | 19522      | established |
| 658187773 | 658178048       | 10043     | 9725       | established |
| 658198275 | 658178048       | 10043     | 20227      | established |
| 658210606 | 658178048       | 10043     | 32558      | established |

```

No. of sessions: 6
=====

```

```

*A:Dut-C#

```

```

*A:Dut-C# show router l2tp session state closed detail

```

```

=====
L2TP Session Status
=====

```

```

Connection ID : 143531662

```

```

State : closed

```

```

Tunnel Group : ispl.group-2

```

```

Assignment ID : ispl.tunnel-3

```

```

Error Message : Terminated by PPPoE: RX PADT

```

|                  |                       |                   |                       |
|------------------|-----------------------|-------------------|-----------------------|
| Control Conn ID  | : 143523840           | Remote Conn ID    | : 1148557524          |
| Tunnel ID        | : 2190                | Remote Tunnel ID  | : 17525               |
| Session ID       | : 7822                | Remote Session ID | : 39124               |
| Time Started     | : 04/17/2009 18:44:37 |                   |                       |
| Time Established | : 04/17/2009 18:44:37 | Time Closed       | : 04/17/2009 18:44:50 |
| CDN Result       | : generalError        | General Error     | : noError             |

```

=====
L2TP Session Status
=====

```

```

Connection ID : 236926987

```

```

State : closed

```

```

Tunnel Group : ispl.group-2

```

```

Assignment ID : ispl.tunnel-2

```

```

Error Message : tunnel was closed

```

|                 |             |                   |              |
|-----------------|-------------|-------------------|--------------|
| Control Conn ID | : 236912640 | Remote Conn ID    | : 3861360381 |
| Tunnel ID       | : 3615      | Remote Tunnel ID  | : 58919      |
| Session ID      | : 14347     | Remote Session ID | : 44797      |

```

Time Started : 04/17/2009 18:41:55
Time Established : 04/17/2009 18:41:55 Time Closed : 04/17/2009 18:43:20
CDN Result : generalError General Error : noError

L2TP Session Status
=====
Connection ID : 236927915
State : closed
Tunnel Group : ispl.group-2
Assignment ID : ispl.tunnel-2
Error Message : tunnel was closed

Control Conn ID : 236912640 Remote Conn ID : 3861317210
Tunnel ID : 3615 Remote Tunnel ID : 58919
Session ID : 15275 Remote Session ID : 1626
Time Started : 04/17/2009 18:41:03
Time Established : 04/17/2009 18:41:03 Time Closed : 04/17/2009 18:43:20
CDN Result : generalError General Error : noError

No. of sessions: 3
=====
*A:Dut-C#

*A:Dut-C# show router l2tp session session-id 946
=====
L2TP Session Summary
=====
ID Control Conn ID Tunnel-ID Session-ID State

143524786 143523840 2190 946 established

No. of sessions: 1
=====
*A:Dut-C# show router l2tp session connection-id 143524786 detail
=====
L2TP Session Status
=====
Connection ID : 143524786
State : established
Tunnel Group : ispl.group-2
Assignment ID : ispl.tunnel-3
Error Message : N/A

Control Conn ID : 143523840 Remote Conn ID : 1148528691
Tunnel ID : 2190 Remote Tunnel ID : 17525
Session ID : 946 Remote Session ID : 10291
Time Started : 04/17/2009 18:42:01
Time Established : 04/17/2009 18:42:01 Time Closed : N/A
CDN Result : noError General Error : noError

*A:Dut-C#

*A:Dut-C# show router l2tp session group ispl.group-2
=====
L2TP Session Summary
=====

```

| ID        | Control Conn ID | Tunnel-ID | Session-ID | State       |
|-----------|-----------------|-----------|------------|-------------|
| 143524786 | 143523840       | 2190      | 946        | established |
| 143526923 | 143523840       | 2190      | 3083       | established |
| 143531662 | 143523840       | 2190      | 7822       | closed      |
| 236926987 | 236912640       | 3615      | 14347      | closed      |
| 236927915 | 236912640       | 3615      | 15275      | closed      |
| 658187773 | 658178048       | 10043     | 9725       | established |
| 658198275 | 658178048       | 10043     | 20227      | established |
| 658210606 | 658178048       | 10043     | 32558      | established |

No. of sessions: 8

\*A:Dut-C#

\*A:Dut-C# show router l2tp session tunnel-id 2190 state closed detail

L2TP Session Status

Connection ID : 143531662

State : closed

Tunnel Group : ispl.group-2

Assignment ID : ispl.tunnel-3

Error Message : Terminated by PPPoE: RX PADT

Control Conn ID : 143523840

Remote Conn ID : 1148557524

Tunnel ID : 2190

Remote Tunnel ID : 17525

Session ID : 7822

Remote Session ID : 39124

Time Started : 04/17/2009 18:44:37

Time Established : 04/17/2009 18:44:37 Time Closed : 04/17/2009 18:44:50

CDN Result : generalError General Error : noError

No. of sessions: 1

\*A:Dut-C#

\*A:Dut-C# show router l2tp session assignment-id ispl.tunnel-2

L2TP Session Summary

| ID        | Control Conn ID | Tunnel-ID | Session-ID | State       |
|-----------|-----------------|-----------|------------|-------------|
| 236926987 | 236912640       | 3615      | 14347      | closed      |
| 236927915 | 236912640       | 3615      | 15275      | closed      |
| 658187773 | 658178048       | 10043     | 9725       | established |
| 658198275 | 658178048       | 10043     | 20227      | established |
| 658210606 | 658178048       | 10043     | 32558      | established |

No. of sessions: 5

\*A:Dut-C#

\*A:Dut-C# show router l2tp session assignment-id ispl.tunnel-2 state established

L2TP Session Summary



```

ID Control Conn ID Tunnel-ID Session-ID State

658187773 658178048 10043 9725 established
658198275 658178048 10043 20227 established
658210606 658178048 10043 32558 established

```

No. of sessions: 3

\*A:Dut-C#

\*A:Dut-C# show router l2tp session control-connection-id 658178048

L2TP Session Summary

```

ID Control Conn ID Tunnel-ID Session-ID State

658187773 658178048 10043 9725 established
658198275 658178048 10043 20227 established
658210606 658178048 10043 32558 established

```

No. of sessions: 3

\*A:Dut-C#

\*A:Dut-C# show router l2tp session peer 10.10.20.100

L2TP Session Summary

```

ID Control Conn ID Tunnel-ID Session-ID State

236926987 236912640 3615 14347 closed
236927915 236912640 3615 15275 closed
658187773 658178048 10043 9725 established
658198275 658178048 10043 20227 established
658210606 658178048 10043 32558 established

```

No. of sessions: 5

\*A:Dut-C#

\*A:Dut-C# show router l2tp session peer 10.10.20.100 state closed detail

L2TP Session Status

Connection ID : 236926987

State : closed

Tunnel Group : ispl.group-2

Assignment ID : ispl.tunnel-2

Error Message : tunnel was closed

```

Control Conn ID : 236912640 Remote Conn ID : 3861360381
Tunnel ID : 3615 Remote Tunnel ID : 58919
Session ID : 14347 Remote Session ID : 44797
Time Started : 04/17/2009 18:41:55
Time Established : 04/17/2009 18:41:55 Time Closed : 04/17/2009 18:43:20
CDN Result : generalError General Error : noError

```

```

=====
L2TP Session Status
=====
Connection ID : 236927915
State : closed
Tunnel Group : ispl.group-2
Assignment ID : ispl.tunnel-2
Error Message : tunnel was closed

Control Conn ID : 236912640 Remote Conn ID : 3861317210
Tunnel ID : 3615 Remote Tunnel ID : 58919
Session ID : 15275 Remote Session ID : 1626
Time Started : 04/17/2009 18:41:03
Time Established : 04/17/2009 18:41:03 Time Closed : 04/17/2009 18:43:20
CDN Result : generalError General Error : noError

No. of sessions: 2
=====
*A:Dut-C#

*A:Dut-C# show router l2tp session local-name lacl.wholesaler.com
=====
L2TP Session Summary
=====
ID Control Conn ID Tunnel-ID Session-ID State

143524786 143523840 2190 946 established
143526923 143523840 2190 3083 established
143531662 143523840 2190 7822 closed
236926987 236912640 3615 14347 closed
236927915 236912640 3615 15275 closed
379407426 379387904 5789 19522 established
658187773 658178048 10043 9725 established
658198275 658178048 10043 20227 established
658210606 658178048 10043 32558 established

No. of sessions: 9
=====
*A:Dut-C#

*A:Dut-C# show router l2tp session local-name lacl.wholesaler.com remote-
name lns.retailer1.net
=====
L2TP Session Summary
=====
ID Control Conn ID Tunnel-ID Session-ID State

379407426 379387904 5789 19522 established

No. of sessions: 1
=====
*A:Dut-C#

*A:Fden-Dut2-BSA2# show router l2tp session connection-id 600407016
=====

```

L2TP Session Summary

```
=====
ID Control Conn ID Tunnel-ID Session-ID State

600407016 600375296 9161 31720 established
 simon@base.lac.base.lns
 interface: gi_base_lns_base_lac
 service-id: 100
 ip-address: 10.100.2.1
=====
```

\*A:Fden-Dut2-BSA2# show router l2tp session connection-id 600407016 detail

L2TP Session Status

```
=====
Connection ID: 600407016
State : established
Tunnel Group : base_lns_base_lac
Assignment ID: t1
Error Message: N/A
```

```
Control Conn ID : 600375296 Remote Conn ID : 1026712216
Tunnel ID : 9161 Remote Tunnel ID : 15666
Session ID : 31720 Remote Session ID : 25240
Time Started : 02/02/2010 09:08:54
Time Established : 02/02/2010 09:08:54 Time Closed : N/A
CDN Result : noError General Error : noError

```

PPP information

```
Service Id : 100
Interface : gi_base_lns_base_lac
LCP State : opened
IPCP State : opened
IPv6CP State : initial
PPP MTU : 1492
PPP Auth-Protocol : chap
PPP User-Name : simon@base.lac.base.lns
```

```
Subscriber Origin : radius
Strings Origin : radius
IPCP Info Origin : radius
IPv6CP Info Origin : none
```

```
Subscriber : "simon"
Sub-Profile-String : "sub1"
SLA-Profile-String : "sla1"
ANCP-String : ""
Int-Dest-Id : ""
App-Profile-String : ""
Category-Map-Name : ""
```

```
IP Address : 10.100.2.1
Primary DNS : N/A
Secondary DNS : N/A
Primary NBNS : N/A
```

```

Secondary NBNS : N/A
Address-Pool : N/A

IPv6 Prefix : N/A
IPv6 Del.Pfx. : N/A
Primary IPv6 DNS : N/A
Secondary IPv6 DNS : N/A

Circuit-Id : (Not Specified)
Remote-Id : (Not Specified)

Session-Timeout : N/A
Radius Class : (Not Specified)
Radius User-Name : simon@base.lac.base.lns

```

## statistics

|                    |                                                                    |
|--------------------|--------------------------------------------------------------------|
| <b>Syntax</b>      | <b>statistics</b>                                                  |
| <b>Context</b>     | show>router>l2tp                                                   |
| <b>Description</b> | This command displays L2TP statistics.                             |
| <b>Output</b>      | The following output is an example of L2TP statistics information. |

### Sample Output

```

*A:Dut-C# show router l2tp statistics
=====
L2TP Statistics
=====
Tunnels Sessions

Active : 3 Active : 6

Setup history since 04/17/2009 18:38:41

Total : 4 Total : 9
Failed : 0 Failed : 0
Failed Auth : 0
=====
*A:Dut-C#

```

## tunnel

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>tunnel [statistics] [detail] [peer <i>ip-address</i>] [state <i>tunnel-state</i>] [remote-tunnel-id <i>remote-tunnel-id</i>] [group <i>group-name</i>] [assignment <i>assignment-id</i>] [local-name <i>local-host-name</i>] [remote-name <i>remote-host-name</i>] [radius-accounting-policy <i>policy-name</i>] [blacklist-state <i>bl-state</i>] [failover-state <i>fo-state</i>] [recovery-state <i>recovery-state</i>] [recovery-method {<i>mcs</i>   <i>recovery-tunnel</i>}] [track-srrp <i>srrp-instance</i>] [control-msg-behavior <i>behavior</i>] [transport-type {<i>ip</i>   <i>udp</i>}]</b> |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**tunnel** [**statistics**] [**detail**] [**peer** *ip-address*] [**state** *tunnel-state*] [**remote-connection-id** *remote-connection-id*] [**group** *group-name*] [**assignment** *assignment-id*] [**local-name** *local-host-name*] [**remote-name** *remote-host-name*] [**radius-accounting-policy** *policy-name*] [**blacklist-state** *bl-state*] [**failover-state** *fo-state*] [**recovery-state** *recovery-state*] [**recovery-method** {*mcs* | *recovery-tunnel*}] [**track-srrp** *srrp-instance*] [**control-msg-behavior** *behavior*] [**transport-type** {*ip* | *udp*}]  
**tunnel tunnel-id** *tunnel-id* [**statistics**] [**detail**]  
**tunnel connection-id** *connection-id* [**statistics**] [**detail**]

**Context** show>router>l2tp

**Description** This command displays L2TP tunnel operational information.

**Parameters** **statistics** — Displays L2TP tunnel statistics.

**detail** — Displays detailed L2TP tunnel information.

*ip-address* — Displays information for the specified peer IP address.

**Values** The following values apply to the 7750 SR:

|              |                                                                      |
|--------------|----------------------------------------------------------------------|
| ipv4-address | a.b.c.d (host bits must be 0)                                        |
| ipv6-address | x:x:x:x:x:x:x[-interface]                                            |
|              | x:x:x:x:x:x.d.d.d.d[-interface]                                      |
|              | x: [0 to FFFF]H                                                      |
|              | d: [0 to 255]D                                                       |
|              | interface: 32 characters maximum, mandatory for link local addresses |

**Values** The following values apply to the 7450 ESS:

ipv4-address: a.b.c.d (host bits must be 0)

*tunnel-state* — Displays the operational state of the L2TP session.

**Values** closed, closed-by-peer, draining, drained, established, established-idle, idle, wait-reply, wait-conn

*remote-tunnel-id* — Displays information for the specified remote tunnel ID.

*group-name* — Displays L2TP tunnel information for the specified tunnel group.

*assignment-id* — Specifies a string that distinguishes this Layer Two Tunneling Protocol tunnel.

*local-host-name* — Specifies a local host name used by this system.

*remote-host-name* — Specifies a remote host name used by this system.

*policy-name* — Displays the RADIUS accounting policy.

*bl-state* — Displays the blacklist state of the L2TP session.

*fo-state* — Displays the failover state of the L2TP session.

*recovery-state* — Displays the recovery state of the L2TP session.

**recovery-method** — Displays the recovery method of the L2TP session.

**srrp-instance** — Specifies the SRRP instance identification.

**Values** 0 to 4294967295

**behavior** — Specifies the control message behavior.

**Values** handle, forward-to-mcs-peer

**transport-type** — Specifies that IP or UDP should be used as the transport type for the L2TP session.

**Values** ip, udp

**remote-connection-id** — Displays information for the specified remote connection ID.

**tunnel-id** — Displays information for the specified ID of a L2TP tunnel. In L2TP version 2, it is the 16-bit tunnel ID.

**Values** 1 to 65535

**connection-id** — Specifies the identification number for a Layer Two Tunneling Protocol connection.

**Values** 1 to 429496729

**Output** The following output is an example of L2TP tunnel operational information.

### Sample Output

```
*A:Dut-C# show router l2tp tunnel
=====
Conn ID Loc-Tu-ID Rem-Tu-ID State Ses Active
 Group Ses Total
 Assignment

143523840 2190 17525 established 2
 ispl.group-2 3
 ispl.tunnel-3
236912640 3615 58919 closedByPeer 0
 ispl.group-2 2
 ispl.tunnel-2
379387904 5789 4233 established 1
 ispl.group-1 1
 ispl.tunnel-1
658178048 10043 33762 draining 3
 ispl.group-2 3
 ispl.tunnel-2

No. of tunnels: 4
=====
*A:Dut-C#

*A:Dut-C# show router l2tp tunnel state closed-by-peer detail
=====
L2TP Tunnel Status
=====
Connection ID : 236912640
```

```

State : closedByPeer
IP : 10.20.1.3
Peer IP : 10.10.20.100
Name : lac1.wholesaler.com
Remote Name : lns2.retailer1.net
Assignment ID : ispl.tunnel-2
Group Name : ispl.group-2
Error Message : Goodbye!

Tunnel ID : 3615
UDP Port : 1701
Preference : 100
Hello Interval (s): infinite
Idle TO (s) : 60
Max Retr Estab : 5
Session Limit : 1000
Transport Type : udpIp
Time Started : 04/17/2009 18:41:03
Time Established : 04/17/2009 18:41:03
Stop CCN Result : generalReq

Remote Conn ID : 3861315584
Remote Tunnel ID : 58919
Remote UDP Port : 1701

Destruct TO (s) : 7200
Max Retr Not Estab: 5
AVP Hiding : never
Challenge : never
Time Idle : 04/17/2009 18:43:20
Time Closed : 04/17/2009 18:43:20
General Error : noError

No. of tunnels: 1
=====
*A:Dut-C#

*A:Dut-C# show router l2tp tunnel state established
=====
Conn ID Loc-Tu-ID Rem-Tu-ID State Ses Active
Group Ses Total
Assignment

143523840 2190 17525 established 2
 ispl.group-2 3
 ispl.tunnel-3
379387904 5789 4233 established 1
 ispl.group-1 1
 ispl.tunnel-1

No. of tunnels: 2
=====
*A:Dut-C#

*A:Dut-C# show router l2tp tunnel tunnel-id 2190 statistics
=====
L2TP Tunnel Statistics
=====
Connection ID: 143523840

Attempts Failed Active Total

Sessions 3 0 2 3

Rx Tx

Ctrl Packets 47 47

```

```

Ctrl Octets 954 1438
Error Packets 0 0

*A:Dut-C#

*A:Dut-C# show router l2tp tunnel connection-id 143523840 statistics
=====
L2TP Tunnel Statistics
=====
Connection ID: 143523840

 Attempts Failed Active Total

Sessions 3 0 2 3

 Rx Tx

Ctrl Packets 48 48
Ctrl Octets 974 1450
Error Packets 0 0

*A:Dut-C#

*A:Dut-C# show router l2tp tunnel remote-tunnel-id 17525 detail
=====
L2TP Tunnel Status
=====
Connection ID : 143523840
State : established
IP : 10.20.1.3
Peer IP : 10.10.20.101
Name : lacl.wholesaler.com
Remote Name : lns3.retailer1.net
Assignment ID : ispl.tunnel-3
Group Name : ispl.group-2
Error Message : N/A

Tunnel ID : 2190
UDP Port : 1701
Preference : 100
Hello Interval (s): 300
Idle TO (s) : 0
Max Retr Estab : 5
Session Limit : 1000
Transport Type : udpIp
Time Started : 04/17/2009 18:41:14
Time Established : 04/17/2009 18:41:14
Stop CCN Result : noError

Remote Conn ID : 1148518400
Remote Tunnel ID : 17525
Remote UDP Port : 1701

Destruct TO (s) : 7200
Max Retr Not Estab: 5
AVP Hiding : never
Challenge : never
Time Idle : N/A
Time Closed : N/A
General Error : noError

No. of tunnels: 1
=====
*A:Dut-C#

*A:Dut-C# show router l2tp tunnel remote-connection-id 1148518400 statistics

```



```

=====
L2TP Tunnel Statistics
=====
Connection ID: 143523840

Attempts Failed Active Total

Sessions 3 0 2 3

Rx Tx

Ctrl Packets 50 50
Ctrl Octets 1014 1474
Error Packets 0 0

No. of tunnels: 1
=====
*A:Dut-C#

*A:Dut-C# show router l2tp tunnel peer 10.10.20.100 state closed-by-peer detail
=====
L2TP Tunnel Status
=====
Connection ID : 236912640
State : closedByPeer
IP : 10.20.1.3
Peer IP : 10.10.20.100
Name : lac1.wholesaler.com
Remote Name : lns2.retailer1.net
Assignment ID : ispl.tunnel-2
Group Name : ispl.group-2
Error Message : Goodbye!

Tunnel ID : 3615
UDP Port : 1701
Preference : 100
Hello Interval (s): infinite
Idle TO (s) : 60
Max Retr Estab : 5
Session Limit : 1000
Transport Type : udpIp
Time Started : 04/17/2009 18:41:03
Time Established : 04/17/2009 18:41:03
Stop CCN Result : generalReq

Remote Conn ID : 3861315584
Remote Tunnel ID : 58919
Remote UDP Port : 1701
Destruct TO (s) : 7200
Max Retr Not Estab: 5
AVP Hiding : never
Challenge : never
Time Idle : 04/17/2009 18:43:20
Time Closed : 04/17/2009 18:43:20
General Error : noError

No. of tunnels: 1
=====
*A:Dut-C#

*A:Dut-C# show router l2tp tunnel group ispl.group-2
=====
Conn ID Loc-Tu-ID Rem-Tu-ID State Ses Active
Group Ses Total
Assignment

```

```

143523840 2190 17525 established 2
 ispl.group-2 3
 ispl.tunnel-3
236912640 3615 58919 closedByPeer 0
 ispl.group-2 2
 ispl.tunnel-2
658178048 10043 33762 draining 3
 ispl.group-2 3
 ispl.tunnel-2

```

```

No. of tunnels: 3
=====
```

```
*A:Dut-C#
```

```
*A:Dut-C# show router l2tp tunnel assignment-id ispl.tunnel-
3 state established statistics
```

```
=====
L2TP Tunnel Statistics
=====
```

```
Connection ID: 143523840

```

|          | Attempts | Failed | Active | Total |
|----------|----------|--------|--------|-------|
| Sessions | 3        | 0      | 2      | 3     |

|               | Rx   | Tx   |
|---------------|------|------|
| Ctrl Packets  | 66   | 66   |
| Ctrl Octets   | 1310 | 1690 |
| Error Packets | 0    | 0    |

```

No. of tunnels: 1
=====
```

```
*A:Dut-C#
```

```
*A:Dut-C# show router l2tp tunnel local-name lac1.wholesaler.com remote-
name lns2.retailer1.net state draining
```

```
=====
Conn ID Loc-Tu-ID Rem-Tu-ID State Ses Active
Group Ses Total
Assignment

658178048 10043 33762 draining 3
 ispl.group-2 3
 ispl.tunnel-2

```

```
No. of tunnels: 1
=====
```

```
*A:Dut-C#
```

```
*A:Fden-Dut2-BSA2# show router l2tp tunnel connection-id 600375296 statistics
```

```
=====
L2TP Tunnel Statistics
=====
```

Connection ID: 600375296

|          | Attempts | Failed | Active | Total |
|----------|----------|--------|--------|-------|
| Sessions | 1        | 0      | 1      | 1     |

|               | Rx  | Tx  |
|---------------|-----|-----|
| Ctrl Packets  | 6   | 6   |
| Ctrl Octets   | 553 | 292 |
| Error Packets | 0   | 0   |

|              | Accepted | Duplicate | Out-Of-Wnd |
|--------------|----------|-----------|------------|
| Fsm Messages | 4        | 0         | 0          |

|          | Unsent | Max | Unsent | Cur | Ack | Max | Ack | Cur |
|----------|--------|-----|--------|-----|-----|-----|-----|-----|
| Q Length | 1      |     | 0      |     | 1   |     | 0   |     |

Window Size Cur : 4

acceptedMsgType

- StartControlConnectionRequest : 1
- StartControlConnectionConnected : 1
- IncomingCallRequest : 1
- IncomingCallConnected : 1
- ZeroLengthBody : 3

originalTransmittedMsgType

- StartControlConnectionReply : 1
- Hello : 2
- IncomingCallReply : 1
- ZeroLengthBody : 3

last cleared time : N/A

### On LAC (master node after switchover)

L2TP Tunnel Status

Connection ID: 11206656

State : established

IP : 10.124.0.9

UDP : 1701

Peer IP : 10.124.0.3

Peer UDP : 1701

Tx dst-IP : 10.124.0.3

```

Tx dst-UDP : 1701
Rx src-IP : 10.124.0.3
Rx src-UDP : 1701
Name : mc-lac
Remote Name : mc-lns
Assignment ID: t1
Group Name : mc-lac
Acct. Policy : l2tp-base
Error Message: N/A

```

```

Tunnel ID : 171
Preference : 50
Hello Interval (s): infinite
Idle TO (s) : infinite
Max Retr Estab : 5
Session Limit : 32767
Transport Type : udpIp
Time Started : 02/19/2015 13:00:36
Time Established : 02/19/2015 13:00:36
Stop CCN Result : noError
Blacklist-state : not-blacklisted
Set Dont Fragment : true

Remote Conn ID : 429260800
Remote Tunnel ID : 6550
Receive Window : 64

Destruct TO (s) : 60
Max Retr Not Estab: 5
AVP Hiding : never
Challenge : never
Time Idle : N/A
Time Closed : N/A
General Error : noError

```

```

Failover
State : recoverable
Recovery Conn ID : N/A
Recovery state : not-applicable
Recovered Conn ID : N/A
Recovery method : mcs
Track SRRP : 124
Ctrl msg behavior : handle

```

```

No. of tunnels: 1
=====

```

### On LAC (slave node after switchover)

```
show router l2tp tunnel detail
```

```
=====
L2TP Tunnel Status
=====
```

```

Connection ID: 11206656
State : draining
IP : 10.124.0.9
UDP : 1701
Peer IP : 10.124.0.3
Peer UDP : 1701
Tx dst-IP : 10.124.0.3
Tx dst-UDP : 1701
Rx src-IP : 10.124.0.3
Rx src-UDP : 1701
Name : mc-lac
Remote Name : mc-lns
Assignment ID: t1

```

Group Name : mc-lac  
Acct. Policy : l2tp-base  
Error Message: N/A

|                    |                       |                    |             |
|--------------------|-----------------------|--------------------|-------------|
| Tunnel ID          | : 171                 | Remote Conn ID     | : 429260800 |
| Preference         | : 50                  | Remote Tunnel ID   | : 6550      |
| Hello Interval (s) | : infinite            | Receive Window     | : 64        |
| Idle TO (s)        | : infinite            | Destruct TO (s)    | : 60        |
| Max Retr Estab     | : 5                   | Max Retr Not Estab | : 5         |
| Session Limit      | : 32767               | AVP Hiding         | : never     |
| Transport Type     | : udpIp               | Challenge          | : never     |
| Time Started       | : 02/19/2015 13:00:36 | Time Idle          | : N/A       |
| Time Established   | : 02/19/2015 13:00:36 | Time Closed        | : N/A       |
| Stop CCN Result    | : noError             | General Error      | : noError   |
| Blacklist-state    | : not-blacklisted     |                    |             |
| Set Dont Fragment  | : true                |                    |             |

Failover  
State : recoverable  
Recovery Conn ID : N/A  
Recovery state : not-applicable  
Recovered Conn ID : N/A  
Recovery method : mcs  
Track SRRP : 124  
Ctrl msg behavior : forward-to-mcs-peer

No. of tunnels: 1

### On LNS after switchover

show router l2tp tunnel detail

L2TP Tunnel Status

Connection ID: 429260800  
State : established  
IP : 10.124.0.3  
UDP : 1701  
Peer IP : 10.124.0.9  
Peer UDP : 1701  
Tx dst-IP : 10.124.0.9  
Tx dst-UDP : 1701  
Rx src-IP : 10.124.0.9  
Rx src-UDP : 1701  
Name : mc-lns  
Remote Name : mc-lac  
Assignment ID: t1  
Group Name : mc-lns  
Acct. Policy : N/A  
Error Message: N/A

|                    |        |                  |            |
|--------------------|--------|------------------|------------|
| Tunnel ID          | : 6550 | Remote Conn ID   | : 11206656 |
| Preference         | : 50   | Remote Tunnel ID | : 171      |
| Hello Interval (s) | : 300  | Receive Window   | : 64       |

```

Idle TO (s) : infinite Destruct TO (s) : 60
Max Retr Estab : 5 Max Retr Not Estab: 5
Session Limit : 32767 AVP Hiding : never
Transport Type : udpIp Challenge : never
Time Started : 02/19/2015 13:00:36 Time Idle : N/A
Time Established : 02/19/2015 13:00:36 Time Closed : N/A
Stop CCN Result : noError General Error : noError
Blacklist-state : not-blacklisted
Set Dont Fragment : true

```

```

Failover
State : not-recoverable
Recovery Conn ID : N/A
Recovery state : not-applicable
Recovered Conn ID : N/A
Recovery method : mcs
Track SRRP : (Not specified)
Ctrl msg behavior : handle

```

```

No. of tunnels: 1
=====
```

**On LAC (master node after switchover; 7536640 is the recovered tunnel, 1865089024 is the recovery tunnel)**

```
=====
L2TP Tunnel Status
=====
```

```

Connection ID: 7536640
State : established
IP : 10.124.0.9
UDP : 1701
Peer IP : 10.124.0.3
Peer UDP : 1701
Tx dst-IP : 10.124.0.3
Tx dst-UDP : 1701
Rx src-IP : 10.124.0.3
Rx src-UDP : 1701
Name : mc-lac
Remote Name : mc-lns
Assignment ID: t1
Group Name : mc-lac
Acct. Policy : l2tp-base
Error Message: N/A

```

```

Tunnel ID : 115 Remote Conn ID : 433324032
Preference : 50 Remote Tunnel ID : 6612
Hello Interval (s): infinite Receive Window : 64
Idle TO (s) : infinite Destruct TO (s) : 60
Max Retr Estab : 5 Max Retr Not Estab: 5
Session Limit : 32767 AVP Hiding : never
Transport Type : udpIp Challenge : never
Time Started : 02/19/2015 13:07:53 Time Idle : N/A
Time Established : 02/19/2015 13:07:53 Time Closed : N/A
Stop CCN Result : noError General Error : noError
Blacklist-state : not-blacklisted
Set Dont Fragment : true

```

```
Failover
State : recoverable
Recovery Conn ID : 1865089024
Recovery state : not-applicable
Recovered Conn ID : N/A
Recovery method : recovery-tunnel
Track SRRP : 124
Ctrl msg behavior : handle

```

```
Connection ID: 1865089024
State : closed
IP : 10.124.0.9
UDP : 1701
Peer IP : 10.124.0.3
Peer UDP : 1701
Tx dst-IP : 10.124.0.3
Tx dst-UDP : 1701
Rx src-IP : 10.124.0.3
Rx src-UDP : 1701
Name : mc-lac
Remote Name : mc-lns
Assignment ID: t1
Group Name : mc-lac
Acct. Policy : l2tp-base
Error Message: N/A
```

|                    |                       |                    |                       |
|--------------------|-----------------------|--------------------|-----------------------|
| Tunnel ID          | : 28459               | Remote Conn ID     | : 1169424384          |
| Preference         | : 50                  | Remote Tunnel ID   | : 17844               |
| Hello Interval (s) | : infinite            | Receive Window     | : 64                  |
| Idle TO (s)        | : 60                  | Destruct TO (s)    | : 60                  |
| Max Retr Estab     | : 5                   | Max Retr Not Estab | : 5                   |
| Session Limit      | : 32767               | AVP Hiding         | : never               |
| Transport Type     | : udpIp               | Challenge          | : never               |
| Time Started       | : 02/19/2015 13:12:05 | Time Idle          | : N/A                 |
| Time Established   | : 02/19/2015 13:12:05 | Time Closed        | : 02/19/2015 13:12:05 |
| Stop CCN Result    | : generalReq          | General Error      | : noError             |
| Blacklist-state    | : not-blacklisted     |                    |                       |
| Set Dont Fragment  | : true                |                    |                       |

```
Failover
State : not-applicable
Recovery Conn ID : N/A
Recovery state : recovery-tunnel
Recovered Conn ID : 7536640
Recovery method : default
Track SRRP : 124
Ctrl msg behavior : handle

```

No. of tunnels: 2

### On LAC (slave node after switchover)

```
=====
L2TP Tunnel Status
=====
```

```

Connection ID: 7536640
State : draining
IP : 10.124.0.9
UDP : 1701
Peer IP : 10.124.0.3
Peer UDP : 1701
Tx dst-IP : 10.124.0.3
Tx dst-UDP : 1701
Rx src-IP : 10.124.0.3
Rx src-UDP : 1701
Name : mc-lac
Remote Name : mc-lns
Assignment ID: t1
Group Name : mc-lac
Acct. Policy : l2tp-base
Error Message: N/A

```

```

Tunnel ID : 115
Preference : 50
Hello Interval (s): infinite
Idle TO (s) : infinite
Max Retr Estab : 5
Session Limit : 32767
Transport Type : udpIp
Time Started : 02/19/2015 13:07:53
Time Established : 02/19/2015 13:07:53
Stop CCN Result : noError
Blacklist-state : not-blacklisted
Set Dont Fragment : true

Remote Conn ID : 433324032
Remote Tunnel ID : 6612
Receive Window : 64
Destruct TO (s) : 60
Max Retr Not Estab: 5
AVP Hiding : never
Challenge : never
Time Idle : N/A
Time Closed : N/A
General Error : noError

```

```

Failover
State : recoverable
Recovery Conn ID : N/A
Recovery state : not-applicable
Recovered Conn ID : N/A
Recovery method : recovery-tunnel
Track SRRP : 124
Ctrl msg behavior : forward-to-mcs-peer

```

```

No. of tunnels: 1
=====

```

**On LNS after switchover (433324032 is the recovered tunnel, 1169424384 is the recovery tunnel)**

```

=====
L2TP Tunnel Status
=====

```

```

Connection ID: 433324032
State : established
IP : 10.124.0.3
UDP : 1701
Peer IP : 10.124.0.9
Peer UDP : 1701
Tx dst-IP : 10.124.0.9
Tx dst-UDP : 1701

```



Rx src-IP : 10.124.0.9  
Rx src-UDP : 1701  
Name : mc-lns  
Remote Name : mc-lac  
Assignment ID: t1  
Group Name : mc-lns  
Acct. Policy : N/A  
Error Message: N/A

|                    |                       |                    |           |
|--------------------|-----------------------|--------------------|-----------|
| Tunnel ID          | : 6612                | Remote Conn ID     | : 7536640 |
| Preference         | : 50                  | Remote Tunnel ID   | : 115     |
| Hello Interval (s) | : 300                 | Receive Window     | : 64      |
| Idle TO (s)        | : infinite            | Destruct TO (s)    | : 60      |
| Max Retr Estab     | : 5                   | Max Retr Not Estab | : 5       |
| Session Limit      | : 32767               | AVP Hiding         | : never   |
| Transport Type     | : udpIp               | Challenge          | : never   |
| Time Started       | : 02/19/2015 13:07:53 | Time Idle          | : N/A     |
| Time Established   | : 02/19/2015 13:07:53 | Time Closed        | : N/A     |
| Stop CCN Result    | : noError             | General Error      | : noError |
| Blacklist-state    | : not-blacklisted     |                    |           |
| Set Dont Fragment  | : true                |                    |           |

Failover  
State : not-recoverable  
Recovery Conn ID : 1169424384  
Recovery state : not-applicable  
Recovered Conn ID : N/A  
Recovery method : recovery-tunnel  
Track SRRP : (Not specified)  
Ctrl msg behavior : handle

-----  
Connection ID: 1169424384  
State : closed  
IP : 10.124.0.3  
UDP : 1701  
Peer IP : 10.124.0.9  
Peer UDP : 1701  
Tx dst-IP : 10.124.0.9  
Tx dst-UDP : 1701  
Rx src-IP : 10.124.0.9  
Rx src-UDP : 1701  
Name : mc-lns  
Remote Name : mc-lac  
Assignment ID: t1  
Group Name : mc-lns  
Acct. Policy : N/A  
Error Message: N/A

|                    |                       |                    |              |
|--------------------|-----------------------|--------------------|--------------|
| Tunnel ID          | : 17844               | Remote Conn ID     | : 1865089024 |
| Preference         | : 50                  | Remote Tunnel ID   | : 28459      |
| Hello Interval (s) | : infinite            | Receive Window     | : 64         |
| Idle TO (s)        | : 60                  | Destruct TO (s)    | : 60         |
| Max Retr Estab     | : 5                   | Max Retr Not Estab | : 5          |
| Session Limit      | : 32767               | AVP Hiding         | : never      |
| Transport Type     | : udpIp               | Challenge          | : never      |
| Time Started       | : 02/19/2015 13:12:05 | Time Idle          | : N/A        |

```

Time Established : 02/19/2015 13:12:05 Time Closed : 02/19/2015
13:12:05
Stop CCN Result : generalReq General Error : noError
Blacklist-state : not-blacklisted
Set Dont Fragment : true

Failover
State : not-applicable
Recovery Conn ID : N/A
Recovery state : recovery-tunnel
Recovered Conn ID : 433324032
Recovery method : default
Track SRRP : (Not specified)
Ctrl msg behavior : handle

No. of tunnels: 2
=====

```

### 2.14.2.2 Clear Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

#### router

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>router</b> [ <i>router-instance</i> ]<br><b>router service-name</b> <i>service-name</i>                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | clear>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | This command enters the context in which to clear various parameters for the specified <i>router-instance</i> .                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <i>router-instance</i> — Specifies the router name, CPM router instance, or service ID.<br><br><div style="margin-left: 40px;"> <b>Values</b>     <i>router-name</i> or <i>service-id</i><br/><br/> <i>router-instance</i> : <i>router-name</i><br/> <div style="margin-left: 100px;"> <i>router-name</i>     Base   management   vpls-management  <br/>                           <i>cpm-vr-name</i><br/> <i>cpm-vr-name</i>     [32 characters maximum] </div> <br/> <i>service-id</i>: 1 to 2147483647 </div> |
| <b>Default</b>     | Base                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

*service-name* — Specifies the service name, up to 64 characters.

## arp

|                    |                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>arp</b> { <b>all</b>   <i>ip-address</i> }<br><b>arp interface</b> { <i>ip-int-name</i>   <i>ip-address</i> }                                                                                                                                                                                                                                            |
| <b>Context</b>     | clear>router                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | This command clears all or specific ARP entries.<br><br>The scope of ARP cache entries cleared depends on the command line options specified.                                                                                                                                                                                                               |
| <b>Parameters</b>  | <b>all</b> — Clears all ARP cache entries.<br><br><i>ip-address</i> — Clears the ARP cache entry for the specified IP address.<br><br><i>ip-int-name</i> — Clears all ARP cache entries for the IP interface with the specified name.<br><br><i>ip-address</i> — Clears all ARP cache entries for the specified IP interface with the specified IP address. |

## bfd

|                    |                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>bfd</b>                                                                                        |
| <b>Context</b>     | clear>router                                                                                      |
| <b>Description</b> | This command enables the context to clear bidirectional forwarding (BFD) sessions and statistics. |

## session

|                    |                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>session src-ip</b> <i>ip-address</i> <b>dst-ip</b> <i>ip-address</i>                                                                                                                                   |
| <b>Context</b>     | clear>router>bfd                                                                                                                                                                                          |
| <b>Description</b> | This command clears BFD sessions.                                                                                                                                                                         |
| <b>Parameters</b>  | <b>src-ip</b> <i>ip-address</i> — Specifies the address of the local endpoint of this BFD session.<br><b>dst-ip</b> <i>ip-address</i> — Specifies the address of the remote endpoint of this BFD session. |

## statistics

|               |                                                                                                     |
|---------------|-----------------------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>statistics src-ip</b> <i>ip-address</i> <b>dst-ip</b> <i>ip-address</i><br><b>statistics all</b> |
|---------------|-----------------------------------------------------------------------------------------------------|

---

|                    |                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | clear>router>bfd                                                                                                                                                                                                                                                  |
| <b>Description</b> | This command clears BFD statistics.                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <b>src-ip</b> <i>ip-address</i> — Specifies the address of the local endpoint of this BFD session.<br><b>dst-ip</b> <i>ip-address</i> — Specifies the address of the remote endpoint of this BFD session.<br><b>all</b> — Clears statistics for all BFD sessions. |

## dhcp

|                    |                                                                     |
|--------------------|---------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dhcp</b>                                                         |
| <b>Context</b>     | clear>router                                                        |
| <b>Description</b> | This command enables the context to clear DHCP related information. |

## statistics

|                    |                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>statistics</b> [ <i>ip-address</i>   <i>ip-int-name</i> ]                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | clear>router>dhcp<br>clear>router>dhcp6                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | <p>This command clear statistics for DHCP and DHCP6and DHCP6 relay and snooping statistics.</p> <p>If no IP address or interface name is specified, then statistics are cleared for all configured interfaces.</p> <p>If an IP address or interface name is specified, then only data regarding the specified interface is cleared.</p> |
| <b>Parameters</b>  | <i>ip-address</i>   <i>ip-int-name</i> — Displays statistics for the specified IP interface.                                                                                                                                                                                                                                            |

## dhcp6

|                    |                                                                      |
|--------------------|----------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dhcp6</b>                                                         |
| <b>Context</b>     | clear>router                                                         |
| <b>Description</b> | This command enables the context to clear DHCP6 related information. |

## forwarding-table

|               |                                                |
|---------------|------------------------------------------------|
| <b>Syntax</b> | <b>forwarding-table</b> [ <i>slot-number</i> ] |
|---------------|------------------------------------------------|

---

|                    |                                                                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | clear>router                                                                                                                                                                     |
| <b>Description</b> | This command clears entries in the forwarding table (maintained by the IOMs).<br><br>If the slot number is not specified, the command forces the route table to be recalculated. |
| <b>Parameters</b>  | <i>slot-number</i> — Clears the specified card slot.                                                                                                                             |
|                    | <b>Default</b> all IOMs or linecards                                                                                                                                             |
|                    | <b>Values</b> 1 to 10                                                                                                                                                            |

## grt-lookup

|                    |                                                   |
|--------------------|---------------------------------------------------|
| <b>Syntax</b>      | <b>grt-lookup</b>                                 |
| <b>Context</b>     | clear>router                                      |
| <b>Description</b> | This command re-evaluates route policies for GRT. |

## icmp

|                    |                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>icmp all</b><br><b>icmp global</b><br><b>icmp interface</b> <i>interface-name</i>                                                                                   |
| <b>Context</b>     | clear>router                                                                                                                                                           |
| <b>Description</b> | This command clears ICMP statistics.                                                                                                                                   |
| <b>Parameters</b>  | <b>all</b> — Clears all statistics.<br><b>global</b> — Clears global router statistics.<br><i>interface-name</i> — Clears ICMP statistics for the specified interface. |
|                    | <b>Values</b> 32 characters maximum                                                                                                                                    |

## icmp-redirect-route

|                    |                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>icmp-redirect-route</b> { <b>all</b>   <i>ip-address</i> }                                                      |
| <b>Context</b>     | clear>router                                                                                                       |
| <b>Description</b> | This command deletes routes created as a result of ICMP redirects received on the management interface.            |
| <b>Parameters</b>  | <b>all</b> — Clears all routes.<br><i>ip-address</i> — Clears the routes associated with the specified IP address. |

---

## icmp6

|                    |                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>icmp6 all</b><br><b>icmp6 global</b><br><b>icmp6 interface</b> <i>interface-name</i>                                                                                  |
| <b>Context</b>     | clear>router                                                                                                                                                             |
| <b>Description</b> | This command clears ICMPv6 statistics.                                                                                                                                   |
| <b>Parameters</b>  | <b>all</b> — Clears all statistics.<br><b>global</b> — Clears global router statistics.<br><b>interface-name</b> — Clears ICMPv6 statistics for the specified interface. |

## interface

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>interface</b> [{ <i>ip-int-name</i>   <i>ip-address</i> }] [ <b>urpf-stats</b> ] [ <b>statistics</b> ] [ <b>hold-time</b> ]<br><b>interface</b> [{ <i>ip-int-name</i>   <i>ip-address</i> }] <b>policy-accounting</b> [ <b>class</b> ] [ <b>index</b> ]<br><b>interface</b> { <i>ip-int-name</i>   <i>ip-address</i> } <b>mac</b> [ <i>ieee-address</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | clear>router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | This command clears IP interface statistics.<br><br>If no IP interface is specified either by IP interface name or IP address, the command will perform the clear operation on all IP interfaces.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <i>ip-int-name</i>   <i>ip-address</i> — Specifies IP interface name or IP interface address.<br><br><b>Values</b> <i>ip-int-name</i> : 32 chars max<br><i>ip-address</i> : a.b.c.d<br><br><b>Default</b> all IP interfaces<br><br><b>urpf-stats</b> — Resets the statistics associated with uRPF failures.<br><b>statistics</b> — Resets the IP interface traffic statistics.<br><b>hold-time</b> — Clears the IP interface activation hold time.<br><b>policy-accounting</b> — Clears the accounting statistics.<br><b>class</b> — Specifies whether to clear source class counters or destination class counters.<br><b>Values</b> source-class, dest-class<br><b>index</b> — Specifies the source or destination class index.<br><b>Values</b> 1 to 255<br><b>ieee-address</b> — Specifies the MAC address.<br><b>Values</b> xx:xx:xx:xx:xx:xx or xx-xx-xx-xx-xx-xx |

## l2tp

|                    |                                                      |
|--------------------|------------------------------------------------------|
| <b>Syntax</b>      | <b>l2tp</b>                                          |
| <b>Context</b>     | clear>router                                         |
| <b>Description</b> | This command enables the context to clear L2TP data. |

## group

|                    |                                                                |
|--------------------|----------------------------------------------------------------|
| <b>Syntax</b>      | <b>group</b> <i>tunnel-group-name</i>                          |
| <b>Context</b>     | clear>router>l2tp                                              |
| <b>Description</b> | This command clears L2TP data.                                 |
| <b>Parameters</b>  | <i>tunnel-group-name</i> — Specifies a L2TP tunnel group name. |

## statistics

|                    |                                                                           |
|--------------------|---------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>statistics</b>                                                         |
| <b>Context</b>     | clear>router>l2tp<br>clear>router>l2tp>group<br>clear>router>l2tp> tunnel |
| <b>Description</b> | This command clears statistics for the specified context.                 |

## tunnel

|                    |                                                       |
|--------------------|-------------------------------------------------------|
| <b>Syntax</b>      | <b>tunnel</b> <i>connection-id</i>                    |
| <b>Context</b>     | clear>router>l2tp                                     |
| <b>Description</b> | This command clears L2TP data.                        |
| <b>Parameters</b>  | <i>connection-id</i> — Clears L2TP tunnel statistics. |

## neighbor

|                    |                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>neighbor</b> { <b>all</b>   <i>ipv6-address</i> [ <b>interface</b> <i>interface-name</i> ]}<br><b>neighbor interface</b> { <i>ip-int-name</i>   <i>ipv6-address</i> } |
| <b>Context</b>     | clear>router                                                                                                                                                             |
| <b>Description</b> | This command clears IPv6 neighbor information.                                                                                                                           |

|                   |                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <b>all</b> — Clears all IPv6 neighbors.<br><i>ipv6-address</i> — Clears the specified IPv6 neighbors.                  |
|                   | <b>Values</b>                                                                                                          |
|                   | <i>ipv6-address</i> :<br>x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:d.d.d.d<br>x: [0 to FFFF]H<br>d: [0 to 255]D |
|                   | <i>interface-name</i> — Specifies the interface name.                                                                  |
|                   | <i>ip-int-name</i> — Clears the specified neighbor interface information up to 32 characters.                          |

router-advertisement

|                    |                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>router-advertisement all</b><br><b>router-advertisement interface</b> <i>interface-name</i>                                                                         |
| <b>Context</b>     | clear>router                                                                                                                                                           |
| <b>Description</b> | This command clears all router advertisement counters.                                                                                                                 |
| <b>Parameters</b>  | <b>all</b> — Clears all router advertisement counters for all interfaces.<br><i>interface-name</i> — Clears router advertisement counters for the specified interface. |

2.14.2.3 Debug Commands

router

|                    |                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>router</b> [ <i>router-instance</i> ]<br><b>router service-name</b> <i>service-name</i>                       |
| <b>Context</b>     | debug                                                                                                            |
| <b>Description</b> | This command enters the context to enable debugging of various protocols and areas of a <i>router-instance</i> . |
| <b>Parameters</b>  | <i>router-instance</i> — Specifies the router name, CPM router instance, or service ID.                          |
|                    | <b>Values</b> <i>router-name</i> or <i>service-id</i>                                                            |
|                    | <i>router-instance</i> : <i>router-name</i><br><i>router-name</i> Base   management   <i>cpm-vr-name</i>         |



---

*cpm-vr-name* [32 characters maximum]

*service-id:* 1 to 2147483647

**Default** Base

*service-name* — Specifies the service name, up to 64 characters.

ip

|                    |                                           |
|--------------------|-------------------------------------------|
| <b>Syntax</b>      | [no] ip                                   |
| <b>Context</b>     | debug>router                              |
| <b>Description</b> | This command configures debugging for IP. |

arp

|                    |                                                |
|--------------------|------------------------------------------------|
| <b>Syntax</b>      | arp                                            |
| <b>Context</b>     | debug>router>ip                                |
| <b>Description</b> | This command configures route table debugging. |

icmp

|                    |                                      |
|--------------------|--------------------------------------|
| <b>Syntax</b>      | [no] icmp                            |
| <b>Context</b>     | debug>router>ip                      |
| <b>Description</b> | This command enables ICMP debugging. |

icmp6

|                    |                                        |
|--------------------|----------------------------------------|
| <b>Syntax</b>      | icmp6 [ip-int-name]<br>no icmp6        |
| <b>Context</b>     | debug>router>ip                        |
| <b>Description</b> | This command enables ICMPv6 debugging. |

---

## interface

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] interface</b> [{ <i>ip-int-name</i>   <i>ip-address</i> }]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | debug>router>ip                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | This command displays the router IP interface table sorted by interface index.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <i>ip-int-name</i> — Only displays the interface information associated with the specified IP interface name.<br><b>Values</b> 32 characters maximum<br><i>ip-address</i> — Only displays the interface information associated with the specified IP address.<br><b>Values</b> The following values apply to the 7750 SR and 7950 XRS:<br>ipv4-address a.b.c.d (host bits must be 0)<br>ipv6-address x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:d.d.d.d<br>x: [0 to FFFF]H<br>d: [0 to 255]D<br><br><b>Values</b> The following values apply to the 7450 ESS:<br>ipv4-address: a.b.c.d (host bits must be 0) |

## neighbor

|                    |                                                              |
|--------------------|--------------------------------------------------------------|
| <b>Syntax</b>      | <b>neighbor</b> [ <i>ip-int-name</i> ]<br><b>no neighbor</b> |
| <b>Context</b>     | debug>router>ip                                              |
| <b>Description</b> | This command enables IPv6 neighbor debugging.                |
| <b>Parameters</b>  | <i>ip-int-name</i> — Specifies the IP interface name.        |

## packet

|                    |                                                                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>packet</b> [{ <i>ip-int-name</i>   <i>ip-address</i> }] [ <b>headers</b> ] [ <i>protocol-id</i> ]<br><b>no packet</b> [{ <i>ip-int-name</i>   <i>ip-address</i> }] |
| <b>Context</b>     | debug>router>ip                                                                                                                                                       |
| <b>Description</b> | This command enables debugging for IP packets.                                                                                                                        |

---

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <p><i>ip-int-name</i> — Only displays the interface information associated with the specified IP interface name.</p> <p><b>Values</b> 32 characters maximum</p> <p><i>ip-address</i> — Only displays the interface information associated with the specified IP address.</p> <p><b>headers</b> — Only displays information associated with the packet header.</p> <p><i>protocol-id</i> — Specifies the decimal value representing the IP protocol to debug. Well-known protocol numbers include ICMP(1), TCP(6), UDP(17). The <b>no</b> form the command removes the protocol from the criteria.</p> <p><b>Values</b> 0 to 255 (values can be expressed in decimal, hexadecimal, or binary)</p> |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## route-table

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------|--------------------|---------|-------------|-------------------------------------|--|-------------------|--|-----------------|--|----------------|--------------------|----------|-------------|-------------------------------|--------------------|---------|
| <b>Syntax</b>      | <p><b>route-table</b> [<i>ip-prefix/prefix-length</i>]</p> <p><b>route-table</b> <i>ip-prefix/prefix-length</i> <b>longer</b></p> <p><b>no route-table</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
| <b>Context</b>     | debug>router>ip                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
| <b>Description</b> | This command configures route table debugging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
| <b>Parameters</b>  | <p><i>ip-prefix/prefix-length</i> — The IP prefix for prefix list entry in dotted decimal notation.</p> <p><b>Values</b> The following values apply to the 7750 SR and 7950 XRS:</p> <table> <tr> <td>ipv4-prefix</td><td>a.b.c.d (host bits must be 0)</td></tr> <tr> <td>ipv4-prefix-length</td><td>0 to 32</td></tr> <tr> <td>ipv6-prefix</td><td>x:x:x:x:x:x:x (eight 16-bit pieces)</td></tr> <tr> <td></td><td>x:x:x:x:x:d.d.d.d</td></tr> <tr> <td></td><td>x: [0 to FFFF]H</td></tr> <tr> <td></td><td>d: [0 to 255]D</td></tr> <tr> <td>ipv6-prefix-length</td><td>0 to 128</td></tr> </table> <p><b>Values</b> The following values apply to the 7450 ESS:</p> <table> <tr> <td>ipv4-prefix</td><td>a.b.c.d (host bits must be 0)</td></tr> <tr> <td>ipv4-prefix-length</td><td>0 to 32</td></tr> </table> | ipv4-prefix | a.b.c.d (host bits must be 0) | ipv4-prefix-length | 0 to 32 | ipv6-prefix | x:x:x:x:x:x:x (eight 16-bit pieces) |  | x:x:x:x:x:d.d.d.d |  | x: [0 to FFFF]H |  | d: [0 to 255]D | ipv6-prefix-length | 0 to 128 | ipv4-prefix | a.b.c.d (host bits must be 0) | ipv4-prefix-length | 0 to 32 |
| ipv4-prefix        | a.b.c.d (host bits must be 0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
| ipv4-prefix-length | 0 to 32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
| ipv6-prefix        | x:x:x:x:x:x:x (eight 16-bit pieces)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
|                    | x:x:x:x:x:d.d.d.d                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
|                    | x: [0 to FFFF]H                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
|                    | d: [0 to 255]D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
| ipv6-prefix-length | 0 to 128                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
| ipv4-prefix        | a.b.c.d (host bits must be 0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |
| ipv4-prefix-length | 0 to 32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                               |                    |         |             |                                     |  |                   |  |                 |  |                |                    |          |             |                               |                    |         |

**longer** — Specifies the prefix list entry matches any route that matches the specified *ip-prefix* and prefix *mask* length values greater than the specified *mask*.

---

## tunnel-table

|                    |                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tunnel-table</b> <i>[ip-address]</i> [{ <b>ldp</b>   <b>rsvp</b> [ <b>tunnel-id</b> <i>tunnel-id</i> ]   <b>sdp</b> [ <b>sdp-id</b> <i>sdp-id</i> ]}] |
| <b>Context</b>     | debug>router>ip                                                                                                                                          |
| <b>Description</b> | This command enables debugging for tunnel tables.                                                                                                        |

## l2tp

|                    |                                                                   |
|--------------------|-------------------------------------------------------------------|
| <b>Syntax</b>      | <b>l2tp</b>                                                       |
| <b>Context</b>     | debug>router                                                      |
| <b>Description</b> | This command enables the context to configure debugging for L2TP. |

## peer

|                    |                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>peer</b> <i>ip-address</i> [ <b>udp-port</b> <i>port</i> ] [ <b>ip</b> ]                                                                                                                                                                               |
| <b>Context</b>     | debug>router>l2tp                                                                                                                                                                                                                                         |
| <b>Description</b> | This command enables and configures debugging for an L2TP peer.                                                                                                                                                                                           |
| <b>Parameters</b>  | <i>ip-address</i> — Specifies the IP address of the L2TP peer.<br><i>port</i> — Specifies the UDP port for the L2TP peer. This parameter is only supported with L2TPv2 peers.<br><b>ip</b> — Displays debugging information for peers using IP transport. |

## mtrace

|                    |                                               |
|--------------------|-----------------------------------------------|
| <b>Syntax</b>      | [ <b>no</b> ] <b>mtrace</b>                   |
| <b>Context</b>     | debug>router                                  |
| <b>Description</b> | This command configures debugging for mtrace. |

## misc

|                    |                                                                      |
|--------------------|----------------------------------------------------------------------|
| <b>Syntax</b>      | [ <b>no</b> ] <b>misc</b>                                            |
| <b>Context</b>     | debug>router>mtrace<br>debug>router>mtrace2                          |
| <b>Description</b> | This command enables debugging for mtrace and mtrace2 miscellaneous. |

## packet

|                    |                                                                |
|--------------------|----------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] packet</b> [{query   request   response}]              |
| <b>Context</b>     | debug>router>mtrace<br>debug>router>mtrace2                    |
| <b>Description</b> | This command enables debugging for mtrace and mtrace2 packets. |

## mtrace2

|                    |                                                |
|--------------------|------------------------------------------------|
| <b>Syntax</b>      | <b>[no] mtrace2</b>                            |
| <b>Context</b>     | debug>router                                   |
| <b>Description</b> | This command configures debugging for mtrace2. |

## packet

|                    |                                                                |
|--------------------|----------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] packet</b> [{query   request   reply}]                 |
| <b>Context</b>     | debug>router>mtrace<br>debug>router>mtrace2                    |
| <b>Description</b> | This command enables debugging for mtrace and mtrace2 packets. |

## 2.14.2.4 Tools Commands

## tunnel

|                    |                                                                                            |
|--------------------|--------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tunnel</b> [in-label <i>in-label</i> ]                                                  |
| <b>Context</b>     | tools>dump>router>segment-routing>tunnel                                                   |
| <b>Description</b> | This command displays segment routing tunnel information.                                  |
| <b>Parameters</b>  | <i>in-label</i> — Specifies the number of labels to send.<br><b>Values</b> 0 to 4294967295 |
| <b>Output</b>      | The following output is an example of segment routing tunnel operational information.      |

### Sample Output

```
*A:Dut-F# tools dump router segment-routing tunnel
```

```

=====
Legend: (B) - Backup Next-hop for Fast Re-Route
 (D) - Duplicate
=====
-----+
Prefix
Sid-Type Fwd-Type In-Label Prot-
Inst
 Next Hop(s)
Label(s) Interface/Tunnel-ID | Out-
-----+
10.0.33.3
Node Orig/Transit 70000 OSPF-0
 10.0.36.3
 40000 DUTF_TO
_DUTC.1.0 (B)10.0.26.2
 30998 DUTF_TO
_DUTB.1.0
10.0.44.4
Node Orig/Transit 70001 OSPF-0
 10.0.26.2
 30001 DUTF_TO
_DUTB.1.0 (B)10.0.56.5
 60001 DUTF_TO
_DUTE.1.0
10.0.55.5
Node Orig/Transit 70002 OSPF-0
 10.0.56.5
 60002 DUTF_TO
_DUTE.1.0 (B)10.0.26.2
 30995 DUTF_TO
_DUTB.1.0
Node Terminating 70003 OSPF-0
10.0.11.1
Node Orig/Transit 70004 OSPF-0
 10.0.26.2
 30004 DUTF_TO
_DUTB.1.0 (B)10.0.36.3
 40004 DUTF_TO
_DUTC.1.0
10.0.22.2
Node Orig/Transit 70005 OSPF-0
 10.0.26.2
 30005 DUTF_TO
_DUTB.1.0 (B)10.0.36.3
 40004 DUTF_TO
_DUTC.1.0
 20005
10.20.1.3
Node Orig/Transit 70006 OSPF-0
 10.0.36.3
 40006 DUTF_TO
_DUTC.1.0 (B)10.0.26.2
 30004 DUTF_TO
_DUTB.1.0
 20006
10.20.1.4
Node Orig/Transit 70007 OSPF-0
 10.0.26.2
 30007 DUTF_TO
_DUTB.1.0 (B)10.0.56.5
 60007 DUTF_TO
_DUTE.1.0
10.20.1.5
Node Orig/Transit 70008 OSPF-0

```

|             |               |        |        |       |         |
|-------------|---------------|--------|--------|-------|---------|
| _DUTE.1.0   | 10.0.56.5     |        |        | 60008 | DUTF_TO |
| _DUTB.1.0   | (B) 10.0.26.2 |        |        | 30001 | DUTF_TO |
|             |               |        |        | 50008 |         |
| Node        | Terminating   | 70009  | OSPF-0 |       |         |
| 10.20.1.1   |               |        |        |       |         |
| Node        | Orig/Transit  | 70010  | OSPF-0 |       |         |
|             | 10.0.26.2     |        |        | 30010 | DUTF_TO |
| _DUTB.1.0   | (B) 10.0.36.3 |        |        | 40010 | DUTF_TO |
| _DUTC.1.0   |               |        |        |       |         |
| 10.20.1.2   |               |        |        |       |         |
| Node        | Orig/Transit  | 70011  | OSPF-0 |       |         |
|             | 10.0.26.2     |        |        | 30011 | DUTF_TO |
| _DUTB.1.0   | (B) 10.0.56.5 |        |        | 60001 | DUTF_TO |
| _DUTE.1.0   |               |        |        | 50011 |         |
| Backup Node | Transit       | 70994  | OSPF-0 |       |         |
|             | 10.0.56.5     |        |        | 60994 | DUTF_TO |
| _DUTE.1.0   |               |        |        |       |         |
| Backup Node | Transit       | 70995  | OSPF-0 |       |         |
|             | 10.0.26.2     |        |        | 30995 | DUTF_TO |
| _DUTB.1.0   |               |        |        |       |         |
| Backup Node | Transit       | 70996  | OSPF-0 |       |         |
|             | 10.0.26.2     |        |        | 30005 | DUTF_TO |
| _DUTB.1.0   |               |        |        |       |         |
| Backup Node | Transit       | 70998  | OSPF-0 |       |         |
|             | 10.0.26.2     |        |        | 30998 | DUTF_TO |
| _DUTB.1.0   |               |        |        |       |         |
| Backup Node | Transit       | 70999  | OSPF-0 |       |         |
|             | 10.0.36.3     |        |        | 40999 | DUTF_TO |
| _DUTC.1.0   |               |        |        |       |         |
| Adjacency   | Transit       | 262140 | OSPF-0 |       |         |
|             | 10.0.26.2     |        |        | 3     | DUTF_TO |
| _DUTB.1.0   | (B) 10.0.36.3 |        |        | 40004 | DUTF_TO |
| _DUTC.1.0   |               |        |        | 20005 |         |
| Adjacency   | Transit       | 262141 | OSPF-0 |       |         |
|             | 10.0.56.5     |        |        | 3     | DUTF_TO |
| _DUTE.1.0   |               |        |        |       |         |
| Adjacency   | Transit       | 262142 | OSPF-0 |       |         |
|             | 10.0.36.3     |        |        | 3     | DUTF_TO |
| _DUTC.1.0   |               |        |        |       |         |
| Adjacency   | Transit       | 262143 | OSPF-0 |       |         |
|             | 10.0.26.2     |        |        | 3     | DUTF_TO |
| _DUTB.1.0   |               |        |        |       |         |

```

(B) 10.0.56.5 60001 DUTF_TO
_DUTE.1.0 50011

*A:Dut-F#

*A:Dut-A# tools dump router segment-routing tunnel
=====
Legend: (B) - Backup Next-hop for Fast Re-Route
(D) Duplicate
=====

Prefix
Sid-Type Fwd-Type In-Label Prot-Inst Out-Label(s) Interface/
 Next Hop(s) Tunnel-
ID
Adjacency Transit 262136 ISIS-0
10.10.2.1 10.10.2.3 3 ip-

Adjacency Transit 262137 ISIS-0
10.10.2.1 10.10.2.3 3 ip-

Adjacency Transit 262138 ISIS-0
10.10.1.1 10.10.1.2 3 ip-

Adjacency Transit 262139 ISIS-0
10.10.1.1 10.10.1.2 3 ip-

Node Terminating 474387 ISIS-0
10.20.1.2
Node Orig/Transit 474388 ISIS-0
10.10.1.1 10.10.1.2 474388 ip-
10.20.1.3
Node Orig/Transit 474389 ISIS-0
10.10.2.1 10.10.2.3 474389 ip-
10.20.1.4
Node Orig/Transit 475287 ISIS-0
10.10.1.1 10.10.1.2 475287 ip-
10.20.1.5
Node Orig/Transit 475288 ISIS-0
10.10.2.1 10.10.2.3 475288 ip-
10.20.1.6
Node Orig/Transit 475289 ISIS-0
10.10.1.1 10.10.1.2 475289 ip-

*A:Dut-A#

*A:Dut-C# tools dump router segment-routing tunnel

```



|                                                 |                     |             |          |       |        |      |
|-------------------------------------------------|---------------------|-------------|----------|-------|--------|------|
| =====                                           |                     |             |          |       |        |      |
| Legend: (B) - Backup Next-hop for Fast Re-Route |                     |             |          |       |        |      |
| (D) - Duplicate                                 |                     |             |          |       |        |      |
| =====                                           |                     |             |          |       |        |      |
| -----                                           |                     |             |          |       |        |      |
| Prefix                                          |                     |             |          |       |        |      |
| -----                                           |                     |             |          |       |        |      |
| Sid-Type                                        |                     | Fwd-Type    | In-Label | Prot- |        |      |
| Inst                                            |                     |             |          |       |        |      |
|                                                 |                     | Next Hop(s) |          |       |        | Out- |
| Label(s)                                        | Interface/Tunnel-ID |             |          |       |        |      |
| -----                                           |                     |             |          |       |        |      |
| Adjacency                                       | Transit             | 262129      | ISIS-0   |       |        |      |
| 10.10.12.3                                      | 10.10.12.2          |             |          |       | 3      | ip-  |
| 10.10.3.3                                       | (B) 10.10.3.2       |             |          |       | 3      | ip-  |
| Adjacency                                       | Transit             | 262130      | ISIS-0   |       |        |      |
| 10.10.12.3                                      | 10.10.12.2          |             |          |       | 3      | ip-  |
| 10.10.3.3                                       | (B) 10.10.3.2       |             |          |       | 3      | ip-  |
| Adjacency                                       | Transit             | 262133      | ISIS-0   |       |        |      |
| 10.10.5.3                                       | 10.10.5.5           |             |          |       | 3      | ip-  |
| 10.10.12.3                                      | (B) 10.10.12.2      |             |          |       | 474389 | ip-  |
|                                                 |                     |             |          |       | 474390 |      |
| Adjacency                                       | Transit             | 262134      | ISIS-0   |       |        |      |
| 10.10.5.3                                       | 10.10.5.5           |             |          |       | 3      | ip-  |
| 10.10.12.3                                      | (B) 10.10.12.2      |             |          |       | 474389 | ip-  |
|                                                 |                     |             |          |       | 474390 |      |
| Adjacency                                       | Transit             | 262135      | ISIS-0   |       |        |      |
| 10.10.3.3                                       | 10.10.3.2           |             |          |       | 3      | ip-  |
| 10.10.12.3                                      | (B) 10.10.12.2      |             |          |       | 3      | ip-  |
| Adjacency                                       | Transit             | 262136      | ISIS-0   |       |        |      |
| 10.10.3.3                                       | 10.10.3.2           |             |          |       | 3      | ip-  |
| 10.10.12.3                                      | (B) 10.10.12.2      |             |          |       | 3      | ip-  |
| Adjacency                                       | Transit             | 262137      | ISIS-0   |       |        |      |
| 10.10.2.3                                       | 10.10.2.1           |             |          |       | 3      | ip-  |
| Adjacency                                       | Transit             | 262138      | ISIS-0   |       |        |      |
| 10.10.2.3                                       | 10.10.2.1           |             |          |       | 3      | ip-  |

```

10.20.1.4
Node Orig/Transit 474389 ISIS-0
 10.10.12.2 474389 ip-
10.10.12.3
 (B) 10.10.5.5 474389 ip-
10.10.5.3
10.20.1.5
Node Orig/Transit 474390 ISIS-0
 10.10.5.5 474390 ip-
10.10.5.3
 (B) 10.10.12.2 474389 ip-
10.10.12.3
 474390
10.20.1.6
Node Orig/Transit 474391 ISIS-0
 10.10.5.5 474391 ip-
10.10.5.3
 (B) 10.10.12.2 474391 ip-
10.10.12.3
10.20.1.2
Node Orig/Transit 474392 ISIS-0
 10.10.12.2 474392 ip-
10.10.12.3
 (B) 10.10.3.2 474392 ip-
10.10.3.3

Node Terminating 474393 ISIS-0
*A:Dut-C#

```

\*A:Dut-C# tools dump router segment-routing tunnel

Legend: (B) - Backup Next-hop for Fast Re-Route  
(D) Duplicate

```

=====
Prefix
Sid-Type Fwd-Type In-Label Prot-Inst
 Next Hop(s) Out-Label(s) Interface/Tunnel-ID |

Adjacency Transit 262129 ISIS-0
 10.10.12.2 3 ip-
10.10.12.3
 (B) 10.10.3.2 3 ip-
10.10.3.3

Adjacency Transit 262130 ISIS-0
 10.10.12.2 3 ip-
10.10.12.3
 (B) 10.10.3.2 3 ip-
10.10.3.3

Adjacency Transit 262133 ISIS-0
 10.10.5.5 3 ip-
10.10.5.3
 (B) 10.10.12.2 474389 ip-
10.10.12.3
 474390
Adjacency Transit 262134 ISIS-0

```

|            |                |              |        |        |
|------------|----------------|--------------|--------|--------|
| 10.10.5.3  | 10.10.5.5      |              | 3      | ip-    |
| 10.10.12.3 | (B) 10.10.12.2 |              | 474389 | ip-    |
| Adjacency  | Transit        | 262135       | ISIS-0 |        |
| 10.10.3.3  | 10.10.3.2      |              | 3      | ip-    |
| 10.10.12.3 | (B) 10.10.12.2 |              | 3      | ip-    |
| Adjacency  | Transit        | 262136       | ISIS-0 |        |
| 10.10.3.3  | 10.10.3.2      |              | 3      | ip-    |
| 10.10.12.3 | (B) 10.10.12.2 |              | 3      | ip-    |
| Adjacency  | Transit        | 262137       | ISIS-0 |        |
| 10.10.2.3  | 10.10.2.1      |              | 3      | ip-    |
| Adjacency  | Transit        | 262138       | ISIS-0 |        |
| 10.10.2.3  | 10.10.2.1      |              | 3      | ip-    |
| 10.20.1.4  | Node           | Orig/Transit | 474389 | ISIS-0 |
| 10.10.12.3 | 10.10.12.2     |              | 474389 | ip-    |
| 10.10.5.3  | (B) 10.10.5.5  |              | 474389 | ip-    |
| 10.20.1.5  | Node           | Orig/Transit | 474390 | ISIS-0 |
| 10.10.5.3  | 10.10.5.5      |              | 474390 | ip-    |
| 10.10.12.3 | (B) 10.10.12.2 |              | 474389 | ip-    |
| 10.20.1.6  | Node           | Orig/Transit | 474391 | ISIS-0 |
| 10.10.5.3  | 10.10.5.5      |              | 474391 | ip-    |
| 10.10.12.3 | (B) 10.10.12.2 |              | 474391 | ip-    |
| 10.20.1.2  | Node           | Orig/Transit | 474392 | ISIS-0 |
| 10.10.12.3 | 10.10.12.2     |              | 474392 | ip-    |
| 10.10.3.3  | (B) 10.10.3.2  |              | 474392 | ip-    |
| Node       | Terminating    | 474393       | ISIS-0 |        |

\*A:Dut-C#

\*A:Dut-C>config>router>ospf3# /tools dump router segment-routing tunnel

Legend: (B) - Backup Next-hop for Fast Re-Route

(D) - Duplicate

label stack is ordered from top-most to bottom-most

| =====          |                         |          |           |  |       |         |
|----------------|-------------------------|----------|-----------|--|-------|---------|
| -----+-----    |                         |          |           |  |       |         |
| Prefix         |                         |          |           |  |       |         |
| Sid-Type       | Fwd-Type                | In-Label | Prot-Inst |  |       |         |
|                | Next Hop(s)             |          |           |  | Out-  |         |
| Label(s)       | Interface/Tunnel-ID     |          |           |  |       |         |
| -----+-----    |                         |          |           |  |       |         |
| 3ffe::100:2103 |                         |          |           |  |       |         |
| Node           | Terminating             | 40000    | OSPF3-0   |  |       |         |
| 3ffe::100:2c04 |                         |          |           |  |       |         |
| Node           | Orig/Transit            | 40001    | OSPF3-0   |  |       |         |
|                | fe80::200:ff:fe00:1     |          |           |  | 20001 | DUTC_TO |
| _DUTA.1.0      | (B) fe80::200:ff:fe00:6 |          |           |  | 70001 | DUTC_TO |
| _DUTF.1.0      |                         |          |           |  |       |         |
| 3ffe::100:3705 |                         |          |           |  |       |         |
| Node           | Orig/Transit            | 40002    | OSPF3-0   |  |       |         |
|                | fe80::200:ff:fe00:6     |          |           |  | 70002 | DUTC_TO |
| _DUTF.1.0      | (B) fe80::200:ff:fe00:1 |          |           |  | 20005 | DUTC_TO |
| _DUTA.1.0      |                         |          |           |  | 30002 |         |
| 3ffe::100:4206 |                         |          |           |  |       |         |
| Node           | Orig/Transit            | 40003    | OSPF3-0   |  |       |         |
|                | fe80::200:ff:fe00:6     |          |           |  | 70003 | DUTC_TO |
| _DUTF.1.0      | (B) fe80::200:ff:fe00:1 |          |           |  | 20005 | DUTC_TO |
| _DUTA.1.0      |                         |          |           |  | 30003 |         |
| 3ffe::100:b01  |                         |          |           |  |       |         |
| Node           | Orig/Transit            | 40004    | OSPF3-0   |  |       |         |
|                | fe80::200:ff:fe00:1     |          |           |  | 20004 | DUTC_TO |
| _DUTA.1.0      | (B) fe80::200:ff:fe00:6 |          |           |  | 70005 | DUTC_TO |
| _DUTF.1.0      |                         |          |           |  | 30004 |         |
| 3ffe::100:1602 |                         |          |           |  |       |         |
| Node           | Orig/Transit            | 40005    | OSPF3-0   |  |       |         |
|                | fe80::200:ff:fe00:1     |          |           |  | 20005 | DUTC_TO |
| _DUTA.1.0      | (B) fe80::200:ff:fe00:6 |          |           |  | 70005 | DUTC_TO |
| _DUTF.1.0      |                         |          |           |  |       |         |
| 3ffe::a14:103  |                         |          |           |  |       |         |
| Node           | Terminating             | 40006    | OSPF3-0   |  |       |         |
| 3ffe::a14:104  |                         |          |           |  |       |         |
| Node           | Orig/Transit            | 40007    | OSPF3-0   |  |       |         |
|                | fe80::200:ff:fe00:1     |          |           |  | 20007 | DUTC_TO |
| _DUTA.1.0      | (B) fe80::200:ff:fe00:6 |          |           |  | 70007 | DUTC_TO |
| _DUTF.1.0      |                         |          |           |  |       |         |
| 3ffe::a14:105  |                         |          |           |  |       |         |
| Node           | Orig/Transit            | 40008    | OSPF3-0   |  |       |         |
|                | fe80::200:ff:fe00:6     |          |           |  | 70008 | DUTC_TO |
| _DUTF.1.0      | (B) fe80::200:ff:fe00:1 |          |           |  | 20005 | DUTC_TO |
| _DUTA.1.0      |                         |          |           |  | 30008 |         |

|                                        |                         |        |         |       |         |
|----------------------------------------|-------------------------|--------|---------|-------|---------|
| 3ffe::a14:106                          |                         |        |         |       |         |
| Node                                   | Orig/Transit            | 40009  | OSPF3-0 |       |         |
|                                        | fe80::200:ff:fe00:6     |        |         | 70009 | DUTC_TO |
| _DUTF.1.0                              |                         |        |         |       |         |
|                                        | (B) fe80::200:ff:fe00:1 |        |         | 20005 | DUTC_TO |
| _DUTA.1.0                              |                         |        |         |       |         |
|                                        |                         |        |         | 30009 |         |
| 3ffe::a14:101                          |                         |        |         |       |         |
| Node                                   | Orig/Transit            | 40010  | OSPF3-0 |       |         |
|                                        | fe80::200:ff:fe00:1     |        |         | 20010 | DUTC_TO |
| _DUTA.1.0                              |                         |        |         |       |         |
|                                        | (B) fe80::200:ff:fe00:6 |        |         | 70005 | DUTC_TO |
| _DUTF.1.0                              |                         |        |         |       |         |
|                                        |                         |        |         | 30010 |         |
| 3ffe::a14:102                          |                         |        |         |       |         |
| Node                                   | Orig/Transit            | 40011  | OSPF3-0 |       |         |
|                                        | fe80::200:ff:fe00:1     |        |         | 20011 | DUTC_TO |
| _DUTA.1.0                              |                         |        |         |       |         |
|                                        | (B) fe80::200:ff:fe00:6 |        |         | 70011 | DUTC_TO |
| _DUTF.1.0                              |                         |        |         |       |         |
| fe80::200:ff:fe00:6-"DUTC_TO_DUTF.1.0" |                         |        |         |       |         |
| Adjacency                              | Transit                 | 524286 | OSPF3-0 |       |         |
|                                        | fe80::200:ff:fe00:6     |        |         | 3     | DUTC_TO |
| _DUTF.1.0                              |                         |        |         |       |         |
|                                        | (B) fe80::200:ff:fe00:1 |        |         | 20005 | DUTC_TO |
| _DUTA.1.0                              |                         |        |         |       |         |
|                                        |                         |        |         | 30003 |         |
| fe80::200:ff:fe00:1-"DUTC_TO_DUTA.1.0" |                         |        |         |       |         |
| Adjacency                              | Transit                 | 524287 | OSPF3-0 |       |         |
|                                        | fe80::200:ff:fe00:1     |        |         | 3     | DUTC_TO |
| _DUTA.1.0                              |                         |        |         |       |         |
|                                        | (B) fe80::200:ff:fe00:6 |        |         | 70005 | DUTC_TO |
| _DUTF.1.0                              |                         |        |         |       |         |
|                                        |                         |        |         | 30004 |         |
| -----+                                 |                         |        |         |       |         |
| No. of Entries: 14                     |                         |        |         |       |         |
| -----+                                 |                         |        |         |       |         |

l2tp

|             |                                                                           |
|-------------|---------------------------------------------------------------------------|
| Syntax      | l2tp                                                                      |
| Context     | tools>perform>router                                                      |
| Description | This command enables the context to configure performance tools for L2TP. |

peer

|             |                                                             |
|-------------|-------------------------------------------------------------|
| Syntax      | peer ip-address [udp-port port] [ip]                        |
| Context     | tools>perform>router>l2tp                                   |
| Description | This command configures performance tools for an L2TP peer. |

---

**Parameters**

- ip-address* — Specifies the IP address of the L2TP peer.
- port* — Specifies the UDP port for the L2TP peer. This parameter is only supported with L2TPv2 peers.
- ip** — Enables performance tools for peers using IP transport.

## 3 VRRP

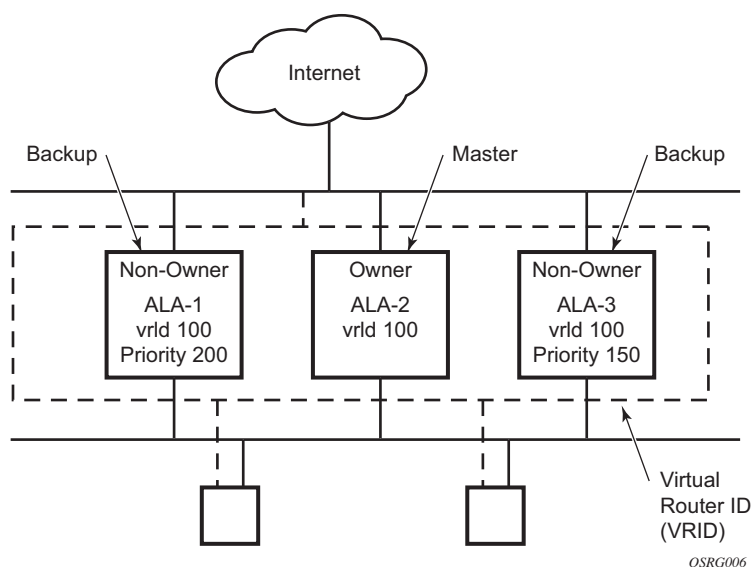
### 3.1 VRRP Overview

The Virtual Router Redundancy Protocol (VRRP) for IPv4 is defined in the IETF RFC 3768, *Virtual Router Redundancy Protocol*. VRRP for IPv6 is specified in *draft-ietf-vrrp-unified-spec-02.txt* and only applies to the 7750 SR and 7950 XRS. VRRP describes a method of implementing a redundant IP interface shared between two or more routers on a common LAN segment, allowing a group of routers to function as one virtual router. When this IP interface is specified as a default gateway on hosts directly attached to this LAN, the routers sharing the IP interface prevent a single point of failure by limiting access to this gateway address. VRRP can be implemented on IES service interfaces and on core network IP interfaces.

If the master virtual router fails, the backup router configured with the highest acceptable priority becomes the master virtual router. The new master router assumes the normal packet forwarding for the local hosts.

Figure 23 shows an example of a VRRP configuration.

**Figure 23 VRRP Configuration**



---

## 3.2 VRRP Components

VRRP consists of the following components:

### 3.2.1 Virtual Router

A virtual router is a logical entity managed by VRRP that acts as a default router for hosts on a shared LAN. It consists of a Virtual Router Identifier (VRID) and a set of associated IP addresses (or an address) across a common LAN. A VRRP router can be the backup for one or more virtual routers.

The purpose of supporting multiple IP addresses within a single virtual router is for multi-netting. This is a common mechanism that allows multiple local subnet attachments on a single routing interface. Up to four virtual routers are possible on a single Nokia IP interface. The virtual routers must be in the same subnet. Each virtual router has its own VRID, state machine, and messaging instance.

### 3.2.2 IP Address Owner

VRRP can be configured in either an owner or non-owner mode. The owner is the VRRP router whose virtual router IP address is the same as the real interface IP address. This is the router that responds to packets addressed to one of the IP addresses for ICMP pings, TCP connections, and so on. All other virtual router instances participating in this message domain must have the same VRID configured and cannot be configured as owner.

Nokia routers allow the virtual routers to be configured as non-owners of the IP address. VRRP on a router can be configured to allow non-owners to respond to ICMP echo requests when they become the virtual router master for the virtual router. Telnet and other connection-oriented protocols can also be configured for non-owner master response. However, the individual application conversations (connections) will not survive a VRRP failover. A non-owner VRRP router operating as a backup will not respond to any packets addressed to any of the virtual router IP addresses.



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### 3.2.3 Primary and Secondary IP Addresses

A primary address is an IP address selected from the set of real interface address. VRRP advertisements are always sent using the primary IP address as the source of the IP packet.

An IP interface must always have a primary IP address assigned for VRRP to be active on the interface. Nokia routers supports both primary and secondary IP addresses (multi-netting) on the IP interface. The virtual router's VRID primary IP address is always the primary address on the IP interface. VRRP uses the primary IP address as the IP address placed in the source IP address field of the IP header for all VRRP messages sent on that interface.

### 3.2.4 Virtual Router Master

The VRRP router that controls the IP addresses associated with a virtual router is called the master. The master is responsible for forwarding packets sent to the VRRP IP addresses. An election process provides dynamic failover of the forwarding responsibility if the master becomes unavailable. This allows any of the virtual router IP addresses on the LAN to be used as the default first hop router by end hosts. This enables a higher availability default path without requiring configuration of dynamic routing or router discovery protocols on every end host.

If the master is unavailable, each backup virtual router for the VRID compares the configured priority values to determine the master role. In case of a tie, the virtual router with the highest primary IP address becomes master.

The preempt parameter can be set to false to prevent a backup virtual router with a better priority value from becoming master when an existing non-owner virtual router is the current master. This is determined on a first-come, first-served basis.

While master, a virtual router routes and originates all IP packets into the LAN using the physical MAC address for the IP interface as the Layer 2 source MAC address, not the VRID MAC address. ARP packets also use the parent IP interface MAC address as the Layer 2 source MAC address while inserting the virtual router MAC address in the appropriate hardware address field. VRRP messages are the only packets transmitted using the virtual router MAC address as the Layer 2 source MAC address.

### 3.2.5 Virtual Router Backup

A new virtual router master is selected from the set of VRRP routers available to assume forwarding responsibility for a virtual router in case the current master fails.

### 3.2.6 Owner and Non-Owner VRRP

The owner controls the IP address of the virtual router and is responsible for forwarding packets sent to this IP address. The owner assumes the role of the master virtual router. Only one virtual router in the domain can be configured as owner. All other virtual router instances participating in this message domain must have the same VRID configured.

The most important parameter to be defined on a non-owner virtual router instance is the priority. The priority defines a virtual router's selection order in the master election process. The priority value and the preempt mode determine the virtual router with the highest priority to become the master virtual router.

The base priority is used to determine the in-use priority of the virtual router instance as modified by any optional VRRP priority control policy. VRRP priority control policies can be used to either override or adjust the base priority value depending on events or conditions within the chassis.

For information about non-owner access parameters, see [VRRP Non-Owner Accessibility](#).

### 3.2.7 Configurable Parameters

As well as to backup IP addresses, to facilitate configuration of a virtual router on Nokia routers, the following parameters can be defined in owner configurations:

- [Virtual Router ID \(VRID\)](#)
- [Message Interval and Master Inheritance](#)
- [VRRP Message Authentication](#)
- [Authentication Data](#)
- [Virtual MAC Address](#)

The following parameters can be defined in non-owner configurations:

- [Virtual Router ID \(VRID\)](#)

- [Priority](#)
- [Message Interval and Master Inheritance](#)
- [Master Down Interval](#)
- [Preempt Mode](#)
- [VRRP Message Authentication](#)
- [Authentication Data](#)
- [Virtual MAC Address](#)
- [Inherit Master VRRP Router's Advertisement Interval Timer](#)
- [Policies](#)

### 3.2.7.1 Virtual Router ID (VRID)

The VRID must be configured with the same value on each virtual router associated with the redundant IP address (or addresses). The VRID is placed in all VRRP advertisement messages sent by each virtual router.

### 3.2.7.2 Priority

The priority value affects the interaction between this VRID and the same VRID of other virtual routers participating on the same LAN. A higher-priority value defines a greater priority in becoming the virtual router master for the VRID. The priority value can only be configured when the defined IP address on the IP interface is different from the virtual router IP address (non-owner mode).

When the IP address on the IP interface matches the virtual router IP address (owner mode), the priority value is fixed at 255, the highest value possible. This virtual router member is considered the owner of the virtual router IP address. There can only be one owner of the virtual router IP address for all virtual router members.

The priority value 0 is reserved for VRRP advertisement message purposes. It is used to tell other virtual routers in the same VRID that this virtual router is no longer acting as master, triggering a new election process. When this happens, each backup virtual router sets its master down timer equal to the skew time value. This shortens the time until one of the backup virtual routers becomes master.

The current master virtual router must transmit a VRRP advertisement message immediately upon receipt of a VRRP message with priority set to 0. This prevents another backup from becoming master for a short period of time.

Non-owner virtual routers may be configured with a priority of 254 through 1. The default value is 100. Multiple non-owners can share the same priority value. When multiple non-owner backup virtual routers are tied (transmit VRRP advertisement messages simultaneously) in the election process, all attempt to become master simultaneously; the one with the best priority will win the election. If the priority value in the message is equal to the master's local priority value, the primary IP address of the local master and of the message is evaluated as the tie breaker. The higher IP address becomes master. (The primary IP address is the source IP address of the VRRP advertisement message.)

The priority value is also used to determine when to preempt the existing master. If the preempt mode value is true, VRRP advertisement messages from inferior (lower-priority) masters are discarded, causing the master down timer to expire and causing the transition to master state.

The priority value also dictates the skew time added to the master timeout period.

### **3.2.7.3 IP Addresses**

Each virtual router with the same VRID should be defined with the same set of IP addresses. These are the IP addresses being used by hosts on the LAN as gateway addresses. Multi-netting supports 16 IP addresses on the IP interface; up to 16 addresses can be assigned to a specific virtual router instance.

### **3.2.7.4 Message Interval and Master Inheritance**

Each virtual router is configured with a message interval per VRID within which it participates. This parameter must be the same for every virtual router on the VRID.

For IPv4, the default advertisement interval is 1 s and can be configured between 100 ms and 255 s 900 ms. For IPv6, the default advertisement interval is 1 s and can be configured between 100 ms and 40 s 950 ms.

As specified in the RFC, the advertisement interval field in every received VRRP advertisement message must match the locally configured advertisement interval. If a mismatch occurs, depending on the inherit configuration, the current master's advertisement interval setting can be used to operationally override the locally configured advertisement interval setting. If the current master changes, the new master setting is used. If the local virtual router becomes master, the locally configured advertisement interval is enforced.

If a VRRP advertisement message is received with an advertisement interval set to a value different from the local value and the inherit parameter is disabled, the message is discarded without processing.

The master virtual router on a VRID uses the advertisement interval to load the advertisement timer, specifying when to send the next VRRP advertisement message. Each backup virtual router on a VRID uses the advertisement interval (with the configured local priority) to determine the master down timer value.

VRRP advertisement messages that are fragmented, or contain IP options (IPv4), or contain extension headers (IPv6) require a longer message interval to be configured.

### 3.2.7.5 Skew Time

The skew time is used to add a time period to the master down interval. This is not a configurable parameter. It is determined from the current local priority of the virtual router's VRID. To calculate the skew time, the virtual router evaluates the following formula:

For IPv4:  $\text{Skew Time} = ((256 - \text{priority}) / 256) \text{ seconds}$

For IPv6:  $\text{Skew Time} = (((256 - \text{priority}) * \text{Master\_Adver\_Interval}) / 256) \text{ centiseconds}$

The higher the priority value, the shorter the skew time will be. This means that virtual routers with a lower priority will transition to master slower than virtual routers with a higher priority.

### 3.2.7.6 Master Down Interval

The master down interval is a calculated value used to load the master down timer. When the master down timer expires, the virtual router enters the master state. To calculate the master down interval, the virtual router evaluates the following formula:

$\text{Master Down Interval} = (3 \times \text{Operational Advertisement Interval}) + \text{Skew Time}$

The operational advertisement interval is dependent upon the state of the inherit parameter. When the inherit parameter is enabled, the operational advertisement interval is determined from the current master's advertisement interval field in the VRRP advertisement message. When inherit is disabled, the operational advertisement interval must be equal to the locally configured advertisement interval.

---

The master down timer is only operational when the local virtual router is operating in backup mode.

### 3.2.7.7 Preempt Mode

Preempt mode is a true or false configured value that controls whether a specific backup virtual router preempts a lower-priority master. The IP address owner will always become master when available. Preempt mode cannot be set to false on the owner virtual router. The default value for preempt mode is true.

When preempt mode is true, a master non-owner virtual router will only allow itself to be preempted when the incoming VRRP advertisement message priority field value is one of the following:

- Greater than the virtual router in-use priority value
- Equal to the in-use priority value, and the source IP address (primary IP address) is greater than the virtual router instance primary IP address

A backup router will only attempt to become the master router if the preempt mode is true and the received VRRP advertisement priority field is less than the virtual router in-use priority value.

### 3.2.7.8 VRRP Message Authentication

The authentication type parameter defines the type of authentication used by the virtual router in VRRP advertisement message authentication. VRRP message authentication is applicable to IPv4 only. The current master uses the configured authentication type to indicate any egress message manipulation that must be performed in conjunction with any supporting authentication parameters before transmitting a VRRP advertisement message. The configured authentication type value is transmitted in the message authentication type field with the appropriate authentication data field filled in. Backup routers use the authentication type message field value in interpreting the contained authentication data field within received VRRP advertisement messages.

VRRP supports three message authentication methods that provide varying degrees of security. The supported authentication types are:

- 0 – No Authentication
- 1 – Simple Text Password
- 2 – IP Authentication Header

### 3.2.7.8.1 Authentication Type 0 – No Authentication

The use of authentication type 0 indicates that VRRP advertisement messages are not authenticated (provides no authentication). The master transmitting VRRP advertisement messages will transmit the value 0 in the egress messages authentication type field and the authentication data field. Backup virtual routers receiving VRRP advertisement messages with the authentication type field equal to 0 will ignore the authentication data field in the message.

All compliant VRRP advertisement messages are accepted. The following fields within the received VRRP advertisement message are checked for compliance (the VRRP specification may require additional checks):

- IP header checks specific to VRRP
  - IP header destination IP address – Must be 224.0.0.18
  - IP header TTL field – Must be equal to 255; the packet must not have traversed any IP routed hops
  - IP header protocol field – must be 112 (decimal)
- VRRP message checks
  - Version field – Must be set to the value of 2
  - Type field – Must be set to the value of 1 (advertisement)
  - Virtual router ID field – Must match one of the configured VRIDs on the ingress IP interface (all other fields are dependent on matching the virtual router ID field to one of the interfaces configured *VRID* parameters)
  - Priority field – Must be equal to or greater than the *VRID* in-use priority or be equal to 0 (if equal to the *VRID* in-use priority and 0, requires further processing regarding master/backup and senders IP address to determine validity of the message)
  - Authentication type field – Must be equal to 0
  - Advertisement interval field – Must be equal to the *VRID* configured advertisement interval
  - Checksum field – Must be valid
  - Authentication data fields – Must be ignored

VRRP messages not meeting the criteria are silently discarded.

### 3.2.7.8.2 Authentication Type 1 – Simple Text Password

The use of authentication type 1 indicates that VRRP advertisement messages are authenticated with a clear (simple) text password. All virtual routers participating in the virtual router instance must be configured with the same 8 octet password. Transmitting virtual routers put a value of 1 in the VRRP advertisement message authentication type field and put the configured simple text password into the message authentication data field. Receiving virtual routers compare the message authentication data field with the local configured simple text password based on the message authentication type field value of 1.

The same checks are performed as for type 0, with the following exceptions (the VRRP specification may require additional checks):

- VRRP message checks
  - Authentication type field – Must be equal to 1
  - Authentication data fields – Must be equal to the *VRID* configured simple text password

Any VRRP messages not meeting the type 0 verification checks, with the preceding exceptions are silently discarded.

### 3.2.7.8.3 Authentication Failure

Any received VRRP advertisement message that fails authentication must be silently discarded with an invalid authentication counter incremented for the ingress virtual router instance.

## 3.2.7.9 Authentication Data

This feature is different from the VRRP advertisement message field with the same name. Authentication data is any required authentication information that is pertinent to the configured authentication type. The type of authentication data used for each authentication type is listed in [Table 40](#).

**Table 40** Authentication Data Type

| Authentication Type | Authentication Data                   |
|---------------------|---------------------------------------|
| 0                   | None, authentication is not performed |



**Table 40 Authentication Data Type (Continued)**

| Authentication Type | Authentication Data                         |
|---------------------|---------------------------------------------|
| 1                   | Simple text password consisting of 8 octets |

### 3.2.7.10 Virtual MAC Address

The MAC address can be used instead of an IP address in ARP responses when the virtual router instance is master. The MAC address configuration must be the same for all virtual routers participating as a virtual router, or indeterminate connectivity by the attached IP hosts will result. All VRRP advertisement messages are transmitted with *ieee-mac-addr* as the source MAC.

### 3.2.7.11 VRRP Advertisement Message IP Address List Verification

VRRP advertisement messages contain an IP address count field that indicates the number of IP addresses listed in the sequential IP address fields at the end of the message.

The Nokia routers implementation always logs mismatching events. The decision on where and whether to forward the generated messages depends on the configuration of the event manager.

To facilitate the sending of mismatch log messages, each virtual router instance keeps the mismatch state associated with each source IP address in the VRRP master table. Whenever the state changes, a mismatch log message is generated indicating the source IP address within the message, the mismatch or match event, and the time of the event.

With secondary IP address support, multiple IP addresses can be in the list and each should match the IP address on the virtual router instance. Owner and non-owner virtual router instances have the supported IP addresses explicitly defined, making mismatched supported IP addresses within the interconnected virtual router instances a provisioning issue.

---

### 3.2.7.12 Inherit Master VRRP Router's Advertisement Interval Timer

The virtual router instance can inherit the master VRRP router's advertisement interval timer, which is used by backup routers to calculate the master down timer.

The inheritance is only configurable in the non-owner nodal context. The inheritance is used to allow the current virtual router instance master to dictate the master down timer for all backup virtual routers.

### 3.2.7.13 IPv6 Virtual Router Instance Operationally Up

After the 7750 SR or 7950 XRS IPv6 virtual router is configured with a minimum of one link-local backup address, the parent interface's router advertisement must be configured to use the virtual MAC address for the virtual router to be considered operationally up.

### 3.2.7.14 Policies

Policies can be configured to control VRRP priority with the virtual router instance. VRRP priority control policies can be used to override or adjust the base priority value, depending on events or conditions within the chassis.

The policy can be associated with more than one virtual router instance. The priority events within the policy override or diminish the base priority dynamically affecting the in-use priority. As priority events clear in the policy, the in-use priority can eventually be restored to the base priority value.

Policies can only be configured in the non-owner VRRP context. For non-owner virtual router instances, if policies are not configured, then the base priority is used as the in-use priority.

---

## 3.3 VRRP Priority Control Policies

This implementation of VRRP supports control policies to manipulate virtual router participation in the VRRP master election process and master self-deprecation. The local priority value for the virtual router instance is used to control the election process and master state.

### 3.3.1 VRRP Virtual Router Policy Constraints

Priority control policies can only be applied to non-owner VRRP virtual router instances. Owner VRRP virtual routers cannot be controlled by a priority control policy because they are required to have a priority value of 255 that cannot be diminished. Only one VRRP priority control policy can be applied to a non-owner virtual router instance.

Multiple VRRP virtual router instances may be associated with the same IP interface, allowing multiple priority control policies to be associated with the IP interface.

An applied VRRP priority control policy only affects the in-use priority on the virtual router instance when the preempt mode has been enabled. A virtual router instance with preempt mode disabled will always use the base priority as the in-use priority, ignoring any configured priority control policy.

### 3.3.2 VRRP Virtual Router Instance Base Priority

Non-owner virtual router instances must have a base priority value between 1 and 254. The value 0 is reserved for master termination. The value 255 is reserved for owners. The default base priority for non-owner virtual router instances is the value 100.

The base priority is the starting priority for the VRRP instance. The actual in-use priority for the VRRP instance is determined from the base priority and an optional VRRP priority control policy.

---

### 3.3.3 VRRP Priority Control Policy Delta In-Use Priority Limit

A VRRP priority control policy enforces an overall minimum value that the policy can assign to the VRRP virtual router instance base priority. This value provides a lower limit to the delta priority events manipulation of the base priority.

A delta priority event is a conditional event defined in the priority control policy that subtracts a specified amount from the current, in-use priority for all VRRP virtual router instances to which the policy is applied. Multiple delta priority events can apply simultaneously, creating a dynamic priority value. The base priority for the instance, less the sum of the delta values, determines the priority value in-use.

An explicit priority event is a conditional event defined in the priority control policy that explicitly defines the in-use priority value for the virtual router instance. The explicitly defined value is not affected by the delta in-use priority limit. When multiple explicit priority events happen simultaneously, the lowest value is used for the in-use priority. The configured base priority is not a factor in explicit priority overrides of the in-use priority.

The allowed range of the Delta In-Use Priority Limit is 1 to 254. The default is 1, which prevents the delta priority events from operationally disabling the virtual router instance.

### 3.3.4 VRRP Priority Control Policy Priority Events

The main function of a VRRP priority control policy is to define conditions or events that affect the system's ability to communicate with outside hosts or portions of the network. When one or multiple of these events are true, the base priority on the virtual router instance is either overwritten with an explicit value, or a sum of delta priorities is subtracted from the base priority. The result is the in-use priority for the virtual router instance. Any priority event may be configured as an explicit event or a delta event.

Explicit events override all delta events. When multiple explicit events occur, the event with the lowest priority value is assigned to the in-use priority. As events clear, the in-use priority is reevaluated accordingly and adjusted dynamically.

Delta priority events also have priority values. When no explicit events have occurred within the policy, the sum of the occurring delta events priorities is subtracted from the base priority of each virtual router instance. If the result is lower than the delta in-use priority limit, the delta in-use priority limit is used as the in-use priority for the virtual router instance. Otherwise, the in-use priority is set to the base priority less the sum of the delta events.

Each event generates a VRRP priority event message indicating the policy-id, the event type, the priority type (delta or explicit), and the event priority value. Another log message is generated when the event is no longer true, indicating that it has been cleared.

### 3.3.4.1 Priority Event Hold-Set Timers

Hold-set timers are used to dampen the effect of a flapping event. A flapping event is where the event continually transitions between clear and set. The hold-set value is loaded into a hold-set timer that prevents a set event from transitioning to the cleared state until it expires.

Each time an event transitions between cleared and set, the timer is loaded and begins to count down to zero. If the timer reaches zero, the event will be allowed to enter the cleared state again. Entering the cleared state is always dependent on the object controlling the event conforming to the requirements defined in the event. It is possible, on some event types, to have a further set action reload the hold-set timer. This extends the time that must pass before the hold-set timer expires, and the event enters the cleared state.

For an example of a hold-set timer setting, refer to [LAG Degrade Priority Event](#).

### 3.3.4.2 Port Down Priority Event

The port down priority event is assigned to either a physical port or a SONET/SDH channel for the 7750 SR and 7450 ESS. The port or channel operational state is evaluated to determine a port down priority event or event clear.

When the port or channel operational state is up, the port down priority event is considered false or cleared. When the port or channel operational state is down, the port down priority event is considered true or set.

### 3.3.4.3 LAG Degrade Priority Event

The LAG degrade priority event is assigned to an existing Link Aggregation Group (LAG). The LAG degrade priority event is conditional on a percentage of available port bandwidth on the LAG. Multiple bandwidth percentage thresholds may be defined, each with its own priority value.

If the LAG transitions from one threshold to the next, the previous threshold priority value is subtracted from the total delta sum while the new threshold priority value is added to the sum. The new sum is then subtracted from the base priority and compared to the delta in-use priority limit to determine the new in-use priority on the virtual router instance.

The following example shows a LAG degrade priority event and its interaction with the hold-set timer in changing the in-use priority.

The following state and timer settings are used for the LAG events listed in [Table 41](#):

- User-defined thresholds: 2 ports down, 4 ports down, 6 ports down
- LAG configured ports: 8 ports
- Hold-set timer (hold-set): 5 seconds

**Table 41 LAG Events**

| Time (seconds) | LAG Port State | Parameter       | State              | Comments                                   |
|----------------|----------------|-----------------|--------------------|--------------------------------------------|
| 0              | All ports down | Event State     | Set - 8 ports down | —                                          |
|                |                | Event Threshold | 6 ports down       | —                                          |
|                |                | Hold-set Timer  | 5 seconds          | Set to <b>hold-set</b> parameter           |
| 1              | One port up    | Event State     | Set - 8 ports down | Cannot change until hold-set timer expires |
|                |                | Event Threshold | 6 ports down       | —                                          |
|                |                | Hold-set Timer  | 5 seconds          | Event does not affect timer                |
| 2              | All ports up   | Event State     | Set - 8 ports down | Still waiting for hold-set timer expiry    |
|                |                | Event Threshold | 6 ports down       | —                                          |
|                |                | Hold-set Timer  | 3 seconds          | —                                          |

**Table 41 LAG Events (Continued)**

| Time (seconds) | LAG Port State   | Parameter       | State                  | Comments                                         |
|----------------|------------------|-----------------|------------------------|--------------------------------------------------|
| 5              | All ports up     | Event State     | Cleared - All ports up | —                                                |
|                |                  | Event Threshold | None                   | Event cleared                                    |
|                |                  | Hold-set Timer  | Expired                | —                                                |
| 100            | Five ports down  | Event State     | Set - 5 ports down     | —                                                |
|                |                  | Event Threshold | 4 ports down           | —                                                |
|                |                  | Hold-set Timer  | Expired                | Set to <b>hold-set</b> parameter                 |
| 102            | Three ports down | Event State     | Set - 5 ports down     | —                                                |
|                |                  | Event Threshold | 4 ports down           | —                                                |
|                |                  | Hold-set Timer  | 3 seconds              | —                                                |
| 103            | All ports up     | Event State     | Set - 5 ports down     | —                                                |
|                |                  | Event Threshold | 4 ports down           | —                                                |
|                |                  | Hold-set Timer  | 2 second               | —                                                |
| 104            | Two ports down   | Event State     | Set - 5 ports down     | —                                                |
|                |                  | Event Threshold | 4 ports down           | —                                                |
|                |                  | Hold-set timer  | 1 second               | Current threshold is 5, so 2 down has no effect  |
| 105            | Two ports down   | Event State     | Set - 2 ports down     | —                                                |
|                |                  | Event Threshold | 2 ports down           | —                                                |
|                |                  | Hold-set timer  | Expired                | —                                                |
| 200            | Four ports down  | Event State     | Set - 2 ports down     | —                                                |
|                |                  | Event Threshold | 4 ports down           | —                                                |
|                |                  | Hold-set timer  | 5 seconds              | Set to <b>hold-set</b> parameter                 |
| 202            | Seven ports down | Event State     | Set - 7 ports down     | Changed due to increase                          |
|                |                  | Event Threshold | 6 ports down           | —                                                |
|                |                  | Hold-set timer  | 5 seconds              | Set to <b>hold-set</b> due to threshold increase |

**Table 41 LAG Events (Continued)**

| Time (seconds) | LAG Port State | Parameter       | State                  | Comments      |
|----------------|----------------|-----------------|------------------------|---------------|
| 206            | All ports up   | Event State     | Set - 7 ports down     | —             |
|                |                | Event Threshold | 6 ports down           | —             |
|                |                | Hold-set timer  | 1 second               | —             |
| 207            | All ports up   | Event State     | Cleared - All ports up | —             |
|                |                | Event Threshold | None                   | Event cleared |
|                |                | Hold-set timer  | Expired                | —             |

### 3.3.4.4 Host Unreachable Priority Event

The host unreachable priority event creates a continuous ping task that is used to test connectivity to a remote host. The path to the remote host and the remote host itself must be capable and configured to accept ICMP echo request and replies for the ping to be successful.

The ping task is controlled by interval and size parameters that define how often the ICMP request messages are transmitted and the size of each message. A historical missing reply parameter defines when the ping destination is considered unreachable.

When the host is unreachable, the host unreachable priority event is considered true or set. When the host is reachable, the host unreachable priority event is considered false or cleared.

### 3.3.4.5 Route Unknown Priority Event

The route unknown priority event defines a task that monitors the existence of a specific route prefix in the system's routing table.

The route monitoring task can be constrained by a condition that allows a prefix, which is less specific than the defined prefix, to be considered as a match. The source protocol can be defined to indicate the protocol that the installed route must be populated from. To further define match criteria when multiple instances of the route prefix exist, an optional next hop parameter can be defined.



---

When a route prefix exists within the active route table that matches the defined match criteria, the route unknown priority event is considered false or cleared. When a route prefix does not exist within the active route table matching the defined criteria, the route unknown priority event is considered true or set.

---

## 3.4 VRRP Non-Owner Accessibility

Although the RFC states that only VRRP owners can respond to ping and other management-oriented protocols directed to the VRID IP addresses, the routers allow an override of this restraint on a per VRRP virtual router instance basis.

### 3.4.1 Non-Owner Access Ping Reply

When non-owner access ping reply is enabled on a virtual router instance, ICMP echo request messages destined to the non-owner virtual router instance IP addresses are not discarded at the IP interface when operating in master mode. ICMP echo request messages are always discarded in backup mode.

When non-owner access ping reply is disabled on a virtual router instance, ICMP echo request messages destined to the non-owner virtual router instance IP addresses are silently discarded in both the master and backup modes.

### 3.4.2 Non-Owner Access Telnet

When non-owner access Telnet is enabled on a virtual router instance, authorized Telnet sessions may be established that are destined to the virtual router instance IP addresses when operating in master mode. Telnet sessions are always discarded at the IP interface when destined to a virtual router IP address operating in backup mode. Enabling non-owner access Telnet does not guarantee Telnet access; correct management and security features must be enabled to allow Telnet on this interface and possibly from the specified source IP address.

When non-owner access Telnet is disabled on a virtual router instance, Telnet sessions destined to the non-owner virtual router instance IP addresses are silently discarded in both master and backup modes.

---

### 3.4.3 Non-Owner Access SSH

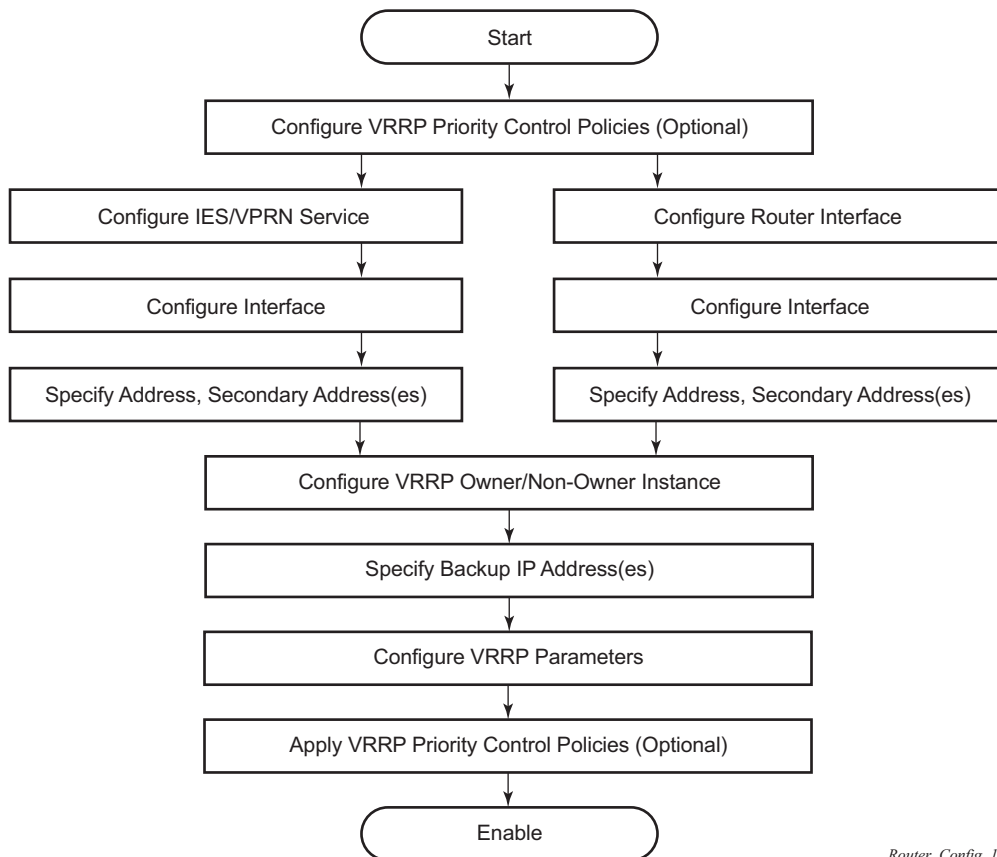
When non-owner access SSH is enabled on a virtual router instance, authorized SSH sessions may be established that are destined to the virtual router instance IP addresses when operating in master mode. SSH sessions are always discarded at the IP interface when destined to a virtual router IP address operating in backup mode. Enabling non-owner access SSH does not guarantee SSH access; correct management and security features must be enabled to allow SSH on this interface and possibly from the specified source IP address. SSH is applicable to IPv4 VRRP only.

When non-owner access SSH is disabled on a virtual router instance, SSH sessions destined to the non-owner virtual router instance IP addresses are silently discarded in both master and backup modes.

## 3.5 VRRP Configuration Process Overview

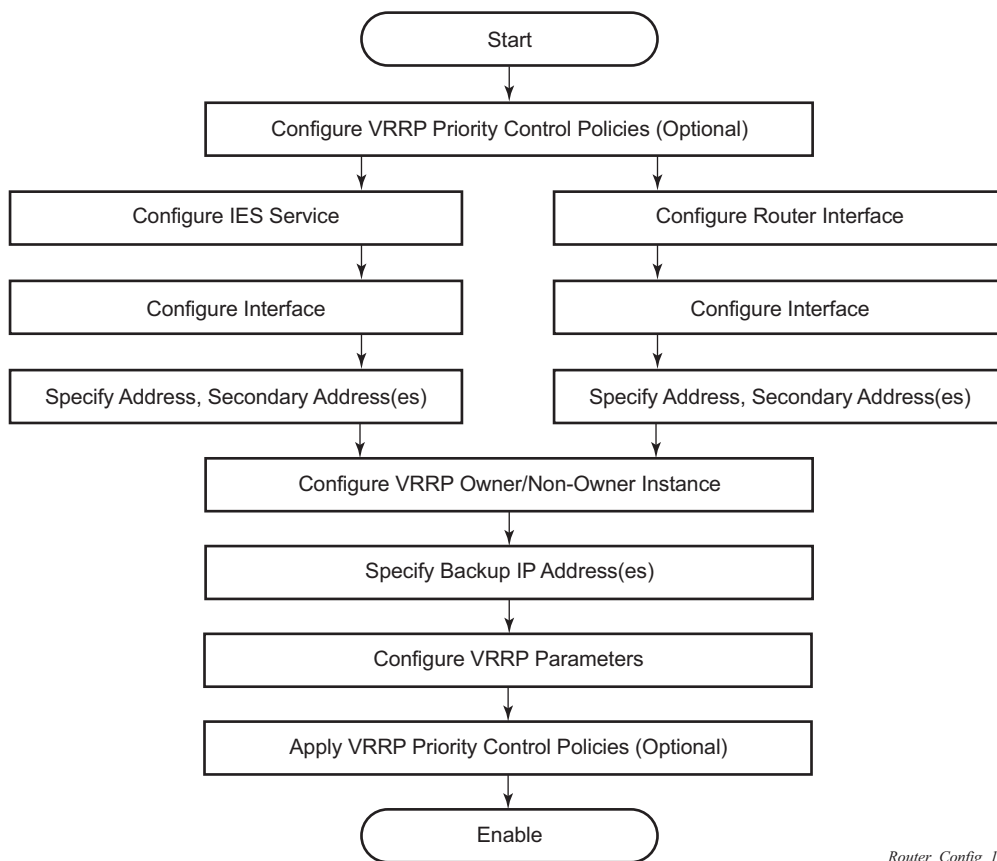
Figure 24 shows part 1 of the process to configure and implement VRRP parameters.

**Figure 24 VRRP Configuration and Implementation Flow - Part 1**



Router\_Config\_14

**Figure 25 VRRP Configuration and Implementation Flow**



Router\_Config\_15

---

## 3.6 Configuration Notes

This section describes VRRP configuration restrictions.

### 3.6.1 General

- Creating and applying VRRP policies are optional.
- Backup command:
  - The backup IP addresses must be on the same subnet. The backup addresses explicitly define which IP addresses are in the VRRP advertisement message IP address list.
  - In the owner mode, the backup IP address must be identical to one of the interface's IP addresses. The backup address explicitly defines which IP addresses are in the VRRP advertisement message IP address list.
  - For IPv6, one of the backup addresses configured must be the link-local address of the owner VRRP instance.

---

## 3.7 Configuring VRRP with CLI

This section provides information to configure VRRP using the command line interface.

### 3.7.1 VRRP Configuration Overview

Configuring VRRP policies and configuring VRRP instances on interfaces and router interfaces is optional. The basic owner and non-owner VRRP configurations on an IES or router interface must specify the **backup** *ip-address* parameter.

VRRP helps eliminate the single point of failure in a routed environment by using a virtual router IP address shared between two or more routers connecting the common domain. VRRP provides dynamic failover of the forwarding responsibility if the master becomes unavailable.

The VRRP implementation allows one master per IP subnet. All other VRRP instances in the same domain must be in backup mode.

#### 3.7.1.1 Preconfiguration Requirements

VRRP policies:

- VRRP policies must be configured before they can be applied to an interface or IES/VRPN VRRP instance. VRRP policies are configured in the **config>vrrp** context.

Configuring VRRP on an IES or VRPN service interface:

- The service customer account must be created before configuring an IES or VRPN VRRP instance.
- The interface address must be specified in the both the owner and non-owner IES, VRPN, or router interface instances.

### 3.7.2 Basic VRRP Configurations

Configure VRRP parameters in the following contexts.

### 3.7.2.1 VRRP Policy

Configuring and applying VRRP policies are optional. There are no default VRRP policies. Each policy must be explicitly defined. A VRRP configuration must include the following:

- Policy ID
- Define at least one of the following priority events:
  - Port down
  - LAG port down
  - Host unreachable
  - Route unknown

The following example shows a sample configuration of a VRRP policy for the 7450 ESS:

```
A:SR2>config>vrrp>policy# info

 delta-in-use-limit 50
 priority-event
 port-down 4/1/2
 hold-set 43200
 priority 100 delta
 exit
 port-down 4/1/3
 priority 200 explicit
 exit
 lag-port-down 1
 number-down 3
 priority 50 explicit
 exit
 exit
 host-unreachable 10.10.24.4
 drop-count 25
 exit
 route-unknown 10.10.0.0/32
 priority 50 delta
 exit
 exit

```

The following example shows a sample configuration of a VRRP policy for the 7750 SR and 7950 XRS:

```
A:SR2>config>vrrp>policy# info

 delta-in-use-limit 50
 priority-event
 port-down 4/1/2
 hold-set 43200
 priority 100 delta
 exit

```



```

exit
port-down 4/1/3
 priority 200 explicit
exit
lag-port-down 1
 number-down 3
 priority 50 explicit
exit
exit
host-unreachable 10.10.24.4
 drop-count 25
exit
route-unknown 10.10.0.0/32
 priority 50 delta
 protocol bgp
exit
exit

```

### 3.7.2.2 VRRP IES Service Parameters

VRRP parameters are configured within an IES service with two contexts: owner or non-owner. The status is specified when the VRRP configuration is created. When configured as owner, the virtual router instance owns the backup IP addresses. All other virtual router instances participating in this message domain must have the same VRID configured and cannot be configured as owner.

For IPv4, up to four virtual router IDs can be configured on an IES service interface. Each virtual router instance can manage up to 16 backup IP addresses. For IPv6, only one virtual router instance can be configured on an IES service interface.

VRRP parameters configured within an IES service must include the following:

- VRID
- Backup IP addresses

The following example shows a sample IES service owner and non-owner VRRP configuration:

```

A:SR2>config>service>ies# info

interface "tuesday" create
address 10.10.36.2/24
sap 7/1/1.2.2 create
vrrp 19 owner
 backup 10.10.36.2
 authentication-key "testabc"
exit
exit
interface "testing" create

```

```

 address 10.10.10.16/24
 sap 1/1/55:0 create
 vrrp 12
 backup 10.10.10.15
 policy 1
 authentication-key "testabc"
 exit
 exit
 no shutdown

A:SR2>config>service>ies#

```

### 3.7.2.2.1 Configure VRRP for IPv6

The following example shows a VRRP for IPV6 configuration and applies to the 7750 SR and 7950 XRS. The interface must be configured first.

```

*A:nlt7750-3>config>router>router-advert# info

 interface "DSC-101-Application"
 use-virtual-mac
 no shutdown
 exit
...

*A:nlt7750-3>config>router>router-advert#

*A:nlt7750-3>config>service>ies# info

 description "VLAN 921 for DSC-101 Application"
 interface "DSC-101-Application" create
 address 10.152.2.220/28
 vrrp 217
 backup 10.152.2.222
 priority 254
 ping-reply
 exit
 ipv6
 address 2001:db8:D68F:1:221::FFFD/64
 link-local-address fe80::d68f:1:221:ffff dad-disable
 vrrp 219
 backup fe80::d68f:1:221:ffff
 priority 254
 ping-reply
 exit
 exit
 sap ccag-1.a:921 create
 description "cross connect to VPLS 921"
 exit
 exit
 no shutdown

*A:nlt7750-3>config>service>ies#

```

### 3.7.2.3 VRRP Router Interface Parameters

VRRP parameters are configured on a router interface with two contexts: owner or non-owner. The status is specified when the VRRP configuration is created. When configured as owner, the virtual router instance owns the backed up IP addresses. All other virtual router instances participating in this message domain must have the same VRID configured and cannot be configured as owner.

For IPv4, up to four virtual router IDs can be configured on a router interface. Each virtual router instance can manage up to 16 backup IP addresses. For IPv6, only one virtual router instance can be configured on a router interface.

VRRP parameters configured on a router interface must include the following:

- VRID
- Backup IP addresses

The following example shows a sample router interface owner and non-owner VRRP configuration:

```
A:SR4>config>router# info
#-----
echo "IP Configuration "
#-----
 interface "system"
 address 10.10.0.4/32
 exit
 interface "test1"
 address 10.10.14.1/24
 secondary 10.10.16.1/24
 secondary 10.10.17.1/24
 secondary 10.10.18.1/24
 exit
 interface "test2"
 address 10.10.10.23/24
 vrrp 1 owner
 backup 10.10.10.23
 authentication-key "testabc"
 exit
 exit
#-----
A:SR4>config>router#
```

## 3.7.3 Common Configuration Tasks

This section provides a brief overview of the tasks that must be performed to configure VRRP and provides the CLI commands.

VRRP parameters are defined under a service interface or a router interface context. An IP address must be assigned to each IP interface. Only one IP address can be associated with an IP interface but several secondary IP addresses also be associated.

Owner and non-owner configurations must include the following parameters:

- All participating routers in a VRRP instance must be configured with the same VRID.
- All participating non-owner routers can specify up to 16 backup IP addresses (IP addresses that the master is representing). The owner configuration must include at least one backup IP address.
- For IPv6, all participating routers must be configured with the same link-local backup address (the one configured for the owner instance).

Other owner and non-owner configurations include the following optional commands:

- authentication-key
- MAC
- message-interval

In addition to the common parameters, the following non-owner commands can be configured:

- master-int-inherit
- priority
- policy
- ping-reply
- preempt
- telnet-reply
- ssh-reply (IPv4 only)
- [no] shutdown

### 3.7.3.1 Creating Interface Parameters

If you have multiple subnets configured on an Ethernet interface, you can configure VRRP on each subnet.

The following displays an IP interface configuration example:

```
A:SR1>config>router# info
#-----
```

```

echo "IP Configuration "
#-----
 interface "system"
 address 10.10.0.1/32
 exit
 interface "testA"
 address 10.123.123.123/24
 exit
 interface "testB"
 address 10.10.14.1/24
 secondary 10.10.16.1/24
 secondary 10.10.17.1/24
 secondary 10.10.18.1/24
 exit
 router-id 10.10.0.1
#-----
A:SR1>config>router#

```

## 3.7.4 Configuring VRRP Policy Components

The following displays a VRRP policy configuration example:

```

A:SR1>config>vrrp# info

 policy 1
 delta-in-use-limit 50
 priority-event
 port-down 1/1/2
 hold-set 43200
 priority 100 delta
 exit
 route-unknown 0.0.0.0/0
 protocol isis
 exit
 exit
exit

A:SR1>config>vrrp#

```

### 3.7.4.1 Configuring Service VRRP Parameters

VRRP parameters can be configured on an interface in a service to provide virtual default router support, which allows traffic to be routed without relying on a single router in case of failure. VRRP can be configured in the following two ways.

### 3.7.4.1.1 Non-Owner VRRP Example

The following displays a basic non-owner VRRP configuration example:

```
A:SR2>config>service>ies# info

...
 interface "testing" create
 address 10.10.10.16/24
 sap 1/1/55:0 create
 vrrp 12
 backup 10.10.10.15
 policy 1
 authentication-key "testabc"
 exit
 exit
 no shutdown

A:SR2>config>service>ies#
```

### 3.7.4.1.2 Owner Service VRRP

The following displays an owner service VRRP configuration example:

```
A:SR4>config>router# info
#-----
echo "IP Configuration "
#-----
...
 interface "test2"
 address 10.10.10.23/24
 vrrp 1 owner
 backup 10.10.10.23
 authentication-key "testabc"
 exit
 exit
#-----
A:SR4>config>router#
```

## 3.7.4.2 Configuring Router Interface VRRP Parameters

VRRP parameters can be configured on an interface in an interface to provide virtual default router support, which allows traffic to be routed without relying on a single router in case of failure. VRRP can be configured in following two ways.

### 3.7.4.2.1 Router Interface VRRP Non-Owner

The following displays a router interface non-owner VRRP configuration example:

```
A:SR2>config># info
#-----
 interface "if-test"
 address 10.20.30.40/24
 secondary 10.10.50.1/24
 secondary 10.10.60.1/24
 secondary 10.10.70.1/24
 vrrp 1
 backup 10.10.50.2
 backup 10.10.60.2
 backup 10.10.70.2
 backup 10.20.30.41
 ping-reply
 telnet-reply
 authentication-key "testabc"
 exit
 exit
#-----
A:SR2>config>#
```

### 3.7.4.2.2 Router Interface VRRP Owner

The following displays a router interface owner VRRP configuration example:

```
A:SR2>config>router# info
#-----
 interface "vrrpowner"
 address 10.10.10.23/24
 vrrp 1 owner
 backup 10.10.10.23
 authentication-key "testabc"
 exit
 exit
#-----
A:SR2>config>router#
```

## 3.8 VRRP Configuration Management Tasks

This section describes VRRP configuration management tasks:

### 3.8.1 Modifying a VRRP Policy

To access a specific VRRP policy, you must specify the policy ID. To display a list of VRRP policies, use the `show vrrp policy` command.

The following example shows the modified VRRP policy configuration:

```
A:SR2>config>vrrp>policy# info

 delta-in-use-limit 50
 priority-event
 port-down 1/1/2
 hold-set 43200
 priority 100 delta
 exit
 port-down 1/1/3
 priority 200 explicit
 exit
 host-unreachable 10.10.24.4
 drop-count 25
 exit
 exit

A:SR2>config>vrrp>policy#
```

#### 3.8.1.1 Deleting a VRRP Policy

Policies are only applied to non-owner VRRP instances. A VRRP policy cannot be deleted if it is applied to an interface or to an IES service. Each instance in which the policy is applied must be deleted.

The Applied column in the following example shows whether the VRRP policies are applied to an entity.

```
A:SR2#
=====
VRRP Policies
=====
```

| Policy Id | Current Priority & Effect | Current Explicit | Current Delta Sum | Delta Limit | Applied |
|-----------|---------------------------|------------------|-------------------|-------------|---------|
| 1         | 200 Explicit              | 200              | 100               | 50          | Yes     |
| 15        | 254                       | None             | None              | 1           | No      |



```

32 100 None None 1 No
=====
A:SR2#

```

## 3.8.2 Modifying Service and Interface VRRP Parameters

### 3.8.2.1 Modifying Non-Owner Parameters

After a VRRP instance is created as non-owner, it cannot be modified to the owner state. The VRID must be deleted, then recreated with the owner keyword, to invoke IP address ownership.

### 3.8.2.2 Modifying Owner Parameters

After a VRRP instance is created as owner, it cannot be modified to the non-owner state. The VRID must be deleted, then recreated without the owner keyword, to remove IP address ownership.

Entering the owner keyword is optional when entering the VRID for modification purposes.

### 3.8.2.3 Deleting VRRP from an Interface or Service

The VRID does not need to be shutdown to remove the virtual router instance from an interface or service.

**Example:**

```

config>router#interface
config>router# interface if-test
config>router>if# shutdown
config>router>if# exit
config>router# no interface if-test
config>router#

```

The following example shows the command usage to delete a VRRP instance from an interface or IES service:

**Example:**

```

config>service#ies 10
config>service>ies# interface "test"
config>service>ies>if# vrrp 1

```

---

```
config>service>ies>if>vrrp# shutdown
config>service>ies>if>vrrp# exit
config>service>ies>if# no vrrp 1
config>service>ies>if# exit all
```

## 3.9 VRRP Configuration Command Reference

- [Command Hierarchies](#)
- [Command Descriptions](#)

### 3.9.1 Command Hierarchies

- [IPv4 Interface VRRP Commands](#)
- [IPv6 Interface VRRP Commands](#)
- [Priority Control Event Policy Commands](#)

#### 3.9.1.1 IPv4 Interface VRRP Commands

```

config
 — router
 — [no] interface interface-name
 — vrrp virtual-router-id [owner] [passive]
 — no vrrp virtual-router-id
 — authentication-key {authentication-key | hash-key} [{hash | hash2}]
 — no authentication-key
 — [no] backup ip-address
 — [no] bfd-enable interface interface-name dst-ip ip-address
 — [no] bfd-enable interface interface-name dst-ip ip-address name
 name
 — [no] bfd-enable svc-id interface interface-name dst-ip ip-address
 — init-delay seconds
 — no init-delay
 — mac mac-address
 — no mac
 — [no] master-int-inherit
 — message-interval [{seconds] [milliseconds milliseconds]}
 — no message-interval
 — oper-group group-name
 — no oper-group
 — [no] ping-reply
 — policy vrrp-policy-id
 — no policy
 — [no] preempt
 — priority priority
 — no priority
 — [no] shutdown
 — [no] ssh-reply
 — [no] standby-forwarding
 — [no] telnet-reply

```

---

— [no] **traceroute-reply**

VRRP commands are applicable to router interfaces, IES interfaces and VPRN. The **authentication-key**, **bfd-enable**, and **ssh-reply** commands are applicable only to IPv4 contexts, not IPv6.

### 3.9.1.2 IPv6 Interface VRRP Commands

The IPv6 interface commands only apply to the 7750 SR and 7950 XRS.

```

config
— router [router-name]
 — [no] interface interface-name
 — [no] ipv6
 — vrrp virtual-router-id [owner] [passive]
 — no vrrp virtual-router-id
 — [no] backup ipv6-address
 — [no] bfd-enable interface interface-name dst-ip ip-address
 — [no] bfd-enable interface interface-name dst-ip ip-address
 name name
 — [no] bfd-enable svc-id interface interface-name dst-ip ip-
 address
 — init-delay seconds
 — no init-delay
 — mac mac-address
 — no mac
 — [no] master-int-inherit
 — message-interval {[seconds] [milliseconds milliseconds]}
 — no message-interval
 — oper-group group-name
 — [no] ping-reply
 — policy vrrp-policy-id
 — no policy
 — [no] preempt
 — priority priority
 — no priority
 — [no] shutdown
 — [no] standby-forwarding
 — [no] telnet-reply
 — [no] traceroute-reply

```

### 3.9.1.3 Priority Control Event Policy Commands

```

config
— vrrp
 — policy policy-id context context-value
 — policy policy-id context name name

```

- 
- [no] **policy** *policy-id*
    - **delta-in-use-limit** *limit*
    - **no delta-in-use-limit**
    - **description** *description string*
    - **no description**
  - [no] **priority-event**
    - [no] **host-unreachable** *ip-address*
    - [no] **host-unreachable** *ipv6-address*
      - **drop-count** *count*
      - **no drop-count**
      - **hold-clear** *seconds*
      - **no hold-clear**
      - **hold-set** *seconds*
      - **no hold-set**
      - **interval** *seconds*
      - **no interval**
      - **padding-size** *size*
      - **no padding-size**
      - **priority** *priority-level* [{**delta** | **explicit**}]
      - **no priority**
      - **timeout** *seconds*
      - **no timeout**
  - [no] **lag-port-down** *lag-id*
    - **hold-clear** *seconds*
    - **no hold-clear**
    - **hold-set** *seconds*
    - **no hold-set**
    - [no] **number-down** *number-of-lag-ports-down*
      - **priority** *priority-level* [{**delta** | **explicit**}]
      - **no priority**
    - [no] **weight-down** *lag-ports-down-weight*
  - [no] **mc-ipsec-non-forwarding** *tunnel-grp-id*
    - **hold-clear** *seconds*
    - **no hold-clear**
    - **hold-set** *seconds*
    - **no hold-set**
    - **priority** *priority-level* **explicit**
    - **no priority**
  - [no] **port-down** *port-id*
    - **hold-clear** *seconds*
    - **no hold-clear**
    - **hold-set** *seconds*
    - **no hold-set**
    - **priority** *priority-level* [{**delta** | **explicit**}]
    - **no priority**
  - [no] **route-unknown** [{*ip-prefix/mask* | *ipv6-address/prefix-length*}]
    - **hold-clear** *seconds*
    - **no hold-clear**
    - **hold-set** *seconds*
    - **no hold-set**
    - **less-specific** [**allow-default**]
    - **no less-specific**
    - [no] **next-hop** *ip-address*
    - **priority** *priority-level* [{**delta** | **explicit**}]

- no **priority**
- **protocol** *protocol*
- no **protocol** [*protocol*]
- [no] **shutdown**

### 3.9.2 Command Descriptions

- [Interface Configuration Commands](#)
- [Priority Control Event Policy Commands](#)

#### 3.9.2.1 Interface Configuration Commands

vrrp

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>vrrp</b> <i>virtual-router-id</i> [ <b>owner</b> ] [ <b>passive</b> ]<br><b>no vrrp</b> <i>virtual-router-id</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>if<br>config>router>if>ipv6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command creates the context to configure a VRRP virtual router instance. A virtual router is defined by its virtual router identifier (VRID) and a set of IP addresses.</p> <p>The optional <b>owner</b> keyword indicates that the <b>owner</b> controls the IP address of the virtual router and is responsible for forwarding packets sent to this IP address. The <b>owner</b> assumes the role of the master virtual router.</p> <p>All other virtual router instances participating in this message domain must have the same <i>vrid</i> configured and cannot be configured as <b>owner</b>. Once created, the <b>owner</b> keyword is optional when entering the <i>vrid</i> for configuration purposes.</p> <p>A <i>vrid</i> is internally associated with the IP interface. This allows the <i>vrid</i> to be used on multiple IP interfaces while representing different virtual router instances.</p> <p>For IPv4, up to four VRRP VRID nodes can be configured on a router interface. Each virtual router instance can manage up to 16 backup IP addresses. For IPv6, only one VRID can be configured on a router interface.</p> <p>The optional <b>passive</b> keyword indicates that a <i>vrid</i> can be configured as <b>passive</b>, in which case, the VRRP advertisement messages are suppressed on transmission and reception, and all routers configured with the same <i>vrid</i> become master. Passive <i>VRIDs</i> can exceed the limit of four VRRP VRID nodes on a router interface.</p> |

The **no** form of the command removes the specified *vrid* from the IP interface. This terminates VRRP participation and deletes all references to the *vrid* in conjunction with the IP interface. The *vrid* does not need to be shut down to remove the virtual router instance.

- Default**      no vrrp — No VRRP virtual router instance is associated with the IP interface.
- Special Cases**      **Virtual Router Instance Owner IP Address Conditions** — The virtual router instance **owner** can be created prior to assigning the parent IP interface primary or secondary IP addresses. In this case, the virtual router instance is not associated with an IP address. The operational state of the virtual router instance is down.
- VRRP Owner Command Exclusions** — By specifying the VRRP *vrid* as **owner**, the following commands are no longer available:
- **vrrp priority** — The virtual router instance **owner** is hard-coded with a **priority** value of 255 and cannot be changed.
  - **vrrp master-int-inherit** — Owner virtual router instances do not accept VRRP advertisement messages; the advertisement interval field is not evaluated and cannot be inherited.
  - **ping-reply**, **telnet-reply** and **ssh-reply** — The **owner** virtual router instance always allows Ping, Telnet and SSH if the management and security parameters are configured to accept them on the parent IP interface.
  - **vrrp shutdown** — The **owner** virtual router instance cannot be shut down on the **vrrp** node. If this was allowed, VRRP messages would not be sent, but the parent IP interface address would continue to respond to ARPs and forward IP packets. Another virtual router instance may detect the missing master due to the termination of VRRP advertisement messages and become master. This would result in two routers responding to ARP requests for the same IP addresses. To shut down the **owner** virtual router instance, use the **shutdown** command in the parent IP interface context. This will prevent VRRP participation, IP ARP reply and IP forwarding. To continue parent IP interface ARP reply and forwarding without VRRP participation, remove the **vrrp vrid** instance.
  - **traceroute-reply**
- VRRP Passive Command Exclusions** — By specifying the VRRP *vrid* as **passive**, the following commands related to the master election and processing of VRRP advertisement messages are no longer available:
- **vrrp priority**
  - **policy**
  - **preempt**
  - **master-int-inherit**
  - **standby-forwarding**
  - **int-delay**
  - **message-interval**
  - **authentication-key**
  - **bfd-enable**

---

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>virtual-router-id</i> — The virtual router ID for the IP interface expressed as a decimal integer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Values</b>     | 1 to 255                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>owner</b>      | Identifies this virtual router instance as owning the virtual router IP addresses. If the <b>owner</b> keyword is not specified at the time of <i>vrid</i> creation, the <b>vrrp backup</b> commands must be specified to define the virtual router IP addresses. The <b>owner</b> keyword is not required when entering the <i>vrid</i> for editing purposes. When created as <b>owner</b> , a <i>vrid</i> on an IP interface cannot have the <b>owner</b> parameter removed. The <i>vrid</i> must be deleted, and then recreated without the <b>owner</b> keyword, to remove ownership.                                                                                                       |
| <b>passive</b>    | Identifies this virtual router instance as <b>passive</b> , therefore owning the virtual router IP addresses. A <b>passive vrid</b> does not send or receive VRRP advertisement messages and is always in either the <b>master</b> state (if the interface is operationally up), or the <b>init</b> state (if the interface is operationally down). The <b>passive</b> keyword is not required when entering the <i>vrid</i> for editing purposes. When a <i>vrid</i> on an IP interface is created as <b>passive</b> , the parameter cannot be removed from the <i>vrid</i> . The <i>vrid</i> must be deleted, and then recreated without the <b>passive</b> keyword, to remove the parameter. |

## authentication-key

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>authentication-key</b> { <i>authentication-key</i>   <i>hash-key</i> } [{ <b>hash</b>   <b>hash2</b> }]<br><b>no authentication-key</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>router>if>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command sets the simple text authentication key used to generate master VRRP advertisement messages and validates VRRP advertisements.</p> <p>If simple text password authentication is not required, the <b>authentication-key</b> command is not required.</p> <p>The command is configurable in both non-owner and owner <b>vrrp</b> nodal contexts.</p> <p>The <i>key</i> parameter identifies the simple text password to be used when VRRP Authentication Type 1 is enabled on the virtual router instance. Type 1 uses an eight octet long string that is inserted into all transmitted VRRP advertisement messages and is compared against all received VRRP advertisement messages. The authentication data fields are used to transmit the <i>key</i>.</p> <p>The <i>key</i> string is case sensitive and is left justified in the VRRP advertisement message authentication data fields. The first field contains the first four characters with the first octet (starting with IETF RFC bit position 0) containing the first character. The second field similarly holds the fifth through eighth characters. Any unspecified portion of the authentication data field is padded with a 0 value in the corresponding octet.</p> |



If the command is re-executed with a different password key defined, the new key is used immediately.

The **authentication-key** command can be executed at anytime.

To change the current in-use password key on multiple virtual router instances:

Identify the current master.

1. Shutdown the virtual router instance on all backups.
2. Execute the **authentication-key** command on the master to change the password key.
3. Execute the **authentication-key** command and **no shutdown** command on each backup.

The **no** form of the command reverts to the default value.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no authentication-key — The authentication key value is the null string.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b> | <p><i>authentication-key</i> — The authentication key. Allowed values are any string up to 8 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, etc.), the entire string must be enclosed within double quotes.</p> <p><i>hash-key</i> — The hash key. The key can be any combination of ASCII characters up to 22 (hash-key1) or 121 (hash-key2) characters in length (encrypted). If spaces are used in the string, enclose the entire string in quotation marks (" ").</p> <p>This is useful when a user must configure the parameter, but for security purposes, the actual unencrypted key value is not provided.</p> <p><b>hash</b> — Specifies the key is entered in an encrypted form. If the <b>hash</b> or <b>hash2</b> parameter is not used, the key is assumed to be in an unencrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the <b>hash</b> or <b>hash2</b> parameter specified</p> <p><b>hash2</b> — Specifies the key is entered in a more complex encrypted form that involves more variables than the key value alone, meaning that the <b>hash2</b> encrypted variable cannot be copied and pasted. If the <b>hash</b> or <b>hash2</b> parameter is not used, the key is assumed to be in an unencrypted, clear text form. For security, all keys are stored in encrypted form in the configuration file with the <b>hash</b> or <b>hash2</b> parameter specified.</p> |

## backup

|                    |                                                                                                                                                                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] backup</b> <i>ip-address</i>                                                                                                                                                                                                                   |
| <b>Context</b>     | config>router>if>vrrp                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command associates router IP addresses with the parental IP interface IP addresses.</p> <p>The <b>backup</b> command has two distinct functions when used in an <b>owner</b> or a <b>non-owner</b> context of the virtual router instance.</p> |

Non-owner virtual router instances actually create a routable IP interface address that is operationally dependent on the virtual router instance mode (master or backup). The **backup** command in **owner** virtual router instances does not create a routable IP interface address; it simply defines the existing parental IP interface IP addresses that are advertised by the virtual router instance.

For **owner** virtual router instances, the **backup** command defines the IP addresses that are advertised within VRRP advertisement messages. This communicates the IP addresses that the master is representing to backup virtual routers receiving the messages. Advertising a correct list is important. The specified *ip-addr* must be equal to one of the existing parental IP interface IP addresses (primary or secondary) or the **backup** command will fail.

For non-owner virtual router instances, the **backup** command actually creates an IP interface IP address used for routing IP packets and communicating with the system when the access commands are defined (**ping-reply**, **telnet-reply**, and **ssh-reply**). The specified *ip-addr* must be an IP address that is within one of the parental IP interface local subnets created with the **address** or **secondary** commands. If a local subnet does not exist that includes the specified *ip-addr* or if *ip-addr* is the same IP address as the parental IP interface IP address, the **backup** command will fail.

The new interface IP address created with the **backup** command assumes the mask and parameters of the corresponding parent IP interface IP address. The *ip-addr* is only active when the virtual router instance is operating in the master state. When not operating as master, the virtual router instance acts as if it is operationally down. It will not respond to ARP requests to *ip-addr*, nor will it route packets received with its *vrid* derived source MAC address. A non-master virtual router instance always silently discards packets destined to *ip-addr*. A single virtual router instance may only have a single virtual router IP address from a given parental local subnet. Multiple virtual router instances can define a virtual router IP address from the same local subnet as long as each is a different IP address.

In IPv4, up to sixteen **backup ip-addr** commands can be executed within the same virtual router instance. Executing **backup** multiple times with the same *ip-addr* results in no operation performed and no error generated. At least one successful **backup ip-addr** command must be executed before the virtual router instance can enter the operational state.

When operating as (non-owner) master, the default functionality associated with *ip-addr* is ARP response to ARP requests to *ip-addr*, routing of packets destined to the virtual router instance source MAC address and silently discarding packets destined to *ip-addr*. Enabling the non-owner-access parameters selectively allows ping, Telnet and SSH connectivity to *ip-addr* when the virtual router instance is operating as master.

The **no** form of the command removes the specified virtual router IP address from the virtual router instance. For non-owner virtual router instances, this causes all routing and local access associated with the *ip-addr* to cease. For **owner** virtual router instances, the **no backup** command only removes *ip-addr* from the list of advertised IP addresses. If the last *ip-addr* is removed from the virtual router instance, the virtual router instance will enter the operationally down state

**Default**      no backup — No virtual router IP address is assigned.

**Special Cases**     **Assigning the Virtual Router ID IP Address** — Once the *vrid* is created on the parent IP interface, IP addresses need to be assigned to the virtual router instance. If the *vrid* was created with the keyword **owner**, the virtual router instance IP addresses must have one or more of the parent IP interface defined IP addresses (primary and secondary). For non-owner virtual router instances, the virtual router IP addresses each must be within one of the parental IP interface IP address defined local subnets. For both **owner** and non-owner virtual router instances, the virtual router IP addresses must be explicitly defined using the **backup ip-addr** command.

**Virtual Router Instance IP Address Assignment Conditions** — The RFC does not specify that the assigned IP addresses to the virtual router instance must be in the same subnet as the parent IP interface primary IP address or secondary IP addresses. The only requirement is that all virtual routers participating in the same virtual router instance have the same virtual router IP addresses assigned. To avoid confusion, the assigned virtual router IP addresses must be in a local subnet of one of the parent IP interfaces IP addresses. For **owner** virtual router instances the assigned virtual router IP address must be the same as one of the parental IP interface primary or secondary IP addresses.

The following rules apply when adding, changing, or removing parental and virtual router IP addresses:

**Owner Virtual Router IP Address Parental Association** — When an IP address is assigned to an **owner** virtual router instance, it must be associated with one of the parental IP interface-assigned IP addresses. The virtual router IP address must be equal to the primary or one of the secondary IP addresses within the parental IP interface.

**Table 42     Example - Owner Virtual Router Instance**

|                              |                                  |                                                    |
|------------------------------|----------------------------------|----------------------------------------------------|
| Parent IP addresses:         | 10.10.10.10/24<br>11.11.11.11/24 |                                                    |
| Virtual router IP addresses: | 10.10.10.11                      | Invalid (not equal to parent IP address)           |
|                              | 10.10.10.10                      | Associated (same as parent IP address 10.10.10.10) |
|                              | 10.10.11.11                      | Invalid (not equal to parent IP address)           |
|                              | 11.11.11.254                     | Invalid (not equal to parent IP address)           |
|                              | 11.11.11.255                     | Invalid (not equal to parent IP address)           |

**Non-Owner Virtual Router IP Address Parental Association** — When an IP address is assigned to a non-owner virtual router instance, it must be associated with one of the parental IP interface assigned IP addresses. The virtual router IP address must be a valid IP address within one of the parental IP interfaces local subnet. Local subnets are created by the primary or secondary IP addresses in conjunction with the IP addresses mask. If the defined virtual router IP address is equal to the associated subnet's broadcast address, it is invalid. Virtual router IP addresses for non-owner virtual router instances that are equal to a parental IP interface IP address are also invalid.

The same virtual router IP address may not be assigned to two separate virtual router instances. If the virtual router IP address already exists on another virtual router instance, the virtual router IP address assignment will fail.

**Table 43**      **Example - Non-Owner Virtual Router Instance**

|                              |                                  |                                               |
|------------------------------|----------------------------------|-----------------------------------------------|
| Parent IP addresses:         | 10.10.10.10/24<br>11.11.11.11/24 |                                               |
| Virtual router IP addresses: | 10.10.10.11                      | Associated with 10.10.10.10 (in subnet)       |
|                              | 10.10.10.10                      | Invalid (same as parent IP address)           |
|                              | 10.10.11.11                      | Invalid (outside of all Parent IP subnets)    |
|                              | 11.11.11.254                     | Associated with 11.11.11.11 (in subnet)       |
|                              | 11.11.11.255                     | Invalid (broadcast address of 11.11.11.11/24) |

**Virtual Router IP Address Assignment without Parent IP Address** — When assigning an IP address to a virtual router instance, an associated IP address (see [backup](#) and [backup](#)) on the parental IP interface must already exist. If an associated IP address on the parental IP interface is not configured, the virtual router IP address assignment fails.

**Parent Primary IP Address Changed** — When a virtual router IP address is set and the associated parent IP interface IP address is changed, the new parent IP interface IP address is evaluated to ensure it meets the association rules defined in [backup](#) or [backup](#). If the association check fails, the parental IP address change is not allowed. If the parental IP address change fails, the previously configured IP address definition remains in effect.

Only the primary parent IP address can be changed. Secondary addresses must be removed before the new IP address can be added. [backup](#) explains IP address removal conditions.

**Parent Primary or Secondary IP Address Removal** — When a virtual router IP address is successfully set, but removing the associated parent IP interface IP address is attempted and fails. All virtual router IP addresses associated with the parental IP interface IP address must be deleted prior to removing the parental IP address. This includes virtual router IP address associations from multiple virtual router instances on the IP interface.

**Parameters** *ip-address* — The virtual router IP address expressed in dotted decimal notation. The IP virtual router IP address must be in the same subnet of the parental IP interface IP address or equal to one of the primary or secondary IP addresses for **owner** virtual router instances.

**Values** 1.0.0.1 to 223.255.255.254

## backup

**Syntax** **[no] backup** *ipv6-address*

**Context** config>router>if>ipv6>vrrp

**Description** This command associates router IPv6 addresses with the parental IP interface IP addresses.

The **backup** command has two distinct functions when used in an **owner** or a **non-owner** context of the virtual router instance.

Non-owner virtual router instances actually create a routable IP interface address that is operationally dependent on the virtual router instance mode (master or backup). The **backup** command in **owner** virtual router instances does not create a routable IP interface address; it simply defines the existing parental IP interface IP addresses that are advertised by the virtual router instance.

For **owner** virtual router instances, the **backup** command defines the IP addresses that are advertised within VRRP advertisement messages. This communicates the IP addresses that the master is representing to backup virtual routers receiving the messages. Advertising a correct list is important. The specified *ipv6-addr* must be equal to one of the existing parental IP interface IP addresses (link-local or global) or the **backup** command will fail.

For non-owner virtual router instances, the **backup** command actually creates an IP interface IP address used for routing IP packets and communicating with the system when the access commands are defined (**ping-reply**, **telnet-reply**, and **ssh-reply**). The specified *ipv6-addr* must be an IP address that is within one of the parental IP interface local subnets created with the **link-local-address** or **address** commands. If a local subnet does not exist that includes the specified *ipv6-addr* or if *ipv6-addr* is the same IP address as the parental IP interface IP address, the **backup** command will fail.

The new interface IP address created with the **backup** command assumes the mask and parameters of the corresponding parent IP interface IP address. The *ipv6-addr* is only active when the virtual router instance is operating in the master state. For IPv6 VRRP, the parental interface's IP address that is in the same subnet as the backup address must be manually-configured, non EUI-64 and configured to be in the preferred state.

When not operating as master, the virtual router instance acts as if it is operationally down. It will not respond to Neighbor Solicitation (NS) requests to *ipv6-addr*, nor will it route packets received with its *vrid* derived source MAC address. A non-master virtual router instance always silently discards packets destined to *ipv6-addr*.

IPv6 allows the configuration of a link-local IPv6 address and multiple global IPv6 addresses on an interface. For each of these configured subnets, a virtual router IP address can be configured. Each IPv6 enabled device on a particular IPv6 subnet dynamically learns the connected IPv6 routers and correlated subnets in addition to the IPv6 default gateway using IPv6 neighbor discovery protocol (RFC4861). This protocol behavior is revised from IPv4 where the default gateway is manually configured or derived from supporting protocols (for example, DHCP). During the IPv6 neighbor discovery process, VRRP enabled routers will use backup IPv6 addresses and correlated derived virtual MAC addresses. Multiple virtual router instances can define a virtual router IP address from the same local subnet as long as each is a different IP address.

Executing **backup** multiple times with the same *ipv6-addr* results in no operation performed and no error generated. At least one successful **backup** *ipv6-addr* command must be executed before the virtual router instance can enter the operational state.

When operating as (non-owner) master, the default functionality associated with *ipv6-addr* results in the IPv6 Neighbor Advertisement response to IPv6 Neighbor Solicitation requests to *ip-addr*, routing of packets destined to the virtual router instance source MAC address, and silently discarding packets destined to *ipv6-addr*. An IPv6 virtual router instance can enter the operational state only if one of the configured backup addresses is a link-local address and the router advertisement of the interface is configured to use the virtual MAC address. Enabling the non-owner-access parameters selectively allows ping, Telnet, and traceroute connectivity to *ipv6-addr* when the virtual router instance is operating as master.

The **no** form of the command removes the specified virtual router IP address from the virtual router instance. For non-owner virtual router instances, this causes all routing and local access associated with the *ipv6-addr* to cease. For **owner** virtual router instances, the **no backup** command only removes *ipv6-addr* from the list of advertised IP addresses. If the last *ipv6-addr* or the *link-local* address is removed from the virtual router instance, the virtual router instance will enter the operationally down state.

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>       | no backup — No virtual router IP address is assigned.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Special Cases</b> | <p><b>Assigning the Virtual Router ID Address</b> — Once the <i>vrid</i> is created on the parent IP interface, IP addresses need to be assigned to the virtual router instance. If the <i>vrid</i> was created with the keyword <b>owner</b>, the virtual router instance IP addresses must have one or more of the parent IP interface defined IP addresses. For non-owner virtual router instances, the virtual router IP addresses each must be within one of the parental IP interface IP address defined local subnets. For both <b>owner</b> and non-owner virtual router instances, the virtual router IP addresses must be explicitly defined using the <b>backup</b> <i>ipv6-addr</i> command.</p> <p>The following rules apply when adding, changing, or removing parental and virtual router IP addresses:</p> |

**Owner Virtual Router IP Address Parental Association** — When an IP address is assigned to an **owner** virtual router instance, it must be associated with one of the parental IP interface-assigned IP addresses.

**Table 44**      **Example - Owner Virtual Router Instance**

|                             |                                  |                                          |
|-----------------------------|----------------------------------|------------------------------------------|
| Parent IP addresses         | 2001:db8:1::2/64<br>fe80::1:2/64 |                                          |
| Virtual router IP addresses | 2001:db8:1::23                   | Invalid (not equal to parent IP address) |
|                             | 2001:db8:1::2                    | Associated (same as parent IP address )  |
|                             | 2001:db8:2::23                   | Invalid (not equal to parent IP address) |

**Non-Owner Virtual Router IP Address Parental Association** — When an IP address is assigned to a non-owner virtual router instance, it must be associated with one of the parental IP interface assigned IP addresses. The virtual router IP address must be a valid IP address within one of the parental IP interfaces local subnet. Local subnets are created by the link-local or global IP addresses in conjunction with the IP addresses mask. Virtual router IP addresses for non-owner virtual router instances that are equal to a parental IP interface IP address are also invalid.

The same virtual router IP address may not be assigned to two separate virtual router instances. If the virtual router IP address already exists on another virtual router instance, the virtual router IP address assignment will fail.

One exception to this rule is for the IPv6 link-local address that is configured as a backup address. The same link-local address can be configured in all virtual routers that use the same vrid.

**Table 45**      **Example - Non-Owner Virtual Router Instance**

|                                |                                  |                                            |
|--------------------------------|----------------------------------|--------------------------------------------|
| Parent IP addresses:           | 2001:db8:1::2/64<br>fe80::1:2/64 |                                            |
| Virtual router IPv6 addresses: | 2001:db8:1::23                   | Associated with 2001:db8:1::2 (in subnet)  |
|                                | 2001:db8:1::2                    | Invalid (same as parent IP address)        |
|                                | 2001:db8:2::2                    | Invalid (outside of all Parent IP subnets) |
|                                | fe80::1:23                       | Associated with fe80::1:2 (in subnet)      |

**Virtual Router IP Address Assignment without Parent IP Address** — When assigning an IP address to a virtual router instance, an associated IP address (see [backup](#) and [backup](#)) on the parental IP interface must already exist. If an associated IP address on the parental IP interface is not configured, the virtual router IP address assignment fails.

**Virtual Router IPv6 Address Assignment** — An IPv6 backup address requires that the parental IP address that is in the same subnet as the backup address must be manually configured, non-EUI-64 and configured to be in the preferred state. A configured IPv6 address is manually set in preferred state by using the **dad-disable** command. A configured IPv6 address on an interface with DAD disabled, immediately enters preferred state, without checking for uniqueness on the interface.

**Parameters** *ipv6-address* — The virtual router IP address is represented as eight groups of four hexadecimal digits, each group representing 16 bits (two octets). The groups are separated by colons (:). The IP virtual router IP address must be in the same subnet of the parental IP interface IP address or equal to one of the parent interface addresses for **owner** virtual router instances.

**Values**

*ipv6-address*    x:x:x:x:x:x:x (eight 16-bit pieces)  
                       x:x:x:x:x:x::d.d.d.d  
                       x: [0..FFFF]H  
                       d: [0..255]D

## bfd-enable

**Syntax**    **[no] bfd-enable interface** *interface-name* **dst-ip** *ip-address*  
**[no] bfd-enable interface** *interface-name* **dst-ip** *ip-address* **name** *name*  
**[no] bfd-enable svc-id interface** *interface-name* **dst-ip** *ip-address*

**Context**    config>router>if>vrrp  
               config>router>if>ipv6>vrrp

**Description**    This commands assigns a bidirectional forwarding detect (BFD) session to a specific VRRP/SRRP instance. This BFD sessions provided a heartbeat mechanism that can be used to speed up the transition of the standby VRRP router to an active state. If the associated BFD session fails, the VRRP routers will immediately send a VRRP Advertisement message. In addition, the standby VRRP router(s) will transition to a Master state to speed convergence. The normal VRRP election process will then take place based on the Advertisement messages sent by all VRRP routers.

There can be only one BFD session assigned to any given VRRP/SRRP instance, but there can be multiple SRRP/VRRP sessions using the same BFD session.

The parameters used for the BFD sessions are set by the BFD command under the IP interface.

The **no** form of this command removes BFD from the configuration.

**Parameters**    *interface-name* — Specifies the name of the interface running BFD. The specified interface may not yet be configured with BFD. However, when it is, this virtual router will then initiate the BFD session.



*ip-address* — Specifies the destination address to be used for the BFD session.

*svc-id* — Specifies the service ID of the interface running BFD.

**Values**      *service-id*: 1 to 2147483647  
*svc-name*: 64 characters maximum

## init-delay

|                    |                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>init-delay</b> <i>seconds</i><br><b>no init-delay</b>                                                    |
| <b>Context</b>     | config>router>if>vrrp<br>config>router>if>ipv6>vrrp                                                         |
| <b>Description</b> | This command configures a VRRP initialization delay timer.                                                  |
| <b>Default</b>     | no init-delay                                                                                               |
| <b>Parameters</b>  | <i>seconds</i> — Specifies the initialization delay timer for VRRP, in seconds.<br><b>Values</b> 1 to 65535 |

## mac

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>mac</b> <i>mac-address</i><br><b>no mac</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>router>if>vrrp<br>config>router>if>ipv6>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command sets an explicit MAC address used by the virtual router instance overriding the VRRP default derived from the VRID.</p> <p>Changing the default MAC address is useful when an existing HSRP or other non-VRRP default MAC is in use by the IP hosts using the virtual router IP address. Many hosts do not monitor unessential ARPs and continue to use the cached non-VRRP MAC address after the virtual router becomes master of the host's gateway address.</p> <p>The <b>mac</b> command sets the MAC address used in ARP responses when the virtual router instance is master. Routing of IP packets with <i>mac-address</i> as the destination MAC is also enabled. The <b>mac</b> setting must be the same for all virtual routers participating as a virtual router or indeterminate connectivity by the attached IP hosts will result. All VRRP advertisement messages are transmitted with <i>mac-address</i> as the source MAC.</p> <p>The command can be configured in both non-owner and owner <b>vrrp</b> nodal contexts.</p> |

The **mac** command can be executed at any time and takes effect immediately. When the virtual router MAC on a master virtual router instance changes, a gratuitous ARP is immediately sent with a VRRP advertisement message. If the virtual router instance is disabled or operating as backup, the gratuitous ARP and VRRP advertisement message is not sent.

The **no** form of the command restores the default VRRP MAC address to the virtual router instance.

**Default** no mac — The virtual router instance uses the default VRRP MAC address derived from the VRID.

**Parameters** *mac-address* — The 48-bit MAC address for the virtual router instance in the form *aa:bb:cc:dd:ee:ff* or *aa-bb-cc-dd-ee-ff* where *aa*, *bb*, *cc*, *dd*, *ee* and *ff* are hexadecimal numbers. Allowed values are any non-broadcast, non-multicast MAC, and non-IEEE reserved MAC addresses.

## master-int-inherit

**Syntax** [no] master-int-inherit

**Context** config>router>if>vrrp  
config>router>if>ipv6>vrrp

**Description** This command enables the virtual router instance to inherit the master VRRP router's advertisement interval timer which is used by backup routers to calculate the master down timer.

The **master-int-inherit** command is only available in the non-owner nodal context and is used to allow the current virtual router instance master to dictate the master down timer for all backup virtual routers. The **master-int-inherit** command has no effect when the virtual router instance is operating as master.

If **master-int-inherit** is not enabled, the locally configured **message-interval** must match the master's VRRP advertisement message advertisement interval field value or the message is discarded.

The **no** form of the command restores the default operating condition which requires the locally configured **message-interval** to match the received VRRP advertisement message advertisement interval field value.

**Default** no master-int-inherit — The virtual router instance does not inherit the master VRRP router's advertisement interval timer and uses the locally configured message interval.

## message-interval

**Syntax** message-interval {[seconds] [milliseconds milliseconds]}  
no message-interval

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>router>if>vrrp<br>config>router>if>ipv6>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>This command configures the administrative advertisement message timer used by the master virtual router instance to send VRRP advertisement messages and to derive the master down timer as backup.</p> <p>For an owner virtual router instance, the administrative advertisement timer directly sets the operational advertisement timer and indirectly sets the master down timer for the virtual router instance.</p> <p>Non-owner virtual router instances usage of the <b>message-interval</b> setting is dependent on the state of the virtual router (master or backup) and the state of the <b>master-int-inherit</b> parameter.</p> <ul style="list-style-type: none"> <li>• When a non-owner is operating as master for the virtual router, the configured <b>message-interval</b> is used as the operational advertisement timer similar to an owner virtual router instance. The <b>master-int-inherit</b> command has no effect when operating as master.</li> <li>• When a non-owner is in the backup state with <b>master-int-inherit</b> disabled, the configured <b>message-interval</b> value is used to match the incoming VRRP advertisement message advertisement interval field. If the locally configured message interval does not match the advertisement interval field, the VRRP advertisement is discarded.</li> <li>• When a non-owner is in the backup state with <b>master-int-inherit</b> enabled, the configured <b>message-interval</b> is ignored. The master down timer is indirectly derived from the incoming VRRP advertisement message advertisement interval field value.</li> </ul> <p>VRRP advertisements messages that are fragmented, or contain IP options (IPv4), or contain extension headers (IPv6) require a longer message interval to be configured.</p> <p>The in-use value of the message interval is used to derive the master down timer to be used when the virtual router is operating in backup mode based on the following formula:</p> <p>(3x (in-use message interval) + skew time)</p> <p>The skew time portion is used to slow down virtual routers with relatively low priority values when competing in the master election process.</p> <p>The command is available in both non-owner and owner <b>vrrp</b> nodal contexts.</p> <p>By default, a <b>message-interval</b> of 1 second is used.</p> <p>The <b>no</b> form of the command reverts to the default value.</p> |
| <b>Default</b>     | message-interval 1 — Advertisement timer set to 1 second.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><i>seconds</i> — The number of seconds that will transpire before the advertisement timer expires expressed as a decimal integer.</p> <p><b>Values</b> IPv4: 1 to 255<br/>IPv6: 1 to 40</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

*milliseconds* — Specifies the time interval, in milliseconds, between sending advertisement messages. This parameter is not supported on the 7450 ESS-1 chassis.

**Values** 100 to 900  
IPv6: 10 to 990

## oper-group

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>oper-group</b> <i>group-name</i><br><b>no oper-group</b>                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>router>if>vrrp<br>config>router>if>ipv6>vrrp                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command configures VRRP to associate with an operational group. When associated, VRRP notifies the operational group of its state changes so that other protocols can monitor it to provide a redundancy mechanism. When VRRP is the master router (MR), the operational group is up; the operational group is down for all other VRRP states.</p> <p>The <b>no</b> form of the command removes the association.</p> |
| <b>Default</b>     | no oper-group — No operational group is configured.                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <i>group-name</i> — Specifies the operational group identifier up to 32 characters in length.                                                                                                                                                                                                                                                                                                                                |

## ping-reply

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] ping-reply</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>router>if>vrrp<br>config>router>if>ipv6>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command enables the non-owner master to reply to ICMP echo requests directed at the virtual router instances IP addresses.</p> <p>Non-owner virtual router instances are limited by the VRRP specifications to responding to ARP requests destined to the virtual router IP addresses and routing IP packets not addressed to the virtual router IP addresses. Many network administrators find this limitation frustrating when troubleshooting VRRP connectivity issues.</p> <p>SR OS allows this access limitation to be selectively lifted for certain applications. Ping, Telnet and SSH can be individually enabled or disabled on a per-virtual-router-instance basis.</p> <p>The <b>ping-reply</b> command enables the non-owner master to reply to ICMP echo requests directed at the virtual router instances IP addresses. The Ping request can be received on any routed interface. Ping must not have been disabled at the management security level (either on the parental IP interface or based on the Ping source host address).</p> |

When **ping-reply** is not enabled, ICMP echo requests to non-owner master virtual IP addresses are silently discarded.

Non-owner backup virtual routers never respond to ICMP echo requests regardless of the **ping-reply** setting.

The **ping-reply** command is only available in non-owner **vrrp** nodal context.

By default, ICMP echo requests to the virtual router instance IP addresses are silently discarded.

The **no** form of the command configures discarding all ICMP echo request messages destined to the non-owner virtual router instance IP addresses.

**Default** no ping-reply — ICMP echo requests to the virtual router instance IP addresses are discarded.

## policy

**Syntax** **policy** *vrrp-policy-id*  
**no policy**

**Context** config>router>if>vrrp  
config>router>if>ipv6>vrrp

**Description** This command adds a VRRP priority control policy association with the virtual router instance.

To further augment the virtual router instance base priority, VRRP priority control policies can be used to override or adjust the base priority value depending on events or conditions within the chassis.

The policy can be associated with more than one virtual router instance. The priority events within the policy either override or diminish the base priority set with the **priority** command dynamically affecting the in-use priority. As priority events clear in the policy, the in-use priority can eventually be restored to the base **priority** value.

The **policy** command is only available in the non-owner **vrrp** nodal context. The priority of **owner** virtual router instances is permanently set to 255 and cannot be changed by VRRP priority control policies. For non-owner virtual router instances, if the **policy** command is not executed, the base **priority** is used as the in-use priority.

The **no** form of the command removes existing VRRP priority control policy associations from the virtual router instance. All associations must be removed prior to deleting the policy from the system.

**Default** no policy — No VRRP priority control policy is associated with the virtual router instance.

---

|                   |                                                                                                                                                                              |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>vrrp-policy-id</i> — The policy ID of the VRRP priority control expressed as a decimal integer. The <i>vrrp-policy-id</i> must already exist for the command to function. |
| <b>Values</b>     | 1 to 9999                                                                                                                                                                    |

### preempt

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] preempt</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>router>if>vrrp<br>config>router>if>ipv6>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>The preempt mode value controls whether a specific backup virtual router preempts a lower priority master.</p> <p>When preempt is enabled, the virtual router instance overrides any non-owner master with an "in use" message priority value less than the virtual router instance in-use priority value. If preempt is disabled, the virtual router only becomes master if the master down timer expires before a VRRP advertisement message is received from another virtual router.</p> <p>The IP address owner will always become master when available. Preempt mode cannot be disabled on the owner virtual router.</p> <p>The default value for preempt mode is enabled.</p> |
| <b>Default</b>     | preempt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

### priority

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>priority <i>priority</i></b><br><b>no priority</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>router>if>vrrp<br>config>router>if>ipv6>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command configures the base router priority for the virtual router instance used in the master election process.</p> <p>The priority is the most important parameter set on a non-owner virtual router instance. The priority defines a virtual router's selection order in the master election process. Together, the priority value and the <b>preempt</b> mode allow the virtual router with the best priority to become the master virtual router.</p> <p>The <i>base-priority</i> is used to derive the in-use priority of the virtual router instance as modified by any optional VRRP priority control policy. VRRP priority control policies can be used to either override or adjust the base priority value depending on events or conditions within the chassis.</p> |

The **priority** command is only available in the non-owner **vrrp** nodal context. The priority of **owner** virtual router instances is permanently set to 255 and cannot be changed.

For non-owner virtual router instances, the default base priority value is 100.

The **no** form of the command reverts to the default value.

|                   |                                                                                                                                                                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | priority 100                                                                                                                                                                                                                            |
| <b>Parameters</b> | <i>priority</i> — The base priority used by the virtual router instance expressed as a decimal integer. If no VRRP priority control policy is defined, the <i>base-priority</i> is the in-use priority for the virtual router instance. |
| <b>Values</b>     | 1 to 254                                                                                                                                                                                                                                |

## shutdown

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>        | [no] shutdown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>       | config>router>if>vrrp<br>config>router>if>ipv6>vrrp<br>config>vrrp>policy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b>   | <p>This command administratively disables an entity. When disabled, an entity does not change, reset, or remove any configuration settings or statistics.</p> <p>The operational state of the entity is disabled as well as the operational state of any entities contained within. Many objects must be shut down before they may be deleted.</p> <p>The <b>no</b> form of this command administratively enables an entity.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Default</b>       | no shutdown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Special Cases</b> | <p><b>Non-Owner Virtual Router</b> — Non-owner virtual router instances can be administratively shutdown. This allows the termination of VRRP participation in the virtual router and stops all routing and other access capabilities with regards to the virtual router IP addresses. Shutting down the virtual router instance provides a mechanism to maintain the virtual routers without causing false backup/master state changes.</p> <p>If the <b>shutdown</b> command is executed, no VRRP advertisement messages are generated and all received VRRP advertisement messages are silently discarded with no processing.</p> <p>By default, virtual router instances are created in the <b>no shutdown</b> state.</p> <p>Whenever the administrative state of a virtual router instance transitions, a log message is generated.</p> <p>Whenever the operational state of a virtual router instance transitions, a log message is generated.</p> |

**Owner Virtual Router** — An owner virtual router context does not have a **shutdown** command. To administratively disable an owner virtual router instance, use the **shutdown** command within the parent IP interface node which administratively downs the IP interface.

## ssh-reply

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] ssh-reply</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>router>if>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command enables the non-owner master to reply to SSH requests directed at the virtual router instance IP addresses. This command is only applicable to IPv4.</p> <p>Non-owner virtual router instances are limited by the VRRP specifications to responding to ARP requests destined to the virtual router IP addresses and routing IP packets not addressed to the virtual router IP addresses.</p> <p>This limitation can be disregarded for certain applications. Ping, Telnet and SSH can be individually enabled or disabled on a per-virtual-router-instance basis.</p> <p>The <b>ssh-reply</b> command enables the non-owner master to reply to SSH requests directed at the virtual router instances IP addresses. The SSH request can be received on any routed interface. SSH must not have been disabled at the management security level (either on the parental IP interface or based on the SSH source host address). Correct login and CLI command authentication is still enforced.</p> <p>When <b>ssh-reply</b> is not enabled, SSH requests to non-owner master virtual IP addresses are silently discarded.</p> <p>Non-owner backup virtual routers never respond to SSH requests regardless of the <b>ssh-reply</b> setting.</p> <p>The <b>ssh-reply</b> command is only available in non-owner <b>vrrp</b> nodal context.</p> <p>By default, SSH requests to the virtual router instance IP addresses are silently discarded.</p> <p>The <b>no</b> form of the command discards all SSH request messages destined to the non-owner virtual router instance IP addresses.</p> |
| <b>Default</b>     | no ssh-reply — SSH requests to the virtual router instance IP addresses are discarded.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## standby-forwarding

|                |                                                     |
|----------------|-----------------------------------------------------|
| <b>Syntax</b>  | <b>[no] standby-forwarding</b>                      |
| <b>Context</b> | config>router>if>vrrp<br>config>router>if>ipv6>vrrp |



|                    |                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command specifies whether this VRRP instance allows forwarding packets to a standby router. When disabled, a standby router should not forward traffic sent to virtual router's MAC address. However, the standby router should forward traffic sent to the standby router's real MAC address. When enabled, a standby router should forward all traffic. |
| <b>Default</b>     | no standby-forwarding                                                                                                                                                                                                                                                                                                                                          |

## telnet-reply

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] telnet-reply</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>router>if>vrrp<br>config>router>if>ipv6>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | <p>This command enables the non-owner master to reply to TCP port 23 Telnet requests directed at the virtual router instances' IP addresses.</p> <p>Non-owner virtual router instances are limited by the VRRP specifications to responding to ARP requests destined to the virtual router IP addresses and routing IP packets not addressed to the virtual router IP addresses. Many network administrators find this limitation frustrating when troubleshooting VRRP connectivity issues.</p> <p>This limitation can be disregarded for certain applications. Ping, SSH and Telnet can each be individually enabled or disabled on a per-virtual-router-instance basis.</p> <p>The <b>telnet-reply</b> command enables the non-owner master to reply to Telnet requests directed at the virtual router instances' IP addresses. The Telnet request can be received on any routed interface. Telnet must not have been disabled at the management security level (either on the parental IP interface or based on the Telnet source host address). Correct login and CLI command authentication is still enforced.</p> <p>When <b>telnet-reply</b> is not enabled, Telnet requests to non-owner master virtual IP addresses are silently discarded.</p> <p>Non-owner backup virtual routers never respond to Telnet requests regardless of the <b>telnet-reply</b> setting.</p> <p>The <b>telnet-reply</b> command is only available in non-owner <b>vrrp</b> nodal context.</p> <p>By default, Telnet requests to the virtual router instance IP addresses will be silently discarded.</p> <p>The <b>no</b> form of the command configures discarding all Telnet request messages destined to the non-owner virtual router instance IP addresses.</p> |
| <b>Default</b>     | no telnet-reply — Telnet requests to the virtual router instance IP addresses are discarded.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

---

## traceroute-reply

|                    |                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] traceroute-reply</b>                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>router>if>vrrp<br>config>router>if>ipv6>vrrp                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This command is valid only if the VRRP virtual router instance associated with this entry is a non-owner.</p> <p>When this command is enabled, a non-owner master can reply to traceroute requests directed to the virtual router instance IP addresses.</p> <p>A non-owner backup virtual router never responds to such traceroute requests regardless of the <b>trace-route-reply</b> status.</p> |
| <b>Default</b>     | no traceroute-reply                                                                                                                                                                                                                                                                                                                                                                                    |

### 3.9.2.2 Priority Control Event Policy Commands

## policy

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>policy</b> <i>policy-id</i> <b>context</b> <i>context-value</i><br><b>policy</b> <i>policy-id</i> <b>context</b> <b>name</b> <i>name</i><br><b>no policy</b> <i>policy-id</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>This command creates the context to configure a VRRP priority control policy which is used to control the VRRP in-use priority based on priority control events. It is a parental node for the various VRRP priority control policy commands that define the policy parameters and priority event conditions.</p> <p>The virtual router instance <b>priority</b> command defines the initial or base value to be used by non-owner virtual routers. This value can be modified by assigning a VRRP priority control policy to the virtual router instance. The VRRP priority control policy can override or diminish the base priority setting to establish the actual in-use priority of the virtual router instance.</p> <p>The <b>policy</b> <i>policy-id</i> command must be created first, before it can be associated with a virtual router instance.</p> <p>Because VRRP priority control policies define conditions and events that must be maintained, they can be resource intensive. The number of policies is limited to 1000.</p> <p>The <i>policy-id</i> do not have to be consecutive integers. The range of available policy identifiers is from 1 to 9999.</p> |

The **no** form of the command deletes the specific *policy-id* from the system. The *policy-id* must be removed first from all virtual router instances before the **no policy** command can be issued. If the *policy-id* is associated with a virtual router instance, the command will fail.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>policy-id</i> — The VRRP priority control ID expressed as a decimal integer that uniquely identifies this policy from any other VRRP priority control policy defined on the system. Up to 1000 policies can be defined.<br><b>Values</b> 1 to 9999<br><i>context-value</i> — Specifies the service ID to which this policy applies. A value of zero (0) means that this policy does not apply to a service but applies to the base router instance.<br><b>Values</b> 1 to 2147483647 |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

delta-in-use-limit

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>delta-in-use-limit</b> <i>limit</i><br><b>no delta-in-use-limit</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>vrrp>policy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command sets a lower limit on the virtual router in-use priority that can be derived from the delta priority control events.</p> <p>Each <i>vrrp-priority-id</i> places limits on the delta priority control events to define the in-use priority of the virtual router instance. Setting this limit prevents the sum of the delta priority events from lowering the in-use priority value of the associated virtual router instances below the configured value.</p> <p>The limit has no effect on explicit priority control events. Explicit priority control events are controlled by setting the in-use priority to any value between 1 and 254.</p> <p>Only non-owner virtual router instances can be associated with VRRP priority control policies and their priority control events.</p> <p>Once the total sum of all delta events is calculated and subtracted from the base <b>priority</b> of the virtual router instance, the result is compared to the <b>delta-in-use-limit</b> value. If the result is less than the limit, the <b>delta-in-use-limit</b> value is used as the virtual router in-use priority value. If an explicit priority control event overrides the delta priority control events, the <b>delta-in-use-limit</b> has no effect.</p> <p>Setting the limit to a higher value than the default of 1 limits the effect of the delta priority control events on the virtual router instance base <b>priority</b> value. This allows for multiple priority control events while minimizing the overall effect on the in-use priority.</p> <p>Changing the <i>in-use-priority-limit</i> causes an immediate re-evaluation of the in-use priority values for all virtual router instances associated with this <i>vrrp-policy-id</i> based on the current sum of all active delta control policy events.</p> |

The **no** form of the command reverts to the default value.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | delta-in-use-limit 1 — The lower limit of 1 for the in-use priority, as modified, by delta priority control events.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Parameters</b> | <p><i>limit</i> — The lower limit of the in-use priority base, as modified by priority control policies. The <i>in-use-priority-limit</i> has the same range as the non-owner virtual router instance base-priority parameter. If the result of the total delta priority control events minus the virtual router instances base-priority, is less than the <i>in-use-priority-limit</i>, the <i>in-use-priority-limit</i> value is used as the virtual router instances in-use priority value.</p> <p>Setting the <i>in-use-priority-limit</i> to a value equal to or larger than the virtual router instance <i>base-priority</i> prevents the delta priority control events from having any effect on the virtual router instance in-use priority value.</p> <p><b>Values</b>      1 to 254</p> |

## description

|                    |                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>description</b> <i>description-string</i><br><b>no description</b>                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>vrrp>policy                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command creates a text description stored in the configuration file for a configuration context.</p> <p>The <b>description</b> command associates a text string with a configuration context to help identify the content in the configuration file.</p> <p>The <b>no</b> form of the command removes the string from the configuration.</p> |
| <b>Parameters</b>  | <p><i>description-string</i> — The description character string. Allowed values are any string up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, etc.), the entire string must be enclosed within double quotes.</p>                                                 |

## priority-event

|                    |                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] priority-event</b>                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>vrrp>policy>priority-event                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command creates the context to configure VRRP priority control events used to define criteria to modify the VRRP in-use priority.</p> <p>A priority control event specifies an object to monitor and the effect on the in-use priority level for an associated virtual router instance.</p> |

Up to 32 priority control events can be configured within the **priority-event** node.

The **no** form of the command clears any configured priority events.

## host-unreachable

|                    |                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] host-unreachable</b> <i>ip-address</i><br><b>[no] host-unreachable</b> <i>ipv6-address</i>                                                                         |
| <b>Context</b>     | config>vrrp>policy>priority-event                                                                                                                                          |
| <b>Description</b> | This command creates the context to configure a host unreachable priority control event to monitor the ability to receive ICMP echo reply packets from an IP host address. |

A host unreachable priority event creates a continuous ICMP echo request (ping) probe to the specified *ip-address*. If a ping fails, the event is considered to be set. If a ping is successful, the event is considered to be cleared.

Multiple unique (different *ip-address*) **host-unreachable** event nodes can be configured within the **priority-event** node to a maximum of 32 events.

The **host-unreachable** command can reference any valid local or remote IP address. The ability to ARP a local IP address or find a remote IP address within a route prefix in the route table is considered part of the monitoring procedure. The **host-unreachable** priority event operational state tracks ARP or route table entries dynamically appearing and disappearing from the system. The operational state of the **host-unreachable** event are listed in [Table 46](#).

**Table 46 Host Unreachable Operational States**

| Host Unreachable Operational State | Description                                                                                                                           |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Set – no ARP                       | No ARP address found for <i>ip-addr</i> for <b>drop-count</b> consecutive attempts. Only applies when IP address is considered local. |
| Set – no route                     | No route exists for <i>ip-addr</i> for <b>drop-count</b> consecutive attempts. Only when IP address is considered remote.             |
| Set – host unreachable             | ICMP host unreachable message received for <b>drop-count</b> consecutive attempts.                                                    |
| Set – no reply                     | ICMP echo request timed out for <b>drop-count</b> consecutive attempts.                                                               |
| Set – reply received               | Last ICMP echo request attempt received an echo reply but historically not able to clear the event.                                   |
| Cleared – no ARP                   | No ARP address found for <i>ip-addr</i> - not enough failed attempts to set the event.                                                |

**Table 46 Host Unreachable Operational States (Continued)**

| Host Unreachable Operational State | Description                                                                           |
|------------------------------------|---------------------------------------------------------------------------------------|
| Cleared – no route                 | No route exists for <i>ip-addr</i> - not enough failed attempts to set the event.     |
| Cleared – host unreachable         | ICMP host unreachable message received - not enough failed attempts to set the event. |
| Cleared – no reply                 | ICMP echo request timed out - not enough failed attempts to set the event.            |
| Cleared – reply received           | Event is cleared - last ICMP echo request received an echo reply.                     |

Unlike other priority event types, the **host-unreachable** priority event monitors a repetitive task. A historical evaluation is performed on the success rate of receiving ICMP echo reply messages. The operational state takes its cleared and set orientation from the historical success rate. The informational portion of the operational state is derived from the last attempt's result. It is possible for the previous attempt to fail while the operational state is still cleared due to an insufficient number of failures to cause it to become set. It is also possible for the state to be set while the previous attempt was successful.

When an event transitions from clear to set, the set is processed immediately and must be reflected in the associated virtual router instances in-use priority value. As the event transitions from clear to set, a hold-set timer is loaded with the value configured by the events **hold-set** command. This timer prevents the event from clearing until it expires, damping the effect of event flapping. If the event clears and becomes set again before the hold-set timer expires, the timer is reset to the **hold-set** value, extending the time before another clear can take effect.

The hold-set timer be expired and the historical success rate must be met prior to the event operational state becoming cleared.

The **no** form of the command deletes the specific IP host monitoring event. The event may be deleted at anytime. When the event is deleted, the in-use priority of all associated virtual router instances must be reevaluated. The event's **hold-set** timer has no effect on the removal procedure.

**Default** no host-unreachable — No host unreachable priority events are created.

**Parameters** *ip-address* — The IP address of the host for which the specific event will monitor connectivity. The *ip-addr* can only be monitored by a single event in this policy. The IP address can be monitored by multiple VRRP priority control policies. The IP address can be used in one or multiple **ping** requests. Each VRRP priority control **host-unreachable** and **ping** destined to the same *ip-addr* is uniquely identified on a per message basis. Each session originates a unique identifier value for the ICMP echo request messages it generates. This allows received ICMP echo reply messages to be directed to the appropriate sending application.

**Values** The following values apply to the 7450 ESS:

ipv4-address: a.b.c.d

**Values** The following values apply to the 7750 SR and 7950 XRS:

```
ipv4- a.b.c.d
address:
```

```
ipv6- x:x:x:x:x:x:x[-
address: interface]
```

x: [0..FFFF]H

interface: 32 chars maximum, mandatory for link local addresses

The link-local IPv6 address must have an interface name specified. The global IPv6 address must not have an interface name specified.

drop-count

|                    |                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>drop-count</b> <i>count</i><br><b>no drop-count</b>                                                                                                        |
| <b>Context</b>     | config>vrrp>policy>priority-event>host-unreachable                                                                                                            |
| <b>Description</b> | This command configures the number of consecutively sent ICMP echo request messages that must fail before the host unreachable priority control event is set. |

The **drop-count** command is used to define the number of consecutive message send attempts that must fail for the **host-unreachable** priority event to enter the set state. Each unsuccessful attempt increments the event's consecutive message drop counter. With each successful attempt, the event's consecutive message drop counter resets to zero.

If the event's consecutive message drop counter reaches the **drop-count** value, the **host-unreachable** priority event enters the set state.

The event's **hold-set** value defines how long the event must stay in the set state even when a successful message attempt clears the consecutive drop counter. The event is not cleared until the consecutive drop counter is less than the **drop-count** value and the **hold-set** timer has a value of zero (expired).

The **no** form of the command reverts to the default value.

|                   |                                                                                                                                                                                                                         |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | drop-count 3 — 3 consecutive ICMP echo request failures are required before the host unreachable priority control event is set.                                                                                         |
| <b>Parameters</b> | <i>count</i> — The number of ICMP echo request message attempts that must fail for the event to enter the set state. It also defines the threshold so a lower consecutive number of failures can clear the event state. |
| <b>Values</b>     | 1 to 60                                                                                                                                                                                                                 |

## hold-clear

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>hold-clear</b> <i>seconds</i><br><b>no hold-clear</b>                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>vrrp>policy>priority-event>host-unreachable<br>config>vrrp>policy>priority-event>lag-port-down<br>config>vrrp>policy>priority-event>mc-ipsec-non-forwarding<br>config>vrrp>policy>priority-event>port-down<br>config>vrrp>policy>priority-event>route-unknown                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command configures the hold clear time for the event. The <i>seconds</i> parameter specifies the hold-clear time, the amount of time in seconds by which the effect of a cleared event on the associated virtual router instance is delayed.</p> <p>The hold-clear time is used to prevent black hole conditions when a virtual router instance advertises itself as a master before other conditions associated with the cleared event have had a chance to enter a forwarding state.</p> |
| <b>Default</b>     | no hold-clear                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b>  | <i>seconds</i> — Specifies the amount of time in seconds by which the effect of a cleared event on the associated virtual router instance is delayed.                                                                                                                                                                                                                                                                                                                                              |
| <b>Values</b>      | 0 to 86400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## hold-set

|                |                                                                                                                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>hold-set</b> <i>seconds</i><br><b>no hold-set</b>                                                                                                                                                                                                                 |
| <b>Context</b> | config>vrrp>policy>priority-event>host-unreachable<br>config>vrrp>policy>priority-event>lag-port-down<br>config>vrrp>policy>priority-event>mc-ipsec-non-forwarding<br>config>vrrp>policy>priority-event>port-down<br>config>vrrp>policy>priority-event>route-unknown |



|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command specifies the amount of time that must pass before the set state for a VRRP priority control event can transition to the cleared state to dampen flapping events. A flapping event continually transitions between clear and set.</p> <p>The <b>hold-set</b> command is used to dampen the effect of a flapping event. The <b>hold-set</b> value is loaded into a hold-set timer that prevents a set event from transitioning to the cleared state until it expires.</p> <p>Each time an event transitions between cleared and set, the timer is loaded and begins a countdown to zero. When the timer reaches zero, the event is allowed to enter the cleared state. Entering the cleared state is dependent on the object controlling the event, conforming to the requirements defined in the event itself. It is possible, on some event types, to have another set action reload the hold-set timer. This extends the amount of time that must expire before entering the cleared state.</p> <p>Once the hold-set timer expires and the event meets the cleared state requirements or is set to a lower threshold, the current set effect on the virtual router instances in-use priority can be removed. As with <b>lag-port-down</b> events, this may be a decrease in the set effect if the <i>clearing</i> amounts to a lower set threshold.</p> <p>The <b>hold-set</b> command can be executed at anytime. If the hold-set timer value is configured larger than the new <i>seconds</i> setting, the timer is loaded with the new <b>hold-set</b> value.</p> <p>The <b>no</b> form of the command disables the hold timer so that event transitions are processed immediately.</p> |
| <b>Default</b>     | no hold-set                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><i>seconds</i> — The number of seconds that the hold-set timer waits after an event enters a set state or enters a higher threshold set state, depending on the event type.</p> <p>The value of 0 disables the hold-set timer, preventing any delay in processing lower set thresholds or cleared events.</p> <p><b>Values</b>      0 to 86400</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## interval

|                    |                                                                                                                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>interval</b> <i>seconds</i><br><b>no interval</b>                                                                                                                                                                            |
| <b>Context</b>     | config>vrrp>priority-event>host-unreachable                                                                                                                                                                                     |
| <b>Description</b> | <p>This command configures the number of seconds between host unreachable priority event ICMP echo request messages directed to the host IP address.</p> <p>The <b>no</b> form of the command reverts to the default value.</p> |
| <b>Default</b>     | interval 1                                                                                                                                                                                                                      |

**Parameters**     *seconds* — The number of seconds between the ICMP echo request messages sent to the host IP address for the host unreachable priority event.

**Values**        1 to 60

## padding-size

**Syntax**        **padding-size** *size*  
**no padding-size**

**Context**        config>vrrp>priority-event>host-unreachable

**Description**   This command allows the operator to increase the size of IP packet by padding the PDU.  
The **no** form of the command reverts to the default.

**Default**        padding-size 0

**Parameters**     *size* — Specifies amount of increase to the ICMP PDU.

**Values**        0 to 16384

## priority

**Syntax**        **priority** *priority-level* [{**delta** | **explicit**}]  
**no priority**

**Context**        config>vrrp>policy>priority-event>host-unreachable  
config>vrrp>policy>priority-event>lag-port-down>number-down  
config>vrrp>policy>priority-event>lag-port-down>weight-down  
config>vrrp>policy>priority-event>port-down  
config>vrrp>policy>priority-event>route-unknown

**Description**   This command controls the effect the set event has on the virtual router instance in-use priority.

When the event is set, the *priority-level* is either subtracted from the base priority of each virtual router instance or it defines the explicit in-use priority value of the virtual router instance depending on whether the **delta** or **explicit** keywords are specified.

Multiple set events in the same policy have interaction constraints:

- If any set events have an explicit **priority** value, all the delta **priority** values are ignored.
- The set event with the lowest explicit **priority** value defines the in-use priority that are used by all virtual router instances associated with the policy.
- If no set events have an explicit **priority** value, all the set events delta **priority** values are added and subtracted from the base priority value defined on each virtual router instance associated with the policy.

- If the delta priorities sum exceeds the **delta-in-use-limit** parameter, then the **delta-in-use-limit** parameter is used as the value subtracted from the base priority value defined on each virtual router instance associated with the policy.

If the **priority** command is not configured on the priority event, the *priority-value* defaults to 0 and the qualifier keyword defaults to **delta**, therefore, there is no impact on the in-use priority.

The **no** form of the command configures the set event to subtract 0 from the base priority (no effect).

**Default** no priority

**Parameters** *priority-level* — The priority level adjustment value expressed as a decimal integer.

**Values** 0 to 254

**delta** — Configures what effect the *priority-level* will have on the base priority value. The default base priority value is **delta**.

When **delta** is specified, the *priority-level* value is subtracted from the associated virtual router instance's base priority when the event is set and no explicit events are set. The sum of the priority event *priority-level* values on all set delta priority events are subtracted from the virtual router base priority to derive the virtual router instance in-use priority value. If the **delta** priority event is cleared, the *priority-level* is no longer used in the in-use priority calculation.

**explicit** — Configures what effect the *priority-level* will have on the base priority value.

When **explicit** is specified, the *priority-level* value is used to override the base priority of the virtual router instance if the priority event is set and no other **explicit** priority event is set with a lower *priority-level*. The set **explicit** priority value with the lowest *priority-level* determines the actual in-use protocol value for all virtual router instances associated with the policy.

## timeout

**Syntax** **timeout** *seconds*  
**no timeout**

**Context** config>vrrp vrrp-policy-id>priority-event>host-unreachable

**Description** This command defines the time, in seconds, that must pass before considering the far-end IP host unresponsive to an outstanding ICMP echo request message.

The **timeout** value is not directly related to the configured **interval** parameter. The **timeout** value may be larger, equal, or smaller, relative to the **interval** value.

If the **timeout** value is larger than the **interval** value, multiple ICMP echo request messages may be outstanding. Every ICMP echo request message transmitted to the far end host is tracked individually according to the message identifier and sequence number.

With each consecutive attempt to send an ICMP echo request message, the timeout timer is loaded with the **timeout** value. The timer decrements until:

- an internal error occurs preventing message sending (request unsuccessful)
- an internal error occurs preventing message reply receiving (request unsuccessful)
- a required route table entry does not exist to reach the IP address (request unsuccessful)
- a required ARP entry does not exist and ARP request timed out (request unsuccessful)
- a valid reply is received (request successful)

It is possible for a required ARP request to succeed or timeout after the message timeout timer expires. In this case, the message request is unsuccessful.

If an ICMP echo reply message is not received prior to the **timeout** period for a given ICMP echo request, that request is considered to be dropped and increments the consecutive message drop counter for the priority event.

If an ICMP echo reply message with the same sequence number as an outstanding ICMP echo request message is received prior to that message timing out, the request is considered successful. The consecutive message drop counter is cleared and the request message no longer is outstanding.

If an ICMP Echo Reply message with a sequence number equal to an ICMP echo request sequence number that had previously timed out is received, that reply is silently discarded while incrementing the priority event reply discard counter.

The **no** form of the command reverts to the default value.

|                   |                                                                                                                                                                                          |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | timeout 1                                                                                                                                                                                |
| <b>Parameters</b> | <i>seconds</i> — The number of seconds before an ICMP echo request message is timed out. Once a message is timed out, a reply with the same identifier and sequence number is discarded. |
| <b>Values</b>     | 1 to 60                                                                                                                                                                                  |

## lag-port-down

|                    |                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] lag-port-down</b> <i>lag-id</i>                                                                                                                        |
| <b>Context</b>     | config>vrrp>policy>priority-event                                                                                                                              |
| <b>Description</b> | This command creates the context to configure Link Aggregation Group (LAG) priority control events that monitor the operational state of the links in the LAG. |

The **lag-port-down** command configures a priority control event. The event monitors the operational state of each port in the specified LAG. When one or more of the ports enter the operational down state, the event is considered to be set. When all the ports enter the operational up state, the event is considered to be clear. As ports enter the operational up state, any previous set threshold that represents more down ports is considered cleared, while the event is considered to be set.

Multiple unique **lag-port-down** event nodes can be configured within the **priority-event** node up to the maximum of 32 events.

The **lag-port-down** command can reference an arbitrary LAG. The *lag-id* does have to already exist within the system. The operational state of the **lag-port-down** event will indicate:

- Set – non-existent
- Set – one port down
- Set – two ports down
- Set – three ports down
- Set – four ports down
- Set – five ports down
- Set – six ports down
- Set – seven ports down
- Set – eight ports down
- Cleared – all ports up

When the *lag-id* is created, or a port in *lag-id* becomes operationally up or down, the event operational state must be updated appropriately.

When one or more of the LAG composite ports enters the operationally down state or the *lag-id* is deleted or does not exist, the event is considered to be set. When an event transitions from clear to set, the set is processed immediately and must be reflected in the associated virtual router instances in-use priority value. As the event transitions from clear to set, a hold-set timer is loaded with the value configured by the events **hold-set** command. This timer prevents the event from clearing until it expires, damping the effect of event flapping. If the event clears and becomes set again before the hold-set timer expires, the timer is reset to the **hold-set** value, extending the time before another clear can take effect.

The **lag-port-down** event is considered to have a tiered event set state. While the priority impact per number of ports down is totally configurable, as more ports go down, the effect on the associated virtual router instances in-use priority is expected to increase (lowering the priority). When each configured threshold is crossed, any higher thresholds are considered further event sets and are processed immediately with the hold-set timer reset to the configured value of the **hold-set** command. As the thresholds are crossed in the opposite direction (fewer ports down than previously), the priority effect of the event is not processed until the hold-set timer expires. If the number of ports down threshold again increases before the hold-set timer expires, the timer is only reset to the **hold-set** value if the number of ports down is equal to or greater than the threshold that set the timer.

The event contains **number-down** nodes that define the priority delta or explicit value to be used based on the number of LAG composite ports that are in the operationally down state. These nodes represent the event set thresholds. Not all port down thresholds must be configured. As the number of down ports increase, the **number-down ports-down** node that expresses a value equal to or less than the number of down ports describes the delta or explicit priority value to be applied.

The **no** form of the command deletes the specific LAG monitoring event. The event can be removed at anytime. When the event is removed, the in-use priority of all associated virtual router instances must be reevaluated. The events **hold-set** timer has no effect on the removal procedure.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no lag-port-down — No LAG priority control events are created.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b> | <p><i>lag-id</i> — The LAG ID that the specific event is to monitor expressed as a decimal integer. The <i>lag-id</i> can only be monitored by a single event in this policy. The LAG may be monitored by multiple VRRP priority control policies. A port within the LAG and the LAG ID itself are considered to be separate entities. A composite port may be monitored with the <b>port-down</b> event while the <i>lag-id</i> the port is in is monitored by a <b>lag-port-down</b> event in the same policy.</p> <p><b>Values</b>      1 to 800 (apply to the 7750 SR and 7950 XRS)<br/>                        1 to 200 (apply to the 7450 ESS)</p> |

## number-down

|                    |                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] <b>number-down</b> <i>number-of-lag-ports-down</i>                                                           |
| <b>Context</b>     | config>vrrp>policy>priority-event>lag-port-down                                                                   |
| <b>Description</b> | This command creates a context to configure an event set threshold within a lag-port-down priority control event. |

The **number-down** command defines a sub-node within the **lag-port-down** event and is uniquely identified with the *number-of-lag-ports-down* parameter. Each **number-down** node within the same **lag-port-down** event node must have a unique *number-of-lag-ports-down* value. Each **number-down** node has its own **priority** command that takes effect whenever that node represents the current threshold.

The total number of sub-nodes (uniquely identified by the *number-of-lag-ports-down* parameter) allowed in a single **lag-port-down** event is equal to the total number of possible physical ports allowed in a LAG.

A **number-down** node is not required for each possible number of ports that could be down. The active threshold is always the closest lower threshold. When the number of ports down equals a given threshold, that is the active threshold.

The **no** form of the command deletes the event set threshold. The threshold may be removed at any time. If the removed threshold is the current active threshold, the event set thresholds must be re-evaluated after removal.

---

|                   |                                                                                                                                                                                                                                                                                                                      |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no number-down — No threshold for the LAG priority event is created.                                                                                                                                                                                                                                                 |
| <b>Parameters</b> | <i>number-of-lag-ports-down</i> — The number of LAG ports down to create a set event threshold. This is the active threshold when the number of down ports in the LAG equals or exceeds <i>number-of-lag-ports-down</i> , but does not equal or exceed the next highest configured <i>number-of-lag-ports-down</i> . |
| <b>Values</b>     | 1 to 64 (applies to 64-link LAG)<br>1 to 32 (applies to other LAGs)                                                                                                                                                                                                                                                  |

## weight-down

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] weight-down lag-ports-down-weight</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>vrrp>policy>priority-event>lag-port-down                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command creates a context to configure an event set threshold within a lag-port-down priority control event. The weight-down command defines a sub-node within the lag-port-down event and is uniquely identified with the lag-ports-down-weight parameter. Each weight-down node within the same lag-port-down event node must have a unique lag-ports-down-weight value. Each weight-down node has its own priority command that takes effect whenever that node represents the current threshold. A single LAG can use either weight-threshold or port threshold. The command is required for correct operation on mixed port-speed LAGs and can be used for non-mixed port-speed LAGs as well.</p> <p>The total number of sub-nodes (uniquely identified by the lag-ports-down-weight parameter) allowed in the system is 2048.</p> <p>A <b>weight-down</b> node is not required for each possible number of ports that could be down. The active threshold is always the closest lower threshold.</p> <p>The <b>no</b> form of the command deletes the event set threshold. The threshold may be removed at any time. If the removed threshold is the current active threshold, the event set thresholds must be re-evaluated after removal.</p> |
| <b>Default</b>     | no weight-down                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <p><i>lag-ports-down-weight</i> — The total weight of LAG ports down to create a set event threshold. This is the active threshold when the weight of down ports in the LAG equals or exceeds <i>lag-ports-down-weight</i>, but does not equal or exceed the next highest configured <i>lag-ports-down-weight</i>.</p> <p><b>Values</b> 1 to 64</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## mc-ipsec-non-forwarding

|                |                                                   |
|----------------|---------------------------------------------------|
| <b>Syntax</b>  | <b>[no] mc-ipsec-non-forwarding tunnel-grp-id</b> |
| <b>Context</b> | config>vrrp>policy>priority-event                 |

---

|                    |                                                                                                                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command configures an instance of a multi-chassis IPsec tunnel-group Priority Event used to override the base priority value of a VRRP virtual router instance depending on the operational state of the event. |
| <b>Parameters</b>  | <i>tunnel-grp-id</i> — Identifies the multi-chassis IPsec tunnel group whose non-forwarding state is monitored by this priority control event.                                                                       |

## priority

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>priority</b> <i>priority-level</i> <b>explicit</b><br><b>no priority</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>vrrp>policy>priority-event>mc-ipsec-non-forwarding                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command controls the effect the set event has on the virtual router instance in-use priority.</p> <p>When the event is set, the <i>priority-level</i> is either subtracted from the base priority of each virtual router instance or it defines the explicit in-use priority value of the virtual router instance depending on whether the <b>delta</b> or <b>explicit</b> keywords are specified.</p> <p>Multiple set events in the same policy have interaction constraints:</p> <ul style="list-style-type: none"> <li>• If any set events have an explicit <b>priority</b> value, all the delta <b>priority</b> values are ignored.</li> <li>• The set event with the lowest explicit <b>priority</b> value defines the in-use priority that are used by all virtual router instances associated with the policy.</li> <li>• If no set events have an explicit <b>priority</b> value, all the set events delta <b>priority</b> values are added and subtracted from the base priority value defined on each virtual router instance associated with the policy.</li> <li>• If the delta priorities sum exceeds the <b>delta-in-use-limit</b> parameter, then the <b>delta-in-use-limit</b> parameter is used as the value subtracted from the base priority value defined on each virtual router instance associated with the policy.</li> </ul> <p>If the <b>priority</b> command is not configured on the priority event, the <i>priority-value</i> defaults to 0 and the qualifier keyword defaults to <b>delta</b>, therefore, there is no impact on the in-use priority.</p> <p>The <b>no</b> form of the command configures the set event to subtract 0 from the base priority (no effect).</p> |
| <b>Default</b>     | no priority                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><i>priority-level</i> — The priority level adjustment value expressed as a decimal integer.</p> <p><b>Values</b>      0 to 254</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |



**explicit** — When **explicit** is specified, the *priority-level* value is used to override the base priority of the virtual router instance if the priority event is set and no other **explicit** priority event is set with a lower *priority-level*. The set **explicit** priority value with the lowest *priority-level* determines the actual in-use protocol value for all virtual router instances associated with the policy.

## port-down

|                    |                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] port-down</b> <i>port-id</i>                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>vrrp>policy>priority-event                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | This command configures a port down priority control event that monitors the operational state of a port or SONET/SDH channel. When the port or channel enters the operational down state, the event is considered set. When the port or channel enters the operational up state, the event is considered cleared. |

Multiple unique **port-down** event nodes can be configured within the **priority-event** context up to the overall limit of 32 events. Up to 32 events can be defined in any combination of types.

The **port-down** command can reference an arbitrary port or channel. The port or channel does not need to be preprovisioned or populated within the system. The operational state of the **port-down** event is set as follows:

- Set – non-provisioned
- Set – not populated
- Set – down
- Cleared – up

When the port or channel is provisioned, populated, or enters the operationally up or down state, the event operational state is updated appropriately.

When the event enters the operationally down, non-provisioned, or non-populated state, the event is considered to be set. When an event transitions from clear to set, the set is processed immediately and must be reflected in the associated virtual router instances in-use priority value. As the event transitions from cleared to set, a hold-set timer is loaded with the value configured by the events **hold-set** command. This timer prevents the event from clearing until it expires, damping the effect of event flapping. If the event clears and becomes set again before the hold-set timer expires, the timer is reset to the **hold-set** value, extending the time before another clear can take effect.

When the event enters the operationally up state, the event is considered to be cleared. Once the events **hold-set** expires, the effects of the events **priority** value are immediately removed from the in-use priority of all associated virtual router instances.

The actual effect on the virtual router instance in-use priority value depends on the defined event priority and its delta or explicit nature.

The **no** form of the command deletes the specific port or channel monitoring event. The event may be removed at anytime. When the event is removed, the in-use priority of all associated virtual router instances will be re-evaluated. The events **hold-set** timer has no effect on the removal procedure.

**Default** no port-down — No port down priority control events are defined.

**Parameters** *port-id* — The port ID of the port monitored by the VRRP priority control event.

The *port-id* can only be monitored by a single event in this policy. The port can be monitored by multiple VRRP priority control policies. A port and a specific channel on the port are considered to be separate entities. A port and a channel on the port can be monitored by separate events in the same policy.

**Values** The following values apply to the 7750 SR:

|                                   |                                  |                 |                    |
|-----------------------------------|----------------------------------|-----------------|--------------------|
| port-id                           | <i>slot/mda/port[.channel]</i>   |                 |                    |
| eth-sat-id                        | <i>esat-id/slot/port</i>         | esat            | keyword            |
|                                   |                                  | <i>id</i>       | 1 to 20            |
| pxc-id                            | <i>pxc-id.sub-port</i>           |                 |                    |
|                                   |                                  | pxc             | keyword            |
|                                   |                                  | <i>id</i>       | 1 to 64            |
|                                   |                                  | <i>sub-port</i> | a, b               |
| aps-id                            | <i>aps-group-id[.channel]</i>    |                 |                    |
|                                   |                                  | aps             | keyword            |
|                                   |                                  | group-id        | 1 to 64            |
| bundle-type-slot/mda.<bundle-num> |                                  |                 |                    |
|                                   |                                  | bundle          | keyword            |
|                                   |                                  | type            | ima, ppp           |
|                                   |                                  | bundle-num      | 1 to 256           |
| ccag-id                           | <i>ccag-id. path-id[cc-type]</i> |                 |                    |
|                                   |                                  | ccag            | keyword            |
|                                   |                                  | <i>id</i>       | 1 to 8             |
|                                   |                                  | <i>path-id</i>  | a, b               |
|                                   |                                  | cc-type         | .sap-net, .net-sap |

**Values** The following values apply to the 7450 ESS:

|            |                                |           |         |
|------------|--------------------------------|-----------|---------|
| port-id    | <i>slot/mda/port[.channel]</i> |           |         |
| eth-sat-id | <i>esat-id/slot/port</i>       | esat      | keyword |
|            |                                | <i>id</i> | 1 to 20 |

|         |                                  |                    |
|---------|----------------------------------|--------------------|
| pxc-id  | <i>pxc-id.sub-port</i>           |                    |
|         | <i>pxc</i>                       | keyword            |
|         | <i>id</i>                        | 1 to 64            |
|         | <i>sub-port</i>                  | a, b               |
| ccag-id | <i>ccag-id. path-id[cc-type]</i> |                    |
|         | <i>ccag</i>                      | keyword            |
|         | <i>id</i>                        | 1 to 8             |
|         | <i>path-id</i>                   | a, b               |
|         | <i>cc-type</i>                   | .sap-net, .net-sap |

The POS channel on the port monitored by the VRRP priority control event. The *port-id.channel-id* can only be monitored by a single event in this policy. The channel can be monitored by multiple VRRP priority control policies. A port and a specific channel on the port are considered to be separate entities. A port and a channel on the port can be monitored by separate events in the same policy.

If the port is provisioned, but the *channel* does not exist or the port has not been populated, the appropriate event operational state is Set – non-populated.

If the port is not provisioned, the event operational state is Set – non-provisioned.

If the POS interface is configured as a clear-channel, the *channel-id* is 1 and the channel bandwidth is the full bandwidth of the port.

## route-unknown

|                    |                                                                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] route-unknown</b> [{ <i>ip-prefix/mask</i>   <i>ipv6-address/prefix-length</i> }]                                                                                     |
| <b>Context</b>     | config>vrrp>policy>priority-event                                                                                                                                             |
| <b>Description</b> | This command creates a context to configure a route unknown priority control event that monitors the existence of a specific active IP route prefix within the routing table. |

The **route-unknown** command configures a priority control event that defines a link between the VRRP priority control policy and the Route Table Manager (RTM). The RTM registers the specified route prefix as monitored by the policy. If any change (add, delete, new next hop) occurs relative to the prefix, the policy is notified and takes correct action according to the priority event definition. If the route prefix exists and is active in the routing table according to the conditions defined, the event is in the cleared state. If the route prefix is removed, becomes inactive or fails to meet the event criteria, the event is in the set state.

The command creates a **route-unknown** node identified by *prefix/mask-length* and containing event control commands.

Multiple unique (different *prefix/mask-length*) **route-unknown** event nodes can be configured within the **priority-event** node up to the maximum limit of 32 events.

The **route-unknown** command can reference any valid IP address mask-length pair. The IP address and associated mask length define a unique IP router prefix. The dynamic monitoring of the route prefix results in one of the event operational states listed in [Table 47](#).

**Table 47**      **Route-unknown Operational States**

| <b>route-unknown<br/>Operational State</b> | <b>Description</b>                                                                                                          |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Set – non-existent                         | The route does not exist in the route table.                                                                                |
| Set – inactive                             | The route exists in the route table but is not being used.                                                                  |
| Set – wrong next hop                       | The route exists in the route table but does not meet the <b>next-hop</b> requirements.                                     |
| Set – wrong protocol                       | The route exists in the route table but does not meet the <b>protocol</b> requirements.                                     |
| Set – less specific found                  | The route exists in the route table but does is not an exact match and does not meet any <b>less-specific</b> requirements. |
| Set – default best match                   | The route exists in the route table as the default route but the default route is not allowed for route matching.           |
| Cleared – less specific found              | A less specific route exists in the route table and meets all criteria including the <b>less-specific</b> requirements.     |
| Cleared – found                            | The route exists in the route table manager and meets all criteria.                                                         |

An existing route prefix in the RTM must be active (used by the IP forwarding engine) to clear the event operational state. It may be less specific (the defined prefix may be contained in a larger prefix according to Classless Inter-Domain Routing (CIDR) techniques) if the event has the **less-specific** statement defined. The less specific route that incorporates the router prefix may be the default route (0.0.0.0) if the **less-specific allow-default** statement is defined. The matching prefix may be required to have a specific next hop IP address if defined by the event **next-hop** command. Finally, the source of the RTM prefix may be required to be one of the dynamic routing protocols or be statically defined if defined by the event **protocol** command. If an RTM prefix is not found that matches all the above criteria (if defined in the event control commands), the event is considered to be set. If a matching prefix is found in the RTM, the event is considered to be cleared.

When an event transitions from clear to set, the set is processed immediately and must be reflected in the associated virtual router instances in-use priority value. As the event transitions from clear to set, a hold-set timer is loaded with the value configured by the events **hold-set** command. This timer prevents the event from clearing until it expires, damping the effect of event flapping. If the event clears and becomes set again before the hold-set timer expires, the timer is reset to the **hold-set** value, extending the time before another clear can take effect.

The **no** form of the command is used to remove the specific *prefix/mask-length* monitoring event. The event can be removed at anytime. When the event is removed, the in-use priority of all associated virtual router instances must be reevaluated. The events **hold-set** timer has no effect on the removal procedure.

**Default** no route-unknown — No route unknown priority control events are defined for the priority control event policy.

**Parameters** *ip-prefix/mask* — The IP prefix address in dotted decimal notation and the subnet mask length expressed as a decimal integer associated with the IP *prefix* defining the route prefix to be monitored by the route unknown priority control event.

**Values** The following values apply to the 7750 SR, 7950 XRS, and 7450 ESS:

|                   |           |                            |
|-------------------|-----------|----------------------------|
| <i>ip-prefix/</i> | ip-prefix | a.b.c.d (host bits must be |
| <i>mask:</i>      |           | 0)                         |
|                   | mask      | 0 to 32                    |

*ipv6-address/prefix-length* — The IPv6 address of the host for which the specific event will monitor connectivity. The *ipv6-address* can only be monitored by a single event in this policy. The IPv6 address can be monitored by multiple VRRP priority control policies. The IPv6 address can be used in one or multiple **ping** requests. Each VRRP priority control **host-unreachable** and **ping** destined to the same *ipv6-address* is uniquely identified on a per message basis. Each session originates a unique identifier value for the ICMP echo request messages it generates. This allows received ICMP echo reply messages to be directed to the appropriate sending application.

**Values** The following values apply to the 7750 SR and 7950 XRS:

|                                    |               |                                     |
|------------------------------------|---------------|-------------------------------------|
| <i>ipv6-address/prefix-length:</i> | ipv6-address  | x:x:x:x:x:x:x (eight 16-bit pieces) |
|                                    |               | x:x:x:x:x:x:d.d.d.d                 |
|                                    | x:            | [0..FFFF]H                          |
|                                    | prefix-length | 1 to 128                            |

less-specific

**Syntax** less-specific [allow-default]

**no less-specific**

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>vrrp>policy>priority-event>route-unknown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command allows a CIDR shortest match hit on a route prefix that contains the IP route prefix associated with the route unknown priority event.</p> <p>The <b>less-specific</b> command modifies the search parameters for the IP route prefix specified in the <b>route-unknown</b> priority event. Specifying <b>less-specific</b> allows a CIDR shortest match hit on a route prefix that contains the IP route prefix.</p> <p>The <b>less-specific</b> command eases the RTM lookup criteria when searching for the <i>prefix/mask-length</i>. When the <b>route-unknown</b> priority event sends the prefix to the RTM (as if it was a destination lookup), the result route table prefix (if a result is found) is checked to see if it is an exact match or a less specific match. The <b>less-specific</b> command enables a less specific route table prefix to match the configured prefix. When <b>less-specific</b> is not specified, a less specific route table prefix fails to match the configured prefix. The <b>allow-default</b> optional parameter extends the <b>less-specific</b> match to include the default route (0.0.0.0).</p> <p>The <b>no</b> form of the command prevents RTM lookup results that are less specific than the route prefix from matching.</p> |
| <b>Default</b>     | no less-specific — The route unknown priority events requires an exact prefix/mask match.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <p><b>allow-default</b> — When the <b>allow-default</b> parameter is specified with the <b>less-specific</b> command, an RTM return of 0.0.0.0 matches the IP prefix. If <b>less-specific</b> is entered without the <b>allow-default</b> parameter, a return of 0.0.0.0 will not match the IP prefix. To disable <b>allow-default</b>, but continue to allow <b>less-specific</b> match operation, only enter the <b>less-specific</b> command (without the <b>allow-default</b> parameter).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## next-hop

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] next-hop <i>ip-address</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>vrrp>policy>priority-event>route-unknown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>This command adds an allowed next hop IP address to match the IP route prefix for a route-unknown priority control event.</p> <p>If the next-hop IP address does not match one of the defined <i>ip-address</i>, the match is considered unsuccessful and the <b>route-unknown</b> event transitions to the set state.</p> <p>The <b>next-hop</b> command is optional. If no <b>next-hop ip-address</b> commands are configured, the comparison between the RTM prefix return and the <b>route-unknown</b> IP route prefix are not included in the next hop information.</p> <p>When more than one next hop IP addresses are eligible for matching, a <b>next-hop</b> command must be executed for each IP address. Defining the same IP address multiple times has no effect after the first instance.</p> |

The **no** form of the command removes the *ip-address* from the list of acceptable next hops when looking up the **route-unknown** prefix. If this *ip-address* is the last next hop defined on the **route-unknown** event, the returned next hop information is ignored when testing the match criteria. If the *ip-address* does not exist, the **no next-hop** command returns a warning error, but continues to execute if part of an **exec** script.

**Default** no next-hop — No next hop IP address for the route unknown priority control event is defined.

**Parameters** *ip-address* — The IP address for an acceptable next hop IP address for a returned route prefix from the RTM when looking up the **route-unknown** route prefix.

**Values** The following values apply to the 7450 ESS:

ipv4-address: a.b.c.d

**Values** The following values apply to the 7750 SR and 7950 XRS:

ipv4-address: a.b.c.d

ipv6-address: x:x:x:x:x:x[-interface]

x: [0..FFFF]H

interface: 32 chars maximum, mandatory for link local addresses

The link-local IPv6 address must have an interface name specified. The global IPv6 address must not have an interface name specified.

protocol

**Syntax** **protocol** *protocol*  
**no protocol** [*protocol*]

**Context** config>vrrp>policy>priority-event>route-unknown

**Description** This command adds one or more route sources to match the route unknown IP route prefix for a route unknown priority control event.

If the route source does not match one of the defined protocols, the match is considered unsuccessful and the **route-unknown** event transitions to the set state.

The **protocol** command is optional. If the **protocol** command is not executed, the comparison between the RTM prefix return and the **route-unknown** IP route prefix will not include the source of the prefix. The **protocol** command cannot be executed without at least one associated route source parameter. All parameters are reset each time the **protocol** command is executed and only the explicitly defined protocols are allowed to match.

The **no** form of the command removes protocol route source as a match criteria for returned RTM route prefixes.

To remove specific existing route source match criteria, execute the **protocol** command and include only the specific route source criteria. Any unspecified route source criteria is removed.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no protocol — No route source for the route unknown priority event is defined.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b> | <i>protocol</i> — Explicitly defined protocols                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Values</b>     | <p><b>bgp</b> - This parameter defines BGP as an eligible route source for a returned route prefix from the RTM when looking up the <b>route-unknown</b> route prefix. The <b>bgp</b> parameter is not exclusive from the other available <b>protocol</b> parameters. If <b>protocol</b> is executed without the <b>bgp</b> parameter, a returned route prefix with a source of BGP will not be considered a match and will cause the event to enter the set state. This parameter only applies to the 7750 SR and 7950 XRS.</p> <p><b>bgp-vpn</b> - This parameter defines <b>bgp-vpn</b> as an eligible route source for a returned route prefix from the RTM when looking up the <b>route-unknown</b> route prefix. The <b>bgp-vpn</b> parameter is not exclusive from the other available <b>protocol</b> parameters. If <b>protocol</b> is executed without the <b>bgp-vpn</b> parameter, a returned route prefix with a source of <b>bgp-vpn</b> will not be considered a match and will cause the event to enter the set state. This parameter only applies to the 7750 SR and 7950 XRS.</p> <p><b>ospf</b> - This parameter defines OSPF as an eligible route source for a returned route prefix from the RTM when looking up the <b>route-unknown</b> route prefix. The <b>ospf</b> parameter is not exclusive from the other available <b>protocol</b> parameters. If <b>protocol</b> is executed without the <b>ospf</b> parameter, a returned route prefix with a source of OSPF will not be considered a match and will cause the event to enter the set state.</p> <p><b>is-is</b> - This parameter defines IS-IS as an eligible route source for a returned route prefix from the RTM when looking up the <b>route-unknown</b> route prefix. The <b>is-is</b> parameter is not exclusive from the other available <b>protocol</b> parameters. If <b>protocol</b> is executed without the <b>is-is</b> parameter, a returned route prefix with a source of IS-IS will not be considered a match and will cause the event to enter the set state.</p> <p><b>rip</b> - This parameter defines RIP as an eligible route source for a returned route prefix from the RTM when looking up the <b>route-unknown</b> route prefix. The <b>rip</b> parameter is not exclusive from the other available <b>protocol</b> parameters. If <b>protocol</b> is executed without the <b>rip</b> parameter, a returned route prefix with a source of RIP will not be considered a match and will cause the event to enter the set state.</p> |



---

**static** - This parameter defines a static route as an eligible route source for a returned route prefix from the RTM when looking up the **route-unknown** route prefix. The **static** parameter is not exclusive from the other available **protocol** parameters. If **protocol** is executed without the **static** parameter, a returned route prefix with a source of static route will not be considered a match and will cause the event to enter the set state.



## 3.10 Show, Monitor, Clear, and Debug Command Reference

- [Command Hierarchies](#)
- [Command Descriptions](#)

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

### 3.10.1 Command Hierarchies

- [Show Commands](#)
- [Monitor Commands](#)
- [Clear Commands](#)
- [Debug Commands](#)

#### 3.10.1.1 Show Commands

```
show
 — router
 — vrrp
 — instance
 — instance interface interface-name [vrid virtual-router-id]
 — instance interface interface-name vrid virtual-router-id ipv6
 — statistics
 — vrrp
 — policy [policy-id [event event-type specific-qualifier]]
```

#### 3.10.1.2 Monitor Commands

```
monitor
 — router
 — vrrp
 — instance interface interface-name vr-id virtual-router-id [ipv6] [interval seconds] [repeat repeat] [{absolute | rate}]
```

### 3.10.1.3 Clear Commands

```
clear
 — router
 — vrrp
 — interface interface-name [vrid virtual-router-id]
 — interface interface-name vrid virtual-router-id ipv6
 — statistics
 — statistics interface interface-name [vrid virtual-router-id]
 — statistics interface interface-name vrid virtual-router-id ipv6
 — vrrp
 — statistics [policy policy-id]
```

### 3.10.1.4 Debug Commands

```
debug
 — router
 — vrrp
 — [no] events
 — [no] events interface ip-int-name [vrid virtual-router-id]
 — [no] events interface ip-int-name vrid virtual-router-id ipv6
 — [no] packets
 — [no] packets interface ip-int-name [vrid virtual-router-id]
 — [no] packets interface ip-int-name vrid virtual-router-id ipv6
```

## 3.10.2 Command Descriptions

### 3.10.2.1 Show Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

#### instance

|                    |                                                                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>instance</b><br><b>instance interface</b> <i>interface-name</i> [ <b>vrid</b> <i>virtual-router-id</i> ]<br><b>instance interface</b> <i>interface-name</i> <b>vrid</b> <i>virtual-router-id</i> <b>ipv6</b> |
| <b>Context</b>     | show>router>vrrp                                                                                                                                                                                                |
| <b>Description</b> | This command displays information for VRRP instances.                                                                                                                                                           |

If no command line options are specified, summary information for all VRRP instances displays.

- Parameters**
- interface-name* — Displays detailed information for the VRRP instances on the specified IP interface including status and statistics.
  - Default** Summary information for all VRRP instances.
  - virtual-router-id* — Displays detailed information for the specified VRRP instance on the IP interface.
  - Default** All VRIDs for the IP interface.
  - Values** 1 to 255
  - ipv6** — Specifies the IPv6 instance.

**Output** The following output is an example of VRRP instance information for the 7450 ESS, and [Table 48](#) describes the fields.

### Sample Output

```
*A:ALA-A# show router vrrp instance
=====
VRRP Instances
=====
Interface Name VR Id Own Adm State Base Pri Msg Int
 IP Opr Pol Id InUse Pri Inh Int

n2 1 No Up Master 100 1
 IPv4 Up n/a 100 No
 Backup Addr: 5.1.1.10

Instances : 2
=====
*A:ALA-A#

*A:ALA-A# show router vrrp instance interface n2 vrid 1
=====
VRRP Instance 1 for interface "n2"
=====
Owner : No VRRP State : Master
Primary IP of Master: 5.1.1.2 (Self)
Primary IP : 5.1.1.2 Standby-Forwarding: Disabled
VRRP Backup Addr : 5.1.1.10
Admin State : Up Oper State : Up
Up Time : 09/23/2004 06:53:45 Virt MAC Addr : 00:00:5e:00:01:01
Auth Type : None
Config Mesg Intvl : 1 In-Use Mesg Intvl : 1
Master Inherit Intvl: No
Base Priority : 100 In-Use Priority : 100
Policy ID : n/a Preempt Mode : Yes
Ping Reply : No Telnet Reply : No
SSH Reply : No Traceroute Reply : No
Init Delay : 0 Init Timer Expires: 0.000 sec
Creation State : Active
OperGroup : vrrp1_1
```

```

Master Information

Primary IP of Master: 5.1.1.2 (Self)
Addr List Mismatch : No Master Priority : 100
Master Since : 09/23/2004 06:53:49

Masters Seen (Last 32)

Primary IP of Master Last Seen Addr List Mismatch Msg Count

5.1.1.2 09/23/2004 06:53:49 No 0

Statistics

Become Master : 1 Master Changes : 1
Adv Sent : 103 Adv Received : 0
Pri Zero Pkts Sent : 0 Pri Zero Pkts Rcvd : 0
Preempt Events : 0 Preempted Events : 0
Mesg Intvl Discards : 0 Mesg Intvl Errors : 0
Addr List Discards : 0 Addr List Errors : 0
Auth Type Mismatch : 0 Auth Failures : 0
Invalid Auth Type : 0 Invalid Pkt Type : 0
IP TTL Errors : 0 Pkt Length Errors : 0
Total Discards : 0
=====

```

The following output is an example of VRRP instance information for the 7750 SR and 7950 XRS, and [Table 48](#) describes the fields

### Output Sample

```

*A:ALA-A# show router vrrp instance interface n2 vrid 1 ipv6
=====
VRRP Instance 1 for interface "n2"
=====
No Matching Entries
=====
*A:ALA-A#

*A:ALA-A# show router vrrp instance interface n2 vrid 10 ipv6
=====
VRRP Instance 10 for interface "n2"
=====
Owner : No VRRP State : Master
Primary IP of Master: FE80::1 (Self)
Primary IP : FE80::1
Standby-Forwarding: Disabled

VRRP Backup Addr : 5::10
 : FE80::10
Admin State : Up Oper State : Up
Up Time : 09/23/2004 06:55:12 Virt MAC Addr : 00:00:5e:00:02:0a
Config Mesg Intvl : 1.0 In-Use Mesg Intvl : 1.0
Master Inherit Intvl: Yes
Base Priority : 100 In-Use Priority : 100
Policy ID : n/a Preempt Mode : Yes

```

```

Ping Reply : No Telnet Reply : No
Init Delay : 0 Traceroute Reply : No
Creation State : Active Init Timer Expires: 0.000 sec

Master Information

Primary IP of Master: FE80::1 (Self)
Addr List Mismatch : No Master Priority : 100
Master Since : 09/23/2004 06:55:16
=====
Masters Seen (Last 32)
=====
Primary IP of Master

Last Seen Addr List Mismatch Msg Count

FE80::1
09/23/2004 06:55:16 No 0

Statistics

Master Transitions : 1 Discontinuity Time: 09/09/2004 01:57*
Adv Sent : 23 Adv Received : 0
Pri Zero Pkts Sent : 0 Pri Zero Pkts Rcvd : 0
Preempt Events : 0 Preempted Events : 0
Mesg Intvl Discards : 0 Mesg Intvl Errors : 0
Total Discards : 0 Addr List Errors : 0
Auth Failures : 0 Invalid Pkt Type : 0
IP TTL Errors : 0 Pkt Length Errors : 0
=====
* indicates that the corresponding row element may have been truncated.

```

**Table 48 Show VRRP Instance Output Fields**

| Label          | Description                                                                                  |
|----------------|----------------------------------------------------------------------------------------------|
| Interface name | The name of the IP interface.                                                                |
| VR ID          | The virtual router ID for the IP interface                                                   |
| Own<br>Owner   | Yes<br>Specifies that the virtual router instance as owning the virtual router IP addresses. |
|                | No<br>Indicates that the virtual router instance is operating as a non-owner.                |
| Adm            | Up<br>Indicates that the administrative state of the VRRP instance is up.                    |
|                | Down<br>Indicates that the administrative state of the VRRP instance is down.                |

**Table 48 Show VRRP Instance Output Fields (Continued)**

| Label          | Description                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Opr            | Up<br>Indicates that the operational state of the VRRP instance is up.                                                                                                                                                                                                                                                                                                                                                                   |
|                | Down<br>Indicates that the operational state of the VRRP instance is down.                                                                                                                                                                                                                                                                                                                                                               |
| State          | When owner, <b>backup</b> defines the IP addresses that are advertised within VRRP advertisement messages.<br>When non-owner, <b>backup</b> actually creates an IP interface IP address used for routing IP packets and communicating with the system when the access commands are defined (ping-reply, telnet-reply, and ssh-reply).                                                                                                    |
| Pol Id         | The value that uniquely identifies a Priority Control Policy.                                                                                                                                                                                                                                                                                                                                                                            |
| Base Priority  | The <i>base-priority</i> value used to derive the in-use priority of the virtual router instance as modified by any optional VRRP priority control policy.                                                                                                                                                                                                                                                                               |
| InUse Priority | The current in-use priority associated with the VRRP virtual router instance.                                                                                                                                                                                                                                                                                                                                                            |
| Msg Int        | The administrative advertisement message timer used by the master virtual router instance to send VRRP advertisement messages and to derive the master down timer as backup.                                                                                                                                                                                                                                                             |
| Inh Int        | Yes<br>When the VRRP instance is a non-owner and is operating as a backup and the <b>master-int-inherit</b> command is enabled, the master down timer is indirectly derived from the value in the advertisement interval field of the VRRP message received from the current master.                                                                                                                                                     |
|                | No<br>When the VRRP instance is operating as a backup and the <b>master-int-inherit</b> command is <i>not</i> enabled, the configured advertisement interval is matched against the value in the advertisement interval field of the VRRP message received from the current master. If the two values do not match then the VRRP advertisement is discarded.<br>If the VRRP instance is operating as a master, this value has no effect. |
| Backup Addr    | The backup virtual router IP address.                                                                                                                                                                                                                                                                                                                                                                                                    |
| BFD            | Indicates BFD is enabled.                                                                                                                                                                                                                                                                                                                                                                                                                |



**Table 48 Show VRRP Instance Output Fields (Continued)**

| Label                | Description                                                                                                                                                                                                                                                                                                                                                |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VRRP State           | Specifies whether the VRRP instance is operating in a master or backup state.                                                                                                                                                                                                                                                                              |
| Policy ID            | The VRRP priority control policy associated with the VRRP virtual router instance.<br>A value of 0 indicates that no control policy is associated with the virtual router instance.                                                                                                                                                                        |
| Preempt Mode         | Yes<br>The preempt mode is enabled on the virtual router instance where it will preempt a VRRP master with a lower priority.                                                                                                                                                                                                                               |
|                      | No<br>The preempt mode is disabled and prevents the non-owner virtual router instance from preempting another, less desirable virtual router.                                                                                                                                                                                                              |
| Ping Reply           | Yes<br>A non-owner master is enabled to reply to ICMP Echo requests directed to the virtual router instance IP addresses.<br>Ping Reply is valid only if the VRRP virtual router instance associated with this entry is a non-owner.<br>A non-owner backup virtual router never responds to such ICMP echo requests irrespective if Ping Reply is enabled. |
|                      | No<br>ICMP echo requests to the virtual router instance IP addresses are discarded.                                                                                                                                                                                                                                                                        |
| Telnet Reply         | Yes<br>Non-owner masters can to reply to TCP port 23 Telnet requests directed at the virtual router instances IP addresses.                                                                                                                                                                                                                                |
|                      | No<br>Telnet requests to the virtual router instance IP addresses are discarded.                                                                                                                                                                                                                                                                           |
| SSH Reply            | Yes<br>Non-owner masters can to reply to SSH requests directed at the virtual router instances IP addresses.                                                                                                                                                                                                                                               |
|                      | No<br>All SSH request messages destined to the non-owner virtual router instance IP addresses are discarded.                                                                                                                                                                                                                                               |
| Primary IP of Master | The IP address of the VRRP master.                                                                                                                                                                                                                                                                                                                         |

**Table 48 Show VRRP Instance Output Fields (Continued)**

| Label              | Description                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Primary IP         | The IP address of the VRRP owner.                                                                                                                                                                                                                                                                                                             |
| Up Time            | The date and time when the operational state of the event last changed.                                                                                                                                                                                                                                                                       |
| Virt MAC Addr      | The virtual MAC address used in ARP responses when the VRRP virtual router instance is operating as a master.                                                                                                                                                                                                                                 |
| Auth Type          | Specifies the VRRP authentication Type 0 (no authentication), Type 1 (simple password), or Type 2 (MD5) for the virtual router.                                                                                                                                                                                                               |
| Addr List Mismatch | Specifies whether a trap was generated when the IP address list received in the advertisement messages received from the current master did not match the configured IP address list.<br><br>This is an edge triggered notification. A second trap will not be generated for a packet from the same master until this event has been cleared. |
| Master Priority    | The priority of the virtual router instance which is the current master.                                                                                                                                                                                                                                                                      |
| Master Since       | The date and time when operational state of the virtual router changed to master.<br><br>For a backup virtual router, this value specifies the date and time when it received the first VRRP advertisement message from the virtual router which is the current master.                                                                       |
| OperGroup          | Displays the operational group name associated with the VRRP interface, if configured.                                                                                                                                                                                                                                                        |

## statistics

**Syntax** **statistics**

**Context** show>router>vrrp

**Description** This command displays statistics for VRRP instance.

**Output** The following output is an example of VRRP statistics information, and table describes the fields.

### Sample Output

```
A:ALA-48# show router vrrp statistics
=====
VRRP Global Statistics
=====
```

```
VR Id Errors : 0 Version Errors : 0
Checksum Errors : 0
=====
```

**Table 49**      **Show VRRP Statistics Output Fields**

| Label           | Description                                      |
|-----------------|--------------------------------------------------|
| VR Id Errors    | Displays the number of virtual router ID errors. |
| Version Errors  | Displays the number of version errors.           |
| Checksum Errors | Displays the number of checksum errors.          |

policy

**Syntax**      **policy** [*policy-id* [**event** *event-type specific-qualifier*]]

**Context**      show>vrrp

**Description**      This command displays VRRP priority control policy information.

If no command line options are specified, a summary of the VRRP priority control event policies displays.

**Parameters**      *policy-id* — Displays information on the specified priority control policy ID.

**Default**      All VRRP policies IDs

**Values**      1 to 9999

*event-type* — Displays information on the specified VRRP priority control event within the policy ID.

**Default**      All event types and qualifiers

**Values**      port-down, lag-port-down, host-unreachable, route-unknown, mc-ipsec-non-forwarding

*specific-qualifier* — Display information about the specified qualifier.

**Values**      port-id, lag-id, host-ip-addr, route-prefix/mask, tunnel-group-id

**Output**      **VRRP Policy Output** — The following output is an example of VRRP policy information, and [Table 50](#) describes the fields.

**Table 50**      **Show VRRP Policy Output Fields**

| Label                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Policy Id                  | The VRRP priority control policy associated with the VRRP virtual router instance.<br><br>A value of 0 indicates that no control policy is associated with the virtual router instance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Current Priority & Effects |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Current Explicit           | When multiple explicitly defined events associated with the priority control policy happen simultaneously, the lowest value of all the current explicit priorities will be used as the in-use priority for the virtual router.                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Current Delta Sum          | The sum of the priorities of all the delta events when multiple delta events associated with the priority control policy happen simultaneously. This sum is subtracted from the base priority of the virtual router to give the in-use priority.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Delta Limit                | The delta-in-use-limit for a VRRP policy. Once the total sum of all delta events has been calculated and subtracted from the base-priority of the virtual router, the result is compared to the delta-in-use-limit value. If the result is less than this value, the delta-in-use-limit value is used as the virtual router in-use priority value. If an explicit priority control event overrides the delta priority control events, the delta-in-use-limit has no effect.<br><br>If the delta-in-use-limit is 0, the sum of the delta priority control events to reduce the virtual router's in-use-priority to 0 can prevent it from becoming or staying master. |
| Current Priority           | The configured delta-in-use-limit priority for a VRRP priority control policy or the configured delta or explicit priority for a priority control event.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Applied                    | The number of virtual router instances to which the policy has been applied. The policy cannot be deleted unless this value is 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Description                | A text string which describes the VRRP policy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

**Table 50 Show VRRP Policy Output Fields (Continued)**

| Label              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Event Type & ID    | <p>A delta priority event is a conditional event defined in a priority control policy that subtracts a given amount from the base priority to give the current in-use priority for the VRRP virtual router instances to which the policy is applied.</p> <p>An explicit priority event is a conditional event defined in a priority control policy that explicitly defines the in-use priority for the VRRP virtual router instances to which the policy is applied.</p> <p>Explicit events override all delta Events. When multiple explicit events occur simultaneously, the event with the lowest priority value defines the in-use priority.</p>                                                                                                                                                                                                                                                                                                                                               |
| Event Oper State   | The operational state of the event.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Hold Set Remaining | The amount of time that must pass before the set state for a VRRP priority control event can transition to the cleared state to dampen flapping events.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Priority & Effect  | <p><b>Delta</b></p> <p>The <i>priority-level</i> value is subtracted from the associated virtual router instance's base priority when the event is set and no explicit events are set. The sum of the priority event <i>priority-level</i> values on all set delta priority events are subtracted from the virtual router base priority to derive the virtual router instance in-use priority value.</p> <p>If the <b>delta</b> priority event is cleared, the <i>priority-level</i> is no longer used in the in-use priority calculation.</p> <p><b>Explicit</b></p> <p>The <i>priority-level</i> value is used to override the base priority of the virtual router instance if the priority event is set and no other <b>explicit</b> priority event is set with a lower <i>priority-level</i>.</p> <p>The set <b>explicit</b> priority value with the lowest <i>priority-level</i> determines the actual in-use protocol value for all virtual router instances associated with the policy.</p> |
| In Use             | Specifies whether the event is currently affecting the in-use priority of some virtual router.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

**Sample Output**

```

A:ALA-A# show vrrp policy
=====
VRRP Policies
=====
Policy Current Current Current Delta Applied
Id Priority & Effect Explicit Delta Sum Limit

```

```

1 None None None 1 Yes
2 None None None 1 No
=====

```

A:ALA-A#

A:ALA-A# show vrrp policy 1

VRRP Policy 1

```

=====
Description : 10.10.200.253 reachability
Current Priority: None Applied : No
Current Explicit: None Current Delta Sum : None
Delta Limit : 1

```

```

Applied To VR Opr Base In-use Master Is
Interface Name Id Pri Pri Pri Pri Master

None

```

Priority Control Events

```

Event Type & ID Event Oper State Hold Set Priority In
 Remaining &Effect Use

Host Unreach 10.10.200.252 n/a Expired 20 Del No
Host Unreach 10.10.200.253 n/a Expired 10 Del No
Route Unknown 10.10.100.0/24 n/a Expired 1 Exp No
=====

```

**VRRP Policy Event Output** — The following output is an example of VRRP policy event information, and [Table 51](#) describes the fields.

### Sample Output

A:ALA-A#show vrrp policy 1 event port-down

VRRP Policy 1, Event Port Down 1/1/1

```

=====
Description :
Current Priority: None Applied : Yes
Current Explicit: None Current Delta Sum : None
Delta Limit : 1

```

```

Applied To VR Opr Base In-use Master Is
Interface Name Id Pri Pri Pri Pri Master

ies301backup 1 Down 100 100 0 No

```

Priority Control Event Port Down 1/1/1

```

Priority : 30 Priority Effect : Delta

```

```
Hold Set Config : 0 sec Hold Set Remaining: Expired
Value In Use : No Current State : Cleared
trans to Set : 6 Previous State : Set-down
Last Transition : 04/13/2007 04:54:35
```

=====

A:ALA-A#

A:ALA-A# show vrrp policy 1 event host-unreachable

=====

VRRP Policy 1, Event Host Unreachable 10.10.200.252

=====

```
Description : 10.10.200.253 reachability
Current Priority: None Applied : No
Current Explicit: None Current Delta Sum : None
Delta Limit : 1
```

```

Applied To VR Opr Base In-use Master Is
Interface Name Id Pri Pri Pri Master

None
```

-----

Priority Control Event Host Unreachable 10.10.200.252

-----

```
Priority : 20 Priority Effect : Delta
Interval : 1 sec Timeout : 1 sec
Drop Count : 3
Hold Set Config : 0 sec Hold Set Remaining: Expired
Value In Use : No Current State : n/a
trans to Set : 0 Previous State : n/a
Last Transition : 04/13/2007 23:10:24
```

=====

A:ALA-A#

A:ALA-A# show vrrp policy 1 event route-unknown

=====

VRRP Policy 1, Event Route Unknown 10.10.100.0/24

=====

```
Description : 10.10.200.253 reachability
Current Priority: None Applied : No
Current Explicit: None Current Delta Sum : None
Delta Limit : 1
```

```

Applied To VR Opr Base In-use Master Is
Interface Name Id Pri Pri Pri Master

None
```

-----

Priority Control Event Route Unknown 10.10.100.0/24

-----

```
Priority : 1 Priority Effect : Explicit
Less Specific : No Default Allowed : No
Next Hop(s) : None
Protocol(s) : None
Hold Set Config : 0 sec Hold Set Remaining: Expired
```

```

Value In Use : No Current State : n/a
trans to Set : 0 Previous State : n/a
Last Transition : 04/13/2007 23:10:24
=====

```

**Table 51 Show VRRP Policy Event Output Fields**

| Label                     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description               | A text string which describes the VRRP policy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Policy Id                 | The VRRP priority control policy associated with the VRRP virtual router instance.<br>A value of 0 indicates that no control policy is associated with the virtual router instance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Current Priority          | The base router priority for the virtual router instance used in the master election process.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Current Explicit          | When multiple explicitly defined events associated with the priority control policy happen simultaneously, the lowest value of all the current explicit priorities will be used as the in-use priority for the virtual router.                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Applied                   | The number of virtual router instances to which the policy has been applied. The policy cannot be deleted unless this value is 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Current Delta Sum         | The sum of the priorities of all the delta events when multiple delta events associated with the priority control policy happen simultaneously. This sum is subtracted from the base priority of the virtual router to give the in-use priority.                                                                                                                                                                                                                                                                                                                                                                                                                |
| Delta Limit               | The delta-in-use-limit for a VRRP policy. Once the total sum of all delta events has been calculated and subtracted from the base-priority of the virtual router, the result is compared to the delta-in-use-limit value. If the result is less than this value, the delta-in-use-limit value is used as the virtual router in-use priority value. If an explicit priority control event overrides the delta priority control events, the delta-in-use-limit has no effect.<br>If the delta-in-use-limit is 0, the sum of the delta priority control events to reduce the virtual router's in-use-priority to 0 can prevent it from becoming or staying master. |
| Applied to Interface Name | The interface name where the VRRP policy is applied.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| VR ID                     | The virtual router ID for the IP interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



**Table 51 Show VRRP Policy Event Output Fields (Continued)**

| Label              | Description                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Opr                | Up<br>Indicates that the operational state of the VRRP instance is up.                                                                                                                                                                                                                                                                                         |
|                    | Down<br>Indicates that the operational state of the VRRP instance is down.                                                                                                                                                                                                                                                                                     |
| Base Pri           | The base priority used by the virtual router instance.                                                                                                                                                                                                                                                                                                         |
| InUse Priority     | The current in-use priority associated with the VRRP virtual router instance.                                                                                                                                                                                                                                                                                  |
| Master Priority    | The priority of the virtual router instance which is the current master.                                                                                                                                                                                                                                                                                       |
| Priority           | The base priority used by the virtual router instance.                                                                                                                                                                                                                                                                                                         |
| Priority Effect    | Delta<br>A delta priority event is a conditional event defined in a priority control policy that subtracts a given amount from the base priority to give the current in-use priority for the VRRP virtual router instances to which the policy is applied.                                                                                                     |
|                    | Explicit<br>A conditional event defined in a priority control policy that explicitly defines the in-use priority for the VRRP virtual router instances to which the policy is applied.<br>Explicit events override all delta events. When multiple explicit events occur simultaneously, the event with the lowest priority value defines the in-use priority. |
| Current Priority   | The configured delta-in-use-limit priority for a VRRP priority control policy or the configured delta or explicit priority for a priority control event.                                                                                                                                                                                                       |
| Event Oper State   | The operational state of the event.                                                                                                                                                                                                                                                                                                                            |
| Hold Set Remaining | The amount of time that must pass before the set state for a VRRP priority control event can transition to the cleared state to dampen flapping events.                                                                                                                                                                                                        |
| Priority           | The base priority used by the virtual router instance.                                                                                                                                                                                                                                                                                                         |

**Table 51 Show VRRP Policy Event Output Fields (Continued)**

| Label           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Priority Effect | <p>Delta</p> <p>The <i>priority-level</i> value is subtracted from the associated virtual router instance's base priority when the event is set and no explicit events are set. The sum of the priority event <i>priority-level</i> values on all set delta priority events are subtracted from the virtual router base priority to derive the virtual router instance in-use priority value.</p> <p>If the <b>delta</b> priority event is cleared, the <i>priority-level</i> is no longer used in the in-use priority calculation.</p> |
|                 | <p>Explicit</p> <p>The <i>priority-level</i> value is used to override the base priority of the virtual router instance if the priority event is set and no other <b>explicit</b> priority event is set with a lower <i>priority-level</i>.</p> <p>The set <b>explicit</b> priority value with the lowest <i>priority-level</i> determines the actual in-use protocol value for all virtual router instances associated with the policy.</p>                                                                                            |
| Hold Set Config | The configured number of seconds that the hold-set timer waits after an event enters a set state or enters a higher threshold set state, depending on the event type.                                                                                                                                                                                                                                                                                                                                                                   |
| Value In Use    | <p>Yes</p> <p>The event is currently affecting the in-use priority of some virtual router.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                 | <p>No</p> <p>The event is not affecting the in-use priority of some virtual router.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| # trans to Set  | The number of times the event has transitioned to one of the 'set' states.                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Last Transition | The time and date when the operational state of the event last changed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

### 3.10.2.2 Monitor Commands

instance

**Syntax**    **instance interface** *interface-name* **vr-id** *virtual-router-id* [**ipv6**] [**interval** *seconds*] [**repeat** *repeat*] [{**absolute** | **rate**}]

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | monitor>router>vrrp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | Monitor statistics for a VRRP instance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><i>interface-name</i> — The name of the existing IP interface on which VRRP is configured.</p> <p><i>virtual-router-id</i> — The virtual router ID for the existing IP interface, expressed as a decimal integer.</p> <p><b>ipv6</b> — Monitors IPv6 instances.</p> <p><i>seconds</i> — Configures the interval for each display in seconds.</p> <p><b>Values</b> 3 to 60</p> <p><b>Default</b> 5 seconds</p> <p><i>repeat</i> — Configures how many times the command is repeated.</p> <p><b>Values</b> 1 to 999</p> <p><b>Default</b> 10</p> <p><b>absolute</b> — When the <b>absolute</b> keyword is specified, the raw statistics are displayed, without processing. No calculations are performed on the delta or rate statistics.</p> <p><b>rate</b> — When the <b>rate</b> keyword is specified, the rate-per-second for each statistic is displayed instead of the delta.</p> |
| <b>Output</b>      | The following output is an example of VRRP instance information.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### Sample Output

```
*A:ALA-A# monitor router vrrp instance interface n2 vr-id 1
=====
Monitor statistics for VRRP Instance 1 on interface "n2"
=====

At time t = 0 sec (Base Statistics)

Become Master : 1 Master Changes : 1
Adv Sent : 1439 Adv Received : 0
Pri Zero Pkts Sent : 0 Pri Zero Pkts Rcvd: 0
Preempt Events : 0 Preempted Events : 0
Mesg Intvl Discards : 0 Mesg Intvl Errors : 0
Addr List Discards : 0 Addr List Errors : 0
Auth Type Mismatch : 0 Auth Failures : 0
Invalid Auth Type : 0 Invalid Pkt Type : 0
IP TTL Errors : 0 Pkt Length Errors : 0
Total Discards : 0
=====
```

The following output is an example of VRRP instance information for the 7750 SR and 7950 XRS.

### Sample Output

```

*A:ALA-A# monitor router vrrp instance interface n2 vr-id 10 ipv6
=====
Monitor statistics for VRRP Instance 10 on interface "n2"
=====

At time t = 0 sec (Base Statistics)

Master Transitions : 1 Discontinuity Time: 09/09/2004 01:57*
Adv Sent : 1365 Adv Received : 0
Pri Zero Pkts Sent : 0 Pri Zero Pkts Rcvd : 0
Preempt Events : 0 Preempted Events : 0
Mesg Intvl Discards : 0 Mesg Intvl Errors : 0
Total Discards : 0 Addr List Errors : 0
Auth Failures : 0 Invalid Pkt Type : 0
IP TTL Errors : 0 Pkt Length Errors : 0
=====

```

### 3.10.2.3 Clear Commands

#### interface

- Syntax**     **interface** *interface-name* [**vrid** *virtual-router-id*]  
**interface** *interface-name* **vrid** *virtual-router-id* **ipv6**
- Context**    clear>router>vrrp
- Description** This command resets VRRP protocol instances on an IP interface.
- Parameters** *interface-name* — The IP interface to reset the VRRP protocol instances.  
*virtual-router-id* — Resets the VRRP protocol instance for the specified VRID on the IP interface.
- Default**     All VRIDs on the IP interface.
- Values**     1 to 255
- ipv6** — Clears IPv6 information for the specified interface.

#### statistics

- Syntax**     **statistics**  
**statistics interface** *interface-name* [**vrid** *virtual-router-id*]  
**statistics interface** *interface-name* **vrid** *virtual-router-id* **ipv6**
- Context**    clear>router>vrrp
- Description** This command clears statistics for VRRP instances on an IP interface or VRRP priority control policies.

---

|                   |                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <p><i>interface-name</i> — Clears the VRRP statistics for all VRRP instances on the specified IP interface.</p> <p><i>virtual-router-id</i> — Clears the VRRP statistics for the specified VRRP instance on the IP interface.</p> <p><b>Default</b> All VRRP instances on the IP interface.</p> <p><b>Values</b> 1 to 255</p> <p><b>ipv6</b> — Clears IPv6 statistics for the specified interface.</p> |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## statistics

|                    |                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>statistics</b> [ <b>policy</b> <i>policy-id</i> ]                                                 |
| <b>Context</b>     | clear>vrrp                                                                                           |
| <b>Description</b> | This command enables the context to clear and reset VRRP entities.                                   |
| <b>Parameters</b>  | <p><i>policy-id</i> — Clears statistics for the specified policy.</p> <p><b>Values</b> 1 to 9999</p> |

### 3.10.2.4 Debug Commands

## events

|                    |                                                                                                                                                                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p>[<b>no</b>] <b>events</b></p> <p>[<b>no</b>] <b>events interface</b> <i>ip-int-name</i> [<b>vrid</b> <i>virtual-router-id</i>]</p> <p>[<b>no</b>] <b>events interface</b> <i>ip-int-name</i> <b>vrid</b> <i>virtual-router-id</i> <b>ipv6</b></p> |
| <b>Context</b>     | debug>router>vrrp                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This command enables debugging for VRRP events.</p> <p>The <b>no</b> form of the command disables debugging.</p>                                                                                                                                  |
| <b>Parameters</b>  | <p><i>ip-int-name</i> — Displays the specified interface name.</p> <p><i>virtual-router-id</i> — Displays the specified VRID.</p> <p><b>ipv6</b> — Debugs the specified IPv6 VRRP interface.</p>                                                     |

## packets

|               |                              |
|---------------|------------------------------|
| <b>Syntax</b> | [ <b>no</b> ] <b>packets</b> |
|---------------|------------------------------|

**[no] packets interface** *ip-int-name* [**vrid** *virtual-router-id*]  
**[no] packets interface** *ip-int-name* **vrid** *virtual-router-id* **ipv6**

- Context** debug>router>vrrp
- Description** This command enables debugging for VRRP packets.  
The **no** form of the command disables debugging.
- Parameters** *ip-int-name* — Displays the specified interface name.  
*virtual-router-id* — Displays the specified VRID.  
**ipv6** — Debugs the specified IPv6 VRRP interface.

---

## 4 Filter Policies

### 4.1 ACL Filter Policy Overview

ACL filter policies, also referred to as Access Control Lists (ACLs) or just “filters”, are sets of ordered rule entries specifying packet match criteria and actions to be performed to a packet upon a match. Filter policies are created with a unique filter ID, but each filter can also have a unique filter name configured after the filter policy has been created. Either filter ID or filter name can be used throughout the system to manage filter policies and assign them to interfaces.

There are three main filter policies: **ip-filter** for IPv4, **ipv6-filter** for IPv6, and **mac-filter** for MAC level filtering. Additionally, the filter policy **scope** defines if the policy can be re-used between different interfaces, embedded in another filter policy or applied at the system level:

- An **exclusive** filter defines policy rules explicitly for a single interface. An exclusive filter allows the highest level of customization but uses the most resources, because each exclusive filter consumes hardware resources on line cards on which the interface exists.
- A **template** filter uses an identical set of policy rules across multiple interfaces. Template filters use a single set of resources per line card, regardless of how many interfaces use a specific template filter policy on that line card. Template filter policies used on access interfaces consume resources on line cards only if at least one access interface for a specific template filter policy is configured on a specific line card.
- An **embedded** filter defines a common set of policy rules that can then be used (embedded) by other exclusive or template filters in the system. This allows optimized management of filter policies.
- A **system** filter policy defines a common set of policy rules that can then be activated within other exclusive/template filters. A system filter policy is intended mainly for system-level blacklisting rules but can be used for other applications as well. This allows optimized management of common rules (similarly to embedded filters). However, active system filter policy entries are not duplicated inside each policy that activates the system policy (as is the case when embedding is used). The active system policy is downloaded once to line cards, and activated filter policies are chained to it.

Once created, filter policies must then be associated with interfaces/services/subscribers or with other filter policies (if the created policy cannot be directly deployed on an interface/service/subscriber), so the incoming/outgoing traffic can be subjected to filter rules. Filter policies are associated with interfaces/services/subscribers separately in the ingress and egress directions. A policy deployed on ingress and egress direction can be the same or different. In general, Nokia recommends using different filter policies for the ingress and egress directions and to use different filter policies per service type, since filter policies support different match criteria and different actions for different directions/service contexts.

A filter policy is applied to a packet in the ascending rule entry order. When a packet matches all the parameters specified in a filter entry's match criteria, the system takes the action defined for that entry. If a packet does not match the entry parameters, the packet is compared to the next higher numerical filter entry rule, and so on. If the packet does not match any of the entries, the system executes the **default-action** specified in the filter policy: **drop** or **forward**.

For Layer 2, either an IPv4/IPv6 or MAC filter policy can be applied. For Layer 3 and network interfaces, an IPv4/IPv6 policy can be applied. For R-VPLS service, a Layer 2 filter policy can be applied to Layer 2 forwarded traffic and a Layer 3 filter policy can be applied to Layer 3 routed traffic. For dual-stack interfaces, if both IPv4 and IPv6 filter policies are configured, the policy applied will be based on the outer IP header of the packet. Non-IP packets do not affect an IP filter policy, so the default action in the IP filter policy will not apply to these packets. IPv6 filters do not apply to the 7450 ESS except when it is in mixed mode. Egress IPv4 QoS-based classification criteria are ignored when egress MAC filter policy is configured on the same interface.

Additionally, platforms that support Network Group Encryption (NGE) can use IP exception filters. IP exception filters scan all outbound traffic entering an NGE domain and allow packets that match the exception filter criteria to transit the NGE domain unencrypted. For information on IP exception filters supported by NGE nodes, see [2.8.5 Router Encryption Exceptions using ACLs](#).

### 4.1.1 Filter Policy Basics

The following subsections define main functionality supported by filter policies.



### 4.1.1.1 Filter Policy Packet Match Criteria

This section defines packet match criteria supported on SR OS for IPv4, IPv6, and MAC filters. Supported criteria types depend on the hardware platform and filter direction, see your Nokia representative for more information.

General notes:

- If multiple unique match criteria are specified in a single filter policy entry, all criteria must be met in order for the packet to be considered a match against that filter policy entry (logical AND).
- Any match criteria not explicitly defined is ignored during match.
- An ACL filter policy entry with match criteria defined, but no action configured, is considered incomplete and inactive (an entry is not downloaded to the line card). A filter policy must have at least one entry active for the policy to be considered active.
- An ACL filter entry with no match conditions defined matches all packets.
- Because an ACL filter policy is an ordered list, entries should be configured (numbered) from the most explicit to the least explicit.

### 4.1.1.2 IPv4/IPv6 Filter Policy Entry Match Criteria

The IPv4 and IPv6 match criteria supported by SR OS are listed below. The criteria are evaluated against the outer IPv4/IPv6 header and a Layer 4 header that follows (if applicable). Support for match criteria may depend on hardware or filter direction, as described below. Nokia recommends not configuring a filter in a direction or on hardware where a match criterion is not supported as this may lead to unwanted behavior. Some match criteria may be grouped in match lists and may be auto-generated based on router configuration, see [Filter Policy Advanced Topics](#) for more information.

IPv4 and IPv6 filter policies support three different filter type with **normal**, **src-mac** and **packet-length** each supporting different set of match criteria.

The match criteria available using the normal filter type are defined below. Layer 3 match criteria include:

- **dscp** — Match for the specified DSCP value against the Differentiated Services Code Point/Traffic Class field in the IPv4 or IPv6 packet header.

- **src-ip/dst-ip** — Match for the specified source/destination IPv4/IPv6 address prefix against the source/destination IPv4/IPv6 address field in the IPv4/IPv6 packet header. The operator can optionally configure a mask to be used in a match.
- **flow-label** — Match for the specified flow label against the Flow label field in IPv6 packets. The operator can optionally configure a mask to be used in a match. This operation is supported on ingress filters.
- **protocol** — Matches the specified protocol against the Protocol field in the IPv4 packet header (for example, TCP, UDP, IGMP) of the outer IPv4. “\*” can be used to specify TCP or UDP upper-layer protocol match (Logical OR).
- **next-header** — Matches the specified upper-layer protocol (such as, TCP, UDP, IGMPv6) against the Next Header field of the IPv6 packet header. “\*” can be used to specify TCP or UDP upper-layer protocol match (Logical OR). Next-header matching allows also matching on presence of a subset of IPv6 extension headers. See CLI section for details on which extension header match is supported.

Fragmentation match criteria:

- **fragment** — Match for the presence of fragmented packet. For IPv4, match against the MF bit or Fragment Offset field to determine whether the packet is a fragment. For IPv6, match against the Next Header Field for Fragment Extension Header value to determine whether the packet is a fragment. Up to six extension headers are matched against to find the Fragmentation Extension Header.

IPv6 filters support matching against initial fragment using *first-only* or non-initial fragment *non-first-only*.

IPv4 match fragment criteria are supported on both ingress and egress. IPv6 match fragment criteria are supported on ingress only.

Operational note for fragmented traffic — IP and IPv6 filters defined to match TCP, UDP, ICMP, or SCTP criteria (such as **src-port**, **dst-port**, **port**, **tcp-ack**, **tcp-syn**, **icmp-type**, and **icmp-code**) with values of zero or false will also match non-first fragment packets if other match criteria within the same filter entry are also met. Non-initial fragment packets do not contain a UDP, TCP, ICMP or SCTP header.

IPv4 options match criteria:

- **ip-option** — Matches the specified option value in the first option of the IPv4 packet. Operator can optionally configure a mask to be used in a match.
- **option-present** — Matches the presence of IP options in the IPv4 packet. Padding and EOOL are also considered as IP options. Up to six IP options are matched against.

- **multiple-option** — Matches the presence of multiple IP options in the IPv4 packet.
- **src-route-option** — Matches the presence of IP Option 3 or 9 (Loose or Strict Source Route) in the first three IP options of the IPv4 packet. A packet will also match this rule if the packet has more than three IP options.

IPv6 next-header match criteria: (see the Upper-layer protocol match next-header description below):

- **ah-ext-header** — Matches for the presence of the Authentication Header extension header in the IPv6 packet. This match criterion is supported on ingress only. Up to six extension headers are matched against.
- **esp-ext-header** — Matches for the presence of the Encapsulating Security Payload extension header in the IPv6 packet. This match criterion is supported on ingress only. Up to six extension headers are matched against.
- **hop-by-hop-opt** — Matches for the presence of Hop-by-hop options extension header in the IPv6 packet. This match criterion is supported on ingress only. Up to six extension headers are matched against.
- **routing-type0** — Matches for the presence of Routing extension header type 0 in the IPv6 packet. This match criterion is supported on ingress only. Up to six extension headers are matched against.

Upper-layer protocol match criteria:

- **icmp-code** — Matches the specified value against the Code field of the ICMP/ICMPv6 header of the packet. This match is supported only for entries that also define protocol/next-header match for “ICMP”/“ICMPv6” protocol.
- **icmp-type** — Matches the specified value against the Type field of the ICMP/ICMPv6 header of the packet. This match is supported only for entries that also define protocol/next-header match for “ICMP”/“ICMPv6” protocol.
- **src-port/dst-port/port** — Matches the specified port value, port list, or port range against the Source Port Number/Destination Port Number of the UDP/TCP/SCTP packet header. An option to match either source or destination (Logical OR) using a single filter policy entry is supported by using a directionless “port” command. Source/destination match is supported only for entries that also define protocol/next-header match for “TCP”, “UDP”, “SCTP”, or “TCP or UDP” protocols. A non-initial fragment will never match an entry with non-zero port criteria specified. Match on SCTP **src-port**, **dst-port**, or **port** is supported on ingress filter policy.

- **tcp-ack/tcp-cwr/tcp-ece/tcp-fin/tcp-ns/tcp-psh/tcp-rst/tcp-syn/tcp-urg** — Matches the presence or absence of the TCP flags defined in RFC 793/3168/3540 in the TCP header of the packet. This match criteria also requires defining the protocol/next-header match as "TCP". **tcp-cwr**, **tcp-ece**, **tcp-fin**, **tcp-ns**, **tcp-psh**, **tcp-rst**, **tcp-urg** are supported on FP4-based line cards only. When configured on other line cards, the bit for the unsupported TCP flags is ignored.

Filter type match criteria:

- **src-mac** — This filter type allows to match on the **src-mac** address in IPv4 and IPv6 egress filter within VPLS services. When this filter type is selected, the following filter match criteria are not available:

- IPv4** — src-ip, dscp, ip-option, option-present, multiple-option, src-route-option

- IPv6** — src-ip

Filter type **src-mac** are not supported in R-VPLS endpoints.

- **packet-length** — This filter type allows to match on the total **packet-length** in IPv4 and IPv6 filter policies. The total packet length includes both the IP header and payload. When this filter type is selected, the following filter match criteria are not available:

- IPv4** — dscp, ip-option, option-present, multiple-option, src-route-option

- IPv6** — flow-label

#### 4.1.1.3 MAC Filter Policy Entry Match Criteria

MAC filter policies support 3 different filter type with **normal**, **isid** and **vid** each supporting different set of match criteria.

The following list describes the MAC match criteria supported by SR OS or switches for all types of MAC filters (normal, isid, and vid). The criteria are evaluated against the Ethernet header of the Ethernet frame. Support for a match criteria may depend on H/W and/or filter direction as per below description. Match criterion is blocked if it is not supported by a specified frame-type or MAC filter **type**. Nokia recommends not configuring a filter in a direction or on hardware where a match condition is not supported as this may lead to unwanted behavior.

- **frame-type** — The filter searches to match a specific type of frame format. For example, configuring frame-type ethernet\_II will match only Ethernet-II frames.
- **src-mac** — The filter searches to match source MAC address frames. Operator can optionally configure a mask to be used in a match.

- **dst-mac** — The filter searches to match destination MAC address frames. Operator can optionally configure a mask to be used in a match.
- **dot1p** — The filter searches to match 802.1p frames. The operator can optionally configure a mask to be used in a match.
- **etype** — The filter searches to match Ethernet II frames. The Ethernet type field is a two-byte field used to identify the protocol carried by the Ethernet frame.
- **ssap** — The filter searches to match frames with a source access point on the network node designated in the source field of the packet. Operator can optionally configure a mask to be used in a match.
- **dsap** — The filter searches to match frames with a destination access point on the network node designated in the destination field of the packet. Operator can optionally configure a mask to be used in a match.
- **snap-oui** — The filter searches to match frames with the specified three-byte OUI field.
- **snap-pid** — The filter searches to match frames with the specified two-byte protocol ID that follows the three-byte OUI field.
- **isid** — The filter searches to match for the matching Ethernet frames with the 24-bit ISID value from the PBB I-TAG. This match criterion is mutually exclusive of all the other match criteria under a specific MAC filter policy and is applicable to MAC filters of type **isid** only. The resulting MAC filter can only be applied on a BVPLS SAP or PW in the egress direction.
- **inner-tag/outer-tag** — The filter searches to match Ethernet frames with the non-service delimiting tags, as described in the [VID MAC Filters](#) section. This match criterion is mutually exclusive with all other match criteria under a specific MAC filter policy and is applicable to MAC filters of type **vid** only.

#### 4.1.1.4 IP Exception Filters

An NGE node supports IPv4 exception filters. For information on IP exception filters supported by NGE nodes, refer to the section [2.8.5, Router Encryption Exceptions using ACLs](#).

#### 4.1.1.5 Filter Policy Actions

The following actions are supported by ACL filter policies:

- **drop** — Allows operators to deny traffic to ingress or egress the system.

- IPv4 packet-length and IPv6 payload-length conditional drop — Traffic can be dropped based on IPv4 packet length or IPv6 payload length by specifying a packet length or payload length value or range within the drop filter action (the IPv6 payload length field does not account for the size of the fixed IP header, which is 40 bytes).

This filter action is supported on ingress IPv4 and IPv6 filter policies only, if the filter is configured on an egress interface the **packet-length** or **payload-length** match condition is always true.

This **drop** condition is a filter entry action evaluation, and not a filter entry match evaluation. Within this evaluation, the condition is checked after the packet matches the entry based on the specified filter entry match criteria.

Packets that match a filter policy entry match criteria and the **drop packet-length-value** or **payload-length-value** are dropped. Packets that match only the filter policy entry match criteria and do not match the **drop packet-length-value** or **drop payload-length-value** are forwarded with no further matching in following filter entries.

Packets matching this filter entry and not matching the conditional criteria are not logged, counted, or mirrored.

- IPv4 TTL and IPv6 hop limit conditional drop — Traffic can be dropped based on a IPv4 TTL or IPv6 hop limit by specifying a TTL or hop limit value or range within the **drop** filter action.

This filter action is supported on ingress IPv4 and IPv6 filter policies only. If the filter is configured on an egress interface the packet-length or payload-length match condition is always true.

This **drop** condition is a filter entry action evaluation, and not a filter entry match evaluation. Within this evaluation, the condition is checked after the packet matches the entry based on the specified filter entry match criteria.

Packets that match filter policy entry match criteria and the **drop ttl-value** or **hop-limit-value** are dropped. Packets that match only the filter policy entry match criteria and do not match the **drop ttl-value** or **hop-limit-value** are forwarded with no further match in following filter entries.

Packets matching this filter entry and not matching the conditional criteria are not logged, counted, or mirrored.

- Pattern conditional drop — Traffic can be dropped when it is based on a pattern found in the packet header or data payload. The **pattern** is defined by an **expression**, **mask**, **offset-type**, and **offset-value** match in the first 256 bytes of a packet.

The **pattern expression** is up to 8 bytes long. The **offset-type-value** identifies the starting point for the **offset-value** and the supported offset type values are:

- **layer-3**: layer 3 IP header

- **layer-4**: layer 4 protocol header
- **data**: data payload for TCP or UDP protocols
- **dns-qtype**: DNS request or response query type

The content of the packet is compared with the expression/mask value found at the *offset-type-value* and *offset-value* as defined in the filter entry. For example, if the pattern is expression 0xAA11, mask 0xFFFF, offset-type data, offset-value 20, then the filter entry compares the content of the first 2 bytes in the packet data payload found 20 bytes after the TCP/UDP header with 0xAA11.

This drop condition is a filter entry action evaluation, and not a filter entry match evaluation. Within this evaluation, the condition is checked after the packet matches the entry based on the specified filter entry match criteria.

Packets that match a filter policy's entry match criteria and the pattern, are dropped. Packets that match only the filter policy's entry match criteria and do not match the pattern, are forwarded without a further match in subsequent filter entries.

This filtering capability is supported on ingress IPv4 and IPv6 policies using FP4-based line cards, and cannot be configured on egress. A filter entry using a pattern, is not supported on FP2 or FP3-based line cards. If programmed, the pattern is ignored and the action is **forward**.

Packets matching this filter entry and not matching the conditional criteria are not logged, counted, or mirrored.

- **drop-extracted-traffic** — Traffic extracted to the CPM can be dropped using ingress IPv4 and IPv6 filter policies based on filter match criteria. Any IP traffic extracted to the CPM is subject to this filter action, including routing protocols, snooped traffic, and TTL expired traffic.

Packets that match the filter entry match criteria and extracted to the CPM are dropped. Packets that match only the filter entry match criteria and are not extracted to the CPM are forwarded with no further match in the subsequent filter entries.

Cflowd, log, mirror, and statistics apply to all traffic matching the filter entry, regardless of **drop** or **forward** action.

- **forward** — Allows operators to accept traffic to ingress or egress the system and be subject to regular processing.
- **forward-when** — Allows operators to accept a conditional filter action.

–**Pattern** conditional accept — Traffic can be accepted based on a pattern found in the packet header or data payload. The **pattern** is defined by an **expression**, **mask**, **offset-type**, and **offset-value** match in the first 256 bytes of a packet. The pattern **expression** is up to 8 bytes long. The **offset-type** identifies the starting point for the **offset-value** and the supported offset types are:

- **layer-3**: Layer 3 IP header
- **layer-4**: Layer 4 protocol header
- **data**: data payload for TCP or UDP protocols
- **dns-qtype**: DNS request or response query type

–The content of the packet is compared with the expression/mask value found at the offset-type and offset-value defined in the filter entry. For example, if the pattern is expression 0xAA11, mask 0xFFFF, offset-type data, and offset-value 20, then the filter entry compares the content of the first 2 bytes in the packet data payload found 20 bytes after the TCP/UDP header with 0xAA11.

This accept condition is a filter entry action evaluation, and not a filter entry match evaluation. Within this evaluation, the condition is checked after the packet matches the entry based on the specified filter entry match criteria. Packets that match a filter policy's entry match criteria and the pattern, are accepted. Packets that match only the filter policy's entry match criteria and do not match the pattern, are dropped without a further match in subsequent filter entries.

This filtering capability is supported on ingress IPv4 and IPv6 policies using FP4-based line cards and cannot be configured on egress. A filter entry using a pattern is not supported on FP2 or FP3-based line cards. If programmed, the pattern is ignored and the action is drop.

Packets matching this filter entry and not matching the conditional criteria are not logged, counted, or mirrored.

- **fc** — Allows operators to mark the forwarding class (FC) of packets. This command is supported on ingress IP and IPv6 filter policies. This filter action can be combined with the **rate-limit** *value* action.

Packets matching this filter entry action bypass QoS FC marking and are still subject to QoS queuing, policing and priority marking.

The QPPB forwarding class takes precedence over the filter FC marking action.

- **rate-limit** — This action allows operators to rate-limit traffic matching a filter entry match criteria using IPv4, IPv6, or MAC filter policies.

If multiple interfaces (including LAG interfaces) use the same **rate-limit** filter policy on different FPs, then the system allocates a rate limiter resource for each FP; an independent rate limit applies to each FP.

If multiple interfaces (including LAG interfaces) use the same **rate-limit** filter policy on the same FP, then the system allocates a single rate limiter resource to the FP; a common aggregate rate limit is applied to those interfaces.

Note that traffic extracted to the CPM is not rate limited by an ingress **rate-limit** filter policy while any traffic generated by the router can be rate limited by an egress **rate-limit** filter policy.



**rate-limit** filter policy entries can coexist with cflowd, log, and mirror regardless of the outcome of the rate limit. This filter action is not supported on egress on 7750 SR-a.

Interaction with QoS: Packets matching an ingress **rate-limit** filter policy entry bypass ingress QoS queuing or policing, and only the filter rate limit policer is applied. Packets matching an egress **rate-limit** filter policy bypass egress QoS policing, normal egress QoS queuing still applies.

–IPv4 packet-length and IPv6 payload-length conditional rate limit — Traffic can be rate limited based on the IPv4 packet length and IPv6 payload length by specifying a packet-length value or payload-length value or range within the **rate-limit** filter action. The IPv6 payload-length field does not account for the size of the fixed IP header, which is 40 bytes.

This filter action is supported on ingress IPv4 and IPv6 filter policies only and cannot be configured on egress access or network interfaces.

This **rate-limit** condition is part a filter entry action evaluation, and not a filter entry match evaluation. It is checked after the packet is determined to match the entry based on the configured filter entry match criteria.

Packets that match a filter policy's entry match criteria and the **rate-limit packet-length-value** or **rate-limit payload-length-value** are rate limited. Packets that match only the filter policy's entry match criteria and do not match the **rate-limit packet-length-value** or **rate-limit payload-length-value** are forwarded with no further match in subsequent filter entries.

Cflowd, logging, and mirroring apply to all traffic matching the ACL entry regardless of the outcome of the rate limiter and regardless of the *packet-length-value* or *payload-length-value*.

–IPv4 TTL and IPv6 hop-limit conditional rate limit — Traffic can be rate limited based on the IPv4 TTL or IPv6 hop-limit by specifying a TTL or hop limit value or range within the **rate-limit** filter action using ingress IPv4 or IPv6 filter policies.

The match condition is part of action evaluation (for example, after the packet is determined to match the entry based on other match criteria configured). Packets that match a filter policy entry match criteria and the **rate-limit ttl** or **hop-limit** value are rate limited. Packets that match only the filter policy entry match criteria and do not match the *rate-limit ttl* or *hop-limit* value are forwarded with no further matching in the subsequent filter entries.

Cflowd, logging, and mirroring apply to all traffic matching the ACL entry regardless of the outcome of the **rate-limit** value and the *ttl-value* or *hop-limit-value*.

–Pattern conditional rate limit — Traffic can be rate limited when it is based on a pattern found in the packet header or data payload. The pattern is defined by an **expression**, **mask**, **offset-type**, and **offset-value** match in the first 256 bytes of a packet. The **pattern expression** is up to 8 bytes long. The *offset-type-value* identifies the starting point for the *offset-value* and the supported offset type values are:

- **layer-3**: layer 3 IP header
- **layer-4**: layer 4 protocol header
- **data**: data payload for TCP or UDP protocols
- **dns-qtype**: DNS request or response query type

The content of the packet is compared with the expression/mask value found at the *offset-type-value* and *offset-value* defined in the filter entry. For example, if the pattern is expression 0xAA11, mask 0xFFFF, offset-type data, and offset-value 20, then the filter entry will compare the content of the first 2 bytes in the packet data payload found 20 bytes after the TCP/UDP header with 0xAA11.

This rate limit condition is a filter entry action evaluation, and not a filter entry match evaluation. Within this evaluation, the condition is checked after the packet matches the entry based on the specified filter entry match criteria.

Packets that match a filter policy's entry match criteria and the pattern, are rate limited. Packets that match only the filter policy's entry match criteria and do not match the pattern, are forwarded without a further match in subsequent filter entries.

This filtering capability is supported on ingress IPv4 and IPv6 policies using FP4-based line cards and cannot be configured on egress. A filter entry using a pattern is not supported on FP2 or FP3-based line cards. If programmed, the pattern is ignored and the action is **forward**.

Cflowd, logging, and mirroring apply to all traffic matching this filter entry regardless of the pattern value.

- **forward** “Policy-based Routing/Forwarding (PBR/PBF) action” — Allows operators to permit ingress traffic but change the regular routing/forwarding that a packet would be a subject to. The PBR/PBF is applicable to unicast traffic only. The following PBR/PBF actions are supported (See CLI section for command details):

–**egress-pbr** — Enabling **egress-pbr** activates a PBR action on egress, while disabling **egress-pbr** activates a PBR action on ingress (default).

The following subset of the PBR actions (defined as follows) can be activated on egress: **redirect-policy**, **next-hop router**, and **esi**.

Egress PBR is supported in IPv4 and IPv6 filter policies for ESM only. Unicast traffic that is subject to slow-path processing on ingress (for example, IPv4 packets with options or IPv6 packets with hop-by-hop extension header) will not match egress PBR entries. Filter logging, cflowd, and mirror source are mutually exclusive of configuring a filter entry with an egress PBR action. Configuring **pbr-down-action-override**, if supported with a specific PBR ingress action type, is also supported when the action is an egress PBR action. Processing defined by **pbr-down-action-override** does not apply if the action is deployed in the wrong direction. If a packet matches a filter PBR entry and the entry is not activated for the direction in which the filter is deployed, **action forward** is executed. Egress PBR cannot be enabled in system filters.

- **esi** — Forwards the incoming traffic using VXLAN tunnel resolved using EVPN MP BGP control plane to the first service chain function identified by ESI (Layer 2) or ESI/SF-IP (Layer 3). Supported with VPLS (Layer 2) and IES/VRPN (Layer 3) services. If the service function forwarding cannot be resolved, traffic matches an entry and **action forward** is executed.

For VPLS, no cross-service PBF is supported; that is, the filter specifying ESI PBF entry must be deployed in the VPLS service where BGP EVPN control plane resolution takes place as configured for a specific ESI PBF action. The functionality is supported in filter policies deployed on ingress VPLS interfaces. BUM traffic that matches a filter entry with ESI PBF will be unicast forwarded to the VTEP:VNI resolved through PBF forwarding.

For IES/VRPN, the outgoing R-VPLS interface can be in any VRPN service. The outgoing interface and VRPN service for BGP EVPN control plane resolution must again be configured as part of ESI PBR entry configuration. The functionality is supported in filter policies deployed on ingress IES/VRPN interfaces and in filter policies deployed on ingress and egress for ESM subscribers. Only unicast traffic is subject to ESI PBR; any other traffic matching a filter entry with Layer 3 ESI action will be subject to **action forward**.

When deployed in unsupported direction, traffic matching a filter policy ESI PBR/PBF entry will be subject to **action forward**.

- **lsp** — Forwards the incoming traffic onto the specified LSP. Supports RSVP-TE LSPs (type **static** or **dynamic** only), MPLS-TP LSPs, or SR-TE LSPs. Supported for ingress IPv4/IPv6 filter policies and only deployed on IES SAPs or network interfaces. If the configured LSP is down, traffic matches the entry and **action forward** is executed.

- next-hop** — Changes the IP destination address used in routing from the address in the packet to the address configured in this PBR action. The operator can configure whether the next-hop IP address must be direct (local subnet only) or indirect (any IP). This functionality is supported for ingress IPv4/IPv6 filter policies only, and is deployed on Layer 3 interfaces. If the configured next-hop is not reachable, traffic is dropped and a “ICMP destination unreachable” message is sent. If the indirect keyword is not specified but the IP address is a remote IP address, traffic will be dropped.
  - **interface** — Forwards the incoming traffic onto the specified IPv4 interface. Supported for ingress IPv4 filter policies in global routing table instance. If the configured interface is down or not of the supported type, traffic is dropped.
- redirect-policy** — Implements PBR **next-hop** or PBR **next-hop router** action with ability to select and prioritize multiple redirect targets and monitor the specified redirect targets so PBR action can be changed if the selected destination goes down. Supported for ingress IPv4 and IPv6 filter policies deployed on Layer 3 interfaces only. See section [Redirect Policies](#) for further details.
- remark dscp** — Allows an operator to remark the DiffServ Code Points of packets matching filter policy entry criteria. Packets are remarked regardless of QoS-based in-/out-of- profile classification and QoS-based DSCP remarking is overridden. DSCP remarking is supported both as a main action and as an extended action. As a main action, this functionality applies to IPv4 and IPv6 filter policies of any scope and can only be applied at ingress on either access or network interfaces of Layer 3 services only. Although the filter is applied on ingress the dscp remarking effectively performed on egress. As an extended action, this functionality applies to IPv4 and IPv6 filter policies of any scope and can be applied at ingress on either access or network interfaces of Layer 3 services, or at egress on Layer 3 subscriber interfaces.
- router** — Changes the routing instance a packet is routed in from the upcoming interface’s instance to the routing instance specified in the PBR action (supports both GRT and VPRN redirect). It is supported for ingress IPv4/IPv6 filter policies deployed on Layer 3 interfaces. The action can be combined with the **next-hop** action specifying direct/indirect IPv4/IPv6 next hop. Packets are dropped if they cannot be routed in the configured routing instance. For further details, see section “Traffic Leaking to GRT” in the *7450 ESS, 7750 SR, 7950 XRS, and VSR Layer 3 Services Guide: IES and VPRN*.
- sap** — Forwards the incoming traffic onto the specified VPLS SAP. Supported for ingress IPv4/IPv6 and MAC filter policies deployed in VPLS service. The SAP that the traffic is to egress on must be in the same VPLS service as the incoming interface. If the configured SAP is down, traffic is dropped.

- sdp** — Forwards the incoming traffic onto the specified VPLS SDP. Supported for ingress IPv4/IPv6 and MAC filter policies deployed in VPLS service. The SDP that the traffic is to egress on must be in the same VPLS service as the incoming interface. If the configured SDP is down, traffic is dropped.
- vprn-target** — Redirects the incoming traffic in a similar manner to combined next-hop and LSP redirection actions, but with greater control and slightly different behavior. This action is supported for both IPv4 and IPv6 filter policies and is applicable on ingress of access interfaces of IES/ VPRN services. See [Filter Policy Advanced Topics](#) for further details.
- forward “isa action” — ISA processing actions allow operator to permit ingress traffic and send it for ISA processing as per specified ISA action. The following ISA actions are supported (see CLI section for command details):
  - gtp-local-breakout** — Forwards matching traffic to NAT instead of being GTP tunneled to the mobile operator’s PGW or GGSN. The action applies to GTP-subscriber-hosts. If filter is deployed on other entities, **action forward** is applied. Supported for IPv4 ingress filter policies only. If ISAs performing NAT are down, traffic is dropped.
  - nat** — Forwards matching traffic for NAT. Supported for IPv4/IPv6 filter policies for Layer 3 services in GRT or VPRN. If ISAs performing NAT are down, traffic is dropped. (see CLI for options)
  - reassemble** — Forwards matching packets to the reassembly function. Supported for IPv4 ingress filter policies only. If ISAs performing reassemble are down, traffic is dropped.
  - tcp-mss-adjust** — Forwards matching packets (TCP Syn) to an ISA BB Group for MSS adjustment. In addition to the IP filter, the operator also needs to configure the **mss-adjust-group** command under the Layer 3 service to specify the *bb-group-id* and the new *segment-size*.
- **http-redirect** — Implements the HTTP redirect captive portal. HTTP GET is forwarded to CPM card for captive portal processing by router. See the [HTTP-Redirect \(Captive Portal\)](#) section for more information.
- **ignore-match** — This action allow the operator to disable a filter entry, as a result the entry is not programmed in hardware.

In addition to the above actions:

- An operator can select a **default-action** for a filter policy. The default action is executed on packets subjected to an active filter when none of the filter’s active entries matches the packet. By default, filter policies have default action set to drop but operator can select a default action to be forward instead.

- An operator can override default action applied to packets matching a PBR/PBF entry when the PBR/PBF target is down using **pbr-down-action-override**. Supported options are to drop the packet, forward the packet, or apply the same action as configured for the filter policy's **default-action**. The override is supported for the following PBR/PBF actions. For the last three actions, the override is supported whether in redundancy mode or not.

- forward esi** (Layer 2 or Layer 3)
- forward sap**
- forward sdp**
- forward next-hop [indirect] router**

[Table 52](#) defines default behavior for packets matching a PBR/PBF filter entry when a target is down.

**Table 52**      **Default behavior when a PBR/PBF target is down**

| PBR/PBF action              | Default behavior when down                                                            |
|-----------------------------|---------------------------------------------------------------------------------------|
| forward esi (any type)      | Forward                                                                               |
| forward lsp                 | Forward                                                                               |
| forward next-hop (any type) | Drop                                                                                  |
| forward redirect-policy     | Forward when redirect policy is shutdown                                              |
| forward redirect-policy     | Forward when destination tests are enabled and the best destination is not reachable  |
| forward redirect-policy     | Drop when destination tests are not enabled and the best destination is not reachable |
| forward sap                 | Drop                                                                                  |
| forward sdp                 | Drop                                                                                  |
| forward router              | Drop                                                                                  |
| forward vprn-target         | Forward                                                                               |

#### 4.1.1.6 Viewing Filter Policy Actions

A number of parameters determine the behavior of a packet after it has been matched to a defined criterion or set of criteria:

- the action configured by the user

- the context in which a filter policy is applied. For example, applying a filter policy in an unsupported context can result in simply forwarding the packet rather than applying the configured action.
- external factors, such as the reachability (according to a given test criteria) of a target

Because of this, SR OS provides the following commands that enable the user to capture this context globally and identify how a packet will be handled by the system:

- **show>filter>ip**
- **show>filter>ipv6**
- **show>filter>mac**

This section describes the key information displayed as part of the output for the **show** commands listed above, and explains how to interpret it.

From a configuration point of view, the **show** command output displays the main action (primary and secondary), as well as the extended action.

The “PBR Target Status” field shows the basic information that the system has of the target based on simple verification methods. This information is only shown for the filter entries which are configured in redundancy mode (that is, with both primary and secondary main actions configured), and for ESI redirections. Specifically, the target status in the case of redundancy depends on several factors; for example, on a match in the routing table for next-hop redirects, or on VXLAN tunnel resolution for ESI redirects.

The “Downloaded Action” field specifically describes the action that the system will perform on the packets that match the criterion (or criteria). This typically depends on the context in which the filter has been applied (whether it is supported or not), but in the case of redundancy, it also depends on the target status. For example, the downloaded action will be the secondary main action when the target associated to the primary action is down. In the nominal (for example, non-failure condition) case the “Downloaded Action” will reflect the behavior a packet will be subject to. However, in transient cases (for example, in the case of a failure) it may not be able to capture what will effectively happen to the packet.

The output also displays relevant information such as the default action when the target is down (see [Table 52](#)) as well as the overridden default action when **pbr-down-action-override** has been configured.

There are situations where, collectively, this information does not capture what will effectively happen to the packet throughout the system. To that end, the **effective-action** keyword of the **show>filter>[ip | ipv6 | mac]** commands enables advanced checks to be performed and accurate packet fates to be displayed.

The criteria for determining when a target is down. While there is little ambiguity on that aspect when the target is local to the system performing the steering action, ambiguity is much more prominent when the target is distant. Therefore, because the use of **effective-action** triggers advanced tests, a discrepancy is introduced compared to the action when **effective-action** keyword is not used. This will, for example, be the case for redundant actions.

#### 4.1.1.7 Filter Policy Statistics

Filter policies support per-entry, packet/byte match statistics. The cumulative matched packet/Byte counters are available per ingress and per egress direction. Every packet arriving on an interface/service/subscriber using a filter policy increments ingress or egress (as applicable) matched packet/Byte count for a filter entry the packet matches (if any) on the line card the packet ingresses/egresses. For each policy, the counters for all entries are collected from all line cards, summarized and made available to an operator.

Filter policies applied on access interfaces are downloaded only to line cards that have interfaces associated with those filter policies. If a filter policy is not downloaded to any line card, the statistics show 0. If a filter policy is being removed from any of the line cards the policy is currently downloaded to (as result of association change or when a filter becomes inactive), the associated statistics are reset to 0.

Downloading a filter policy to a new line card continues incrementing existing statistics.

Operational notes:

- Conditional action match criteria filter entries for **ttl**, **hop-limit**, **packet-length**, and **payload-length** support logging and statistics when the condition is met, allowing visibility of filter matched and action executed. If the condition is not met, packets are not logged and statistics against the entry are not incremented.

#### 4.1.1.8 Filter Policy Logging

SR OS supports logging of the information from the packets that match a specific filter policy. Logging is configurable per filter policy entry by specifying preconfigured filter log (**config>filter>log**). A filter log can be applied to ACL filters and CPM hardware filters. Operators can configure multiple filter logs and specify: memory allocated to a filter log destination, syslog ID for filter log destination, filter logging summarization, and wrap-around behavior.



Notes related to filter log summarization:

- The implementation of the feature applies to filter logs with destination syslog.
- Summarization logging is the collection and summarization of log messages for one specific log ID within a period of time.
- The summarization interval is 100 seconds.
- Upon activation of a summary, a mini-table with src/dst-address and count is created for each type (IPv4/IPv6/MAC).
- Every received log packet (due to filter match) is examined for source or destination address.
- If the log packet (source/destination address) matches a source/destination address entry in the mini-table, from a packet received previously, the summary counter of the matching address is incremented.
- If source or destination address of the log messages does not match an entry already present in the table, the source/destination address is stored in a free entry in the mini-table.
- In case the mini-table has no more free entries, only total counter is incremented.
- At expiry of the summarization interval, the mini-table for each type is flushed to the syslog destination.

Operational note:

- Conditional action match criteria filter entries for **ttl**, **hop-limit**, **packet-length**, and **payload-length** support logging and statistics when the condition is met, allowing visibility of filter matched and action executed. If the condition is not met, packets are not logged and statistics against the entry are not incremented.

#### 4.1.1.9 Filter Policy cflowd Sampling

Filter policies can be used to control how cflowd sampling is performed on an IP interface. If an IP interface has cflowd sampling enabled, an operator can exclude some flows for interface sampling by configuring filter policy rules that match the flows and by disabling interface sampling as part of the filter policy entry configurations (**interface-disable-sample**). If an IP interface has cflowd sampling disabled, an operator can enable cflowd sampling on a subset of flows by configuring filter policy rules that match the flows and by enabling cflowd sampling as part of the filter policy entry configurations (**filter-sample**).

The above cflowd filter sampling behavior is exclusively driven by match criteria. The sampling logic applies regardless of whether an action was executed (including evaluation of conditional action match criteria, for example, **packet-length** or **ttl**).

---

## 4.1.1.10 Filter Policy Management

### 4.1.1.10.1 Modifying Existing Filter Policy

There are several ways to modify an existing filter policy. A filter policy can be modified through configuration change or can have entries populated through dynamic, policy-controlled dynamic interfaces; for example, RADIUS, OpenFlow, flowspec, or Gx. Although in general, SR OS ensures filter resources exist before a filter can be modified, because of the dynamic nature of the policy-controlled interfaces, a configuration that was accepted may not be applied in H/W due to lack of resources. When that happens, an error is raised.

A filter policy can be modified directly—by changing/adding/deleting the existing entry in that filter policy—or indirectly. Examples of indirect change to filter policy include changing embedded filter entry this policy embeds (see the [Filter Policy Scope and Embedded Filters](#) section) or changing redirect policy this filter policy uses.

Finally, a filter policy deployed on a specific interface can be changed by changing the policy the interface is associated with.

All of the above changes can be done in service. A filter policy that is associated with service/interface cannot be deleted unless all associations are removed first.

For a large (complex) filter policy change, it may take a few seconds to load and initiate the filter policy configuration. Filter policy changes are downloaded to line cards immediately; therefore, operators should use filter policy copy or transactional CLI to ensure partial policy change is not activated.

### 4.1.1.10.2 Filter Policy Copy and Renumbering

To assist operators in filter policy management, SR OS supports entry copy and entry renumbering operations.

Filter **copy** allows operators to perform bulk operations on filter policies by copying one filter's entries to another filter. Either all entries or a specified entry of the source filter can be selected for copy. When entries are copied, entry order is preserved unless destination filter's entry ID is selected (applicable to single-entry copy). The filter copy allows overwrite of the existing entries in the destination filter by specifying

“overwrite” option during the copy command. Filter copy can be used, for example, when creating new policies from existing policies or when modifying an existing filter policy (an existing source policy is copied to a new destination policy, the new destination policy is modified, then the new destination policy is copied back to the source policy with overwrite specified).

Entry renumbering allows operators to change relative order of a filter policy entry by changing the entry ID. Entry renumbering can also be used to move two entries closer together or further apart, thereby creating additional entry space for new entries.

## 4.1.2 Filter Policy Advanced Topics

### 4.1.2.1 Match List for Filter Policies

The filter match-list **ip-prefix-list**, **ipv6-prefix-list** and **port-list** define a list of IPv4, IPv6 and TCP-UDP ports that can be used as match criteria for line card ip-filter, ipv6-filter and CPM filters.

A match-list simplifies the filter policy configuration with multiple prefixes or ports that can be matched in a single filter entry instead of creating an entry for each.

The same match list can be used in one or more line card, or CPM filter policies. A change in a match-list content is automatically propagated across all policies that use that list.

#### 4.1.2.1.1 Apply-Path

The router supports the auto-generation of IPv4 and IPv6 prefix list entries for BGP peers which are configured in the Base router, or VPRN services using filter **match-list apply-path**. This capability simplifies the management of CPM filters to allow BGP control traffic from trusted configured peers only.

By using the filter **match-list apply-path**, the operator can:

- specify one or more regex expression matches per match list, including wildcard matches (".\*")
- mix auto-generated entries with statically configured entries within a match list

Additional rules are applied when using **apply-path** as follows:

- Operational and administrative states of a specific router configuration are ignored when auto-generating address prefixes.
- Duplicates are not removed when populated by different auto-generation matches and static configuration.
- Configuration fails if auto-generation of an address prefix results in the filter policy resource exhaustion on a filter entry, system, or line card level.

#### 4.1.2.1.2 Prefix-exclude

A prefix can be excluded from an IPv4 or IPv6 prefix list by using the **prefix-exclude** command.

For example, when the operator needs to rate-limit traffic to 10.0.0.0/16 at with exception of 10.0.2.0/24, then the following options are available.

- By applying **prefix-exclude**, a single ip-prefix-list with two prefixes is configured:

```
ip-prefix-list "list-1" create
 prefix 10.0.0.0/16
 prefix-exclude 10.0.2.0/24
exit
```

- Without applying **prefix-exclude**, all eight included subnets should be manually configured in the ip-prefix-list:

```
ip-prefix-list "list-1" create
 prefix 10.0.0.0/23
 prefix 10.0.3.0/24
 prefix 10.0.4.0/22
 prefix 10.0.8.0/21
 prefix 10.0.16.0/20
 prefix 10.0.32.0/19
 prefix 10.0.64.0/18
 prefix 10.0.128.0/17
exit
```

This is a time consuming, and error-prone task compared to using the **prefix-exclude** command.

The filter resources, consumed in hardware, are identical between the two configurations.

A filter match-list using **prefix-exclude** is mutually exclusive with **apply-path**, and is not supported as a match criterion in cpm-filter.

Configured **prefix-exclude** prefixes are ignored when no overlapping larger subnet is configured in the prefix-list. For example: prefix-exclude 1.1.1.1/24 is ignored if the only included subnet is 10.0.0.0/16.

### 4.1.2.2 Filter Policy Scope and Embedded Filters

The system supports four different filter policies:

- scope template
- scope exclusive
- scope embedded
- scope system

Each scope provides different characteristics and capabilities to deploy a filter policy on a single interface, multiple interfaces or optimize the use of system resources or the management of the filter policies when sharing a common set of filter entries.

#### Template and Exclusive

A filter policy of **scope template** can be re-used across multiple interfaces. This filter policy uses a single set of resources per line card regardless of how many interfaces use it. Template filter policies used on access interfaces consume resources on line cards where the access interfaces are configured only. A filter policy of **scope template** is the most common type of filter policies configured in a router.

A filter policy of **scope exclusive** defines a filter dedicated to a single interface. An exclusive filter allows the highest level of customization but uses the most resources on the system line cards as it cannot be shared with other interfaces.

#### Embedded

To simplify the management of filters sharing a common set of filter entries, the operator can create a filter policy of **scope embedded**. This filter can then be included in (embedded into) a filter of **scope template**, *exclusive* or *system*.

Using filter **scope embedded**, a common set of filter entries can be updated in a single place and deployed across multiple filter policies. The scope embedded is supported for IPv4 and IPv6 filter policies.

A filter policy of **scope embedded** is not directly downloaded to a line card and cannot be directly referenced in an interface. However, this policy helps the network operator provision a common set of rules across different filter policies.

The following rules apply when using filter policy of **scope embedded**:

- The operator explicitly defines the **offset** at which to insert a filter of scope embedded in a template, exclusive or system filter. The embedded filter entry-id  $X$  becomes entry-id  $(X + \text{offset})$  in the main filter.
- Multiple filter policies of **scope embedded** can be included (embedded into) in a single filter policy of scope template, exclusive or system.
- The same filter policy of **scope embedded** can be included in multiple filter policies of scope template, exclusive or system.
- Configuration modifications to embedded filter policy entries are automatically applied to all filter policies that embed this filter.
- The system performs a resource management check when a filter policy of scope embedded is updated or embedded in a new filter. If resources are not available, the configuration is rejected. In rare cases, a filter policy resource check may pass but the filter policy can still fail to load due to a resource exhaustion on a line card (for example, when other filter policy entries are dynamically configured by applications like RADIUS in parallel). If that is the case, the embedded filter policy configured will be deactivated (configuration will be changed from activate to inactivate).
- An embedded filter is never embedded partially in a single filter and resources must exist to embed all the entries in a given exclusive, template or system filter. However, an embedded filter may be embedded only in a subset of all the filters it is referenced into, only those where there are sufficient resources available.
- Overlapping of filter entries between an embedded filter and a filter of scope template, exclusive or system filter can happen but should be avoided. It is recommended instead that network operators use a large enough offset value and an appropriate filter entry-id in the main filter policy to avoid overlapping. In case of overlapping entries, the main filter policy entry overwrites the embedded filter entry.
- Configuring a default action in a filter of scope embedded is not required as this information is not used to embed filter entries.

Figure 26 shows a configuration with two filter policies of scope template, filter 100 and 200 each embed filter policy 10 at a different offset:

- Filter policy 100 and 200 are of scope template.
- Filter policy 10 of scope embedded is configured with 4 filter entries: entry-id 10, 20, 30, 40.
- Filter policy 100 embed filter 10 at offset 0 and includes two additional static entries with entry-id 20010 and 20020.
- Filter policy 200 embed filter 10 at offset 10000 and includes two additional static entries with entry-id 100 and 110.

- As a result, filter 100 automatically creates entry 10, 20, 30, 40 while filter 200 automatically creates entry 10010, 10020, 10030, 10040. Filter policy 100 and 200 consumed in total 12 entries when both policies are installed in the same line card.

```
*A:7750>config>filter# info

 ip-filter 10 name "10" create
 scope embedded
 entry 10 create

 exit
 entry 20 create

 exit
 entry 30 create

 exit
 entry 40 create

 exit
 exit
 ip-filter 100 name "100" create
 scope template
 embed-filter 10
 entry 20010 create

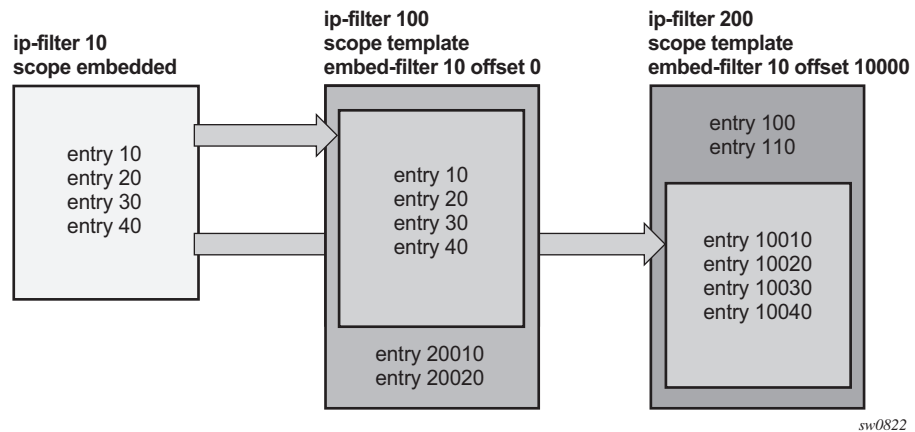
 exit
 entry 20020 create

 exit
 exit
 ip-filter 200 name "200" create
 scope template
 embed-filter 10 offset 10000
 entry 100 create

 exit
 entry 110 create

 exit
 exit

```

**Figure 26 Embedded Filter Policy**

## System

The filter policy of **scope system** provides the most optimized use of hardware resources by programming filter entries once in the line cards regardless of how many IPv4 or IPv6 filter policies of scope template or exclusive use this filter. The system filter policy entries are not duplicated inside each policy that uses it, instead, template or exclusive filter policies can be chained to the system filter using the **chain-to-system-filter** command.

When a template of exclusive filter policy is chained to the system filter, system filter rules are evaluated first before any rules of the chaining filter are evaluated (that is chaining filter's rules are only matched against if no system filter match took place).

The system filter policy is intended primarily for deploying a common set of system level blacklisting and infrastructure level filtering rules to allow, block or rate limit traffic. Other actions like, for example, PBR actions, or redirect to ISAs should not be used unless the system filter policy is activated only in filters used by services that support such action. The “*nat*” action is not supported and should not be configured. Failure to observe these restrictions can lead to unwanted behavior as system filter actions are not verified against the services the chaining filters are deployed for. System filter policy entries also cannot be the sources of mirroring.

System filter policies can be populated using CLI, SNMP, Netconf management interfaces and Openflow policy interface. System filter policy entries cannot be populated using **flowspec**, **RADIUS**, or **Gx**.

An example for IPv4 system filter configuration is shown as follows:

- System filter policy 10 includes a single entry to rate limit NTP traffic to the Infrastructure subnets.



- Filter policy 100 of scope template is configured to use the system filter using the **chain-to-system-filter** command.

```
*7750>config>filter# info

ip-filter 10 name "10" create
 scope system
 entry 10 create
 description "Rate Limit NTP to the Infrastructure"
 match protocol udp
 dst-ip ip-prefix-list "Infrastructure IPs"
 dst-port eq 123
 exit
 action
 rate-limit 2000
 exit
exit
exit
ip-filter 100 name "100" create
 chain-to-system-filter
 description "Filter scope template for network interfaces"
exit
system-filter
 ip 10
exit

```

### 4.1.2.3 Filter Policy Type

The filter policy type defines the list of match criteria available in a filter policy. It provides filtering flexibility by reallocating the CAM in the line card at the filter policy level to filter traffic using additional match criteria not available using filter **type normal**. The filter type is specific to the filter policy, it is not a system wide or line card setting. The operator can configure different filter policy types on different interfaces of the same system and line card.

Mac-filter supports three different filter types: *normal*, *isid*, *vid*.

IPv4 and IPv6 filters support three different filter types: *normal*, *src-mac*, *packet-length*.

#### IPv4, IPv6 filter type src-mac

This filter policy type provides src-mac match criterion for IPv4 and IPv6 filters.

The following match criteria are not available for filter entries in a filter policy of type *src-mac*:

- **IPv4** — src-ip, dscp, ip-option, option-present, multiple-option, src-route-option
- **IPv6** — src-ip

For a QoS policy assigned to the same service or interface endpoint as a filter policy of type `src-mac`, QoS IP criteria cannot use **src-ip** or **dscp** and QoS IPv6 criteria cannot use **src-ip**.

Filter type `src-mac` is available for egress filtering on VPLS services only. R-VPLS endpoints are not supported.

Dynamic filter entry embedding using Openflow, Flowspec and VSD is not supported using this filter type.

### IPv4, IPv6 filter type `packet-length`

This filter policy type provides packet-length match criterion capability. For this match, the system uses the total packet length including both the IP header and payload for IPv4 and IPv6.

The following match criteria are not available for filter entries in a filter policy of type *packet-length*:

- **IPv4** — `dscp`, `ip-option`, `option-present`, `multiple-option`, `src-route-option`
- **IPv6** — `flow-label`

For a QoS policy assigned to the same service or interface endpoint on egress as a filter policy of type `packet-length`, QoS IP criteria cannot use **dscp** match criteria with no restriction to ingress.

This filter type is available for both ingress and egress on all service and router interfaces endpoints with the exception of FPIPE, IPIPE, Video ISA, service templates and PW templates.

### IPv4 and IPv6 filter type and embedding

IPv4 and IPv6 filter policy of scope embedded must have the same **type** as the main filter policy of scope template, exclusive or system embedding it:

- If this condition is not met the filter cannot be embedded.
- Once embedded, the main filter policy cannot change the filter type if one of the embedded filters is of a different type.
- Once embedded, the embedded filter cannot change the filter type if it does not match the main filter policy.

Similarly, the system filter **type** must be identical to the template or exclusive filter to allow chaining when using the **chain-to-system-filter** command.

#### 4.1.2.4 Filter Policies and Dynamic Policy-Driven Interfaces

Filter policy entries can be statically configured using CLI, SNMP, NETCONF or dynamically created using BGP flowspec, OpenFlow, VSD (XMPP), and RADIUS/Diameter for ESM subscribers.

Dynamic filter entries for **flowspec**, **openflow**, and **vsd** can be inserted in a filter of **scope template** or **exclusive** using the **embed-filter** command in IPv4 and IPv6 filter policies.

##### BGP flowspec

BGP flowspec routes are learned in a particular routing instance and can be used to dynamically create filter entries in a given filter policy using the **embed-filter flowspec** command.

The following rules apply to flowspec embedding:

- The operator explicitly defines both the **offset** at which to insert flowspec filter entries and the **router** instance the flowspec routes belongs to. The embedded flowspec filter entry ID is chosen by the system following the *RFC 5575, Dissemination of Flow Specification Rules*. Note that these entry IDs are not necessarily sequential and do not necessarily follow the order at which a rule is received.
- The maximum number of flowspec filter entries in a given filter policy is configurable by the operator at the router or VPRN level using the **ip-filter-max-size** and **ipv6-filter-max-size** commands. This limit defines the boundary for flowspec embedding in a filter policy (**offset** and **ip-filter-max-size**).
- The router instance defined in the **embed-filter flowspec** command must match the router interface on which the filter policy is applied to and the router instance the flowspec routes are received from.
- See section [IPv4/IPv6 Filter Policy Entry Match Criteria](#) on embedded filter scope for recommendations on filter entry ID spacing and overlapping of entries.

The following is a flowspec configuration example:

- The maximum number of flowspec routes in the base router instance is configured for 50,000 entries using the **ip-filter-max-size** command.
- The filter policy 100 of **scope template** is configured to embed flowspec routes from the base router instance at offset 100,000. The offset chosen in this example avoids overlapping with statically defined entries in the same policy. In this case, the statically defined entries can use the entry ID range 1-99999 and 149999-2M for defining static entries before or after the flowspec filter entries.

```
A:7750>config>router#
```

```
flowspec
 ip-filter-max-size 50000
exit

A:7750>config>filter# info

 ip-filter 100 name "100" create
 embed-filter flowspec router "Base" offset 100000
 exit

```

## OpenFlow

The embedded filter infrastructure is used to insert OpenFlow rules into an existing filter policy. See [Hybrid OpenFlow Switch](#) for more details. Policy-controlled auto-created filters are re-created on system reboot. Policy controlled filter entries are lost on system reboot and need to be re-programmed.

## VSD

VSD filters are created dynamically using XMPP and managed using a Python script so rules can be inserted into or removed from the correct VSD template or embedded filters. XMPP messages received by the 7750 SR are passed transparently to the Python module to generate the appropriate CLI. For more information about VSD filter provisioning, automation, and Python scripting details refer to the 7450 ESS, 7750 SR, 7950 XRS, and VSR Layer 2 Services and EVPN Guide: VLL, VPLS, PBB, and EVPN.

## RADIUS/Diameter for Subscriber Management

The operator can assign filter policies or filter entries used by a subscriber within a preconfigured filter entry range defined for RADIUS or Diameter. Refer to the 7450 ESS, 7750 SR, and VSR Triple Play Service Delivery Architecture Guide and filter RADIUS-related commands for more details.

### 4.1.2.5 Primary and Secondary Filter Policy Action for PBR/PBF Redundancy

In some deployments, operators may want to specify a backup PBR/PBF target if the primary target is down. SR OS allows the configuration of a primary action (**config>filter>{ip-filter | ipv6-filter | mac-filter}>entry>action**) and a secondary action (**config>filter>{ip-filter | ipv6-filter | mac-filter}>entry>action secondary**) as part of a single filter policy entry. The secondary action can only be configured if the primary action is configured.

For Layer 2 PBF redundancy, the operator can configure the following redundancy options:

- **action forward sap AND action secondary forward sap**
- **action forward sdp AND action secondary forward sdp**
- **action forward sap AND action secondary forward sdp**
- **action forward sdp AND action secondary forward sap**

For Layer 3 PBR redundancy, an operator can configure any of the following actions as a primary action and any (either same or different than primary) of the following as a secondary action. Furthermore, none of the parameters need to be the same between primary and secondary actions. Although the following commands refer to IPv4 in the *ip-address* parameter, they also apply to IPv6.

- **forward next-hop *ip-address* router *router-instance***
- **forward next-hop *ip-address* router *service-name* *service-name***
- **forward next-hop indirect *ip-address* router *router-instance***
- **forward next-hop indirect *ip-address* router *service-name* *service-name***

When primary and secondary actions are configured, PBR/PBF uses the primary action if its target is operationally up, or it uses the secondary action if the primary PBR/PBF target is operationally down. If both targets are down, the default action when the target is down (see [Table 52](#)), as per the primary action, is used, unless **pbr-down-action-override** is configured.

When PBR/PBF redundancy is configured, the operator can use sticky destination functionality for a redundant filter entry. When sticky destination is configured (**config>filter>{ip-filter | ipv6-filter | mac-filter}>entry>sticky-dest**), the functionality mimics that of sticky destination configured for redirect policies. To force a switchover from the secondary to the primary action when sticky destination is enabled and secondary action is selected, the operator can use the **tools>perform>filter>{ip-filter | ipv6-filter | mac-filter}>entry>activate-primary-action** command. Sticky destination can be configured even if no secondary action is configured.

The control plane monitors whether primary and secondary actions can be performed and programs forwarding filter policy to use either the primary or secondary action as required. More generally, the state of PBR/PBF targets is monitored in the following situations:

- when a secondary action is configured
- when sticky destination is configured
- when a **pbr-down-action-override** is configured

The **show>filter>{ip-filter | ipv6-filter | mac-filter} [entry]** command displays which redundant action is activated or downloaded, including when both PBR/PBF targets are down. The following example shows partial output of the command as applicable for PBF redundancy.

```
*A:vsim-200001# show filter ip 10 entry 1000
...
Primary Action : Forward (SAP) <-details of (primary) action
 Next Hop : 1/1/1
 Service Id : Not configured
 PBR Target Status : Does not exist
Secondary Action : Forward (SAP) <-details of secondary action
 Next Hop : 1/1/2
 Service Id : Not configured
 PBR Target Status : Does not exist
PBR Down Action : Forward (pbr-down-action-override) <- PBR down behavior
Downloaded Action : None <- currently downloaded action
Dest. Stickiness : 1000 Hold Remain : 0 <-
 sticky dest details
```

#### 4.1.2.6 Extended Action for Performing Two Actions at a Time

In certain deployment scenarios, for example to realize service function chaining, operators may want to perform a second action in addition to a traffic steering action. SR OS allows this behavior by configuring an extended action for a main action. This functionality is supported for Layer 3 traffic steering (that is, PBR) and more specifically for the following main actions:

- **forward esi** (Layer 3 version)
- **forward lsp**
- **forward next-hop [indirect] [router]**
- **forward next-hop interface**
- **forward redirect-policy**
- **forward router**
- **forward vprn-target**

Furthermore, the capability to specify an extended action is also supported in the case of PBR redundancy, therefore for the following action:

- **forward next-hop [indirect] router**

The supported extended action is:

- **remark dscp** *dscp-name*

The extended action is available in the following contexts: **config>filter>ip-filter>entry>action>extended-action** and **config>filter>ipv6-filter>entry>action>extended-action**.

If the status of the target of the main action is tracked, which is the case, amongst others, for PBR/PBF redundancy, the extended action listed above will not be performed when the PBR target is down. Moreover, a filter policy containing an entry with the extended action **remark dscp** will be blocked in the following cases:

- if applied on ingress with the **egress-pbr** flag set
- if applied on egress without the **egress-pbr** flag set

The latter case includes actions that are not supported on egress (and for which **egress-pbr** cannot be set).

#### 4.1.2.7 Advanced VPRN Redirection

The **vprn-target** action is a resilient redirection capability which combines both data-path and control plane lookups to achieve the desired redirection. It allows for the following redirection models:

- redirection towards the default PE while selecting a specific LSP to use
- redirection towards an alternative PE while selecting or not a specific LSP to use. If a specific LSP is not selected, then the system will automatically select one based on the BGP next-hop tunnel resolution mechanism
- all of the above within any VPRN

When configuring this action, the user must specify the target BGP next-hop (**bgp-nh**) towards which the redirection should occur, as well as the routing context (**router**) in which the necessary lookups will be performed (to derive the service label).

The target BGP next-hop can be configured with any label allocation method (label per VRF, label per next-hop, label per prefix). These methods entail different forwarding behaviors; however, the steering node is not aware of the configuration of the target node. If the user does not specify an advertised route prefix (**adv-prefix**), the steering node will assume that label per VRF is used by the target node and will select the service label accordingly. If the target node is not operating according to the label per VRF method, the user must specify an appropriate route prefix for which a service label is advertised by the target node, keeping in mind the resulting forwarding behavior at the target node of the redirected packet. This specification will instruct the steering node to use that specific service label.

Be aware that the system will perform an exact match between the specified *ip-address/mask* (or *ipv6-address/prefix-length*) and the advertised route.

The user can specify an LSP (RSVP-TE, MPLS-TP, or SR-TE LSP) to use towards the BGP next-hop. If no LSP is specified, the system will automatically select one the same way it would have done when normally forwarding a packet towards the BGP next-hop.



**Note:** While the system only performs the redirection when the traffic is effectively able to reach the target BGP next-hop, it does not verify whether the redirected packets will effectively reach their destination after that.

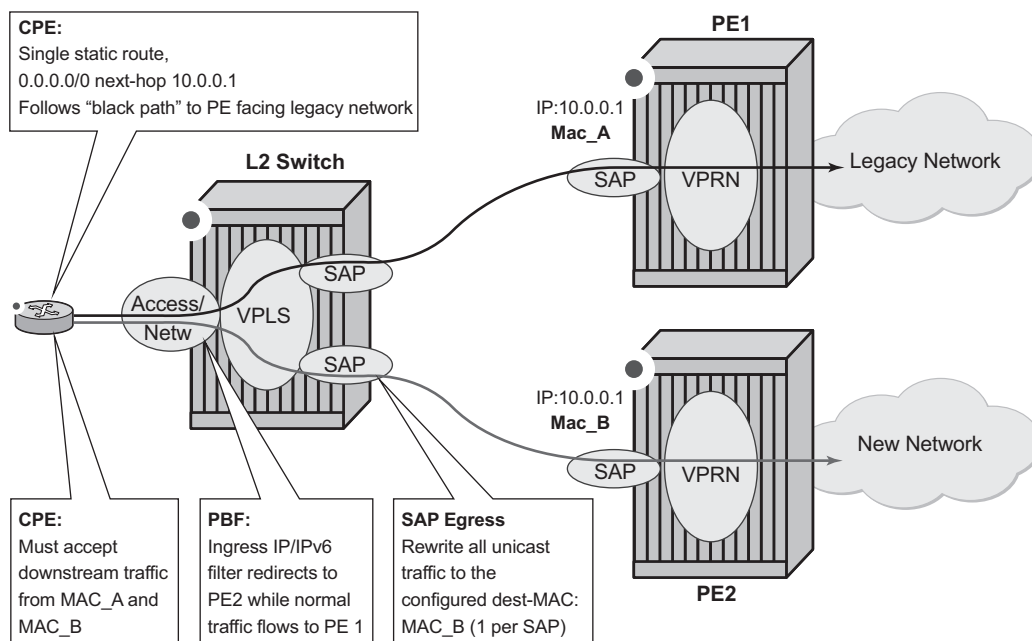
This action is resilient in that it tracks events affecting the redirection at the service level and reacts to those events. As such, the system will perform the redirection as long as it can reach the target BGP next-hop using the proper service label. If the redirection cannot be performed (for example, if no LSP is available, the peer is down, or there is no more specific labeled route), the system will revert to normal forwarding. This can be overridden and configured to drop. A maximum of 8k of unique (3-tuple {**bgp-nh**, **router**, **adv-prefix**}) redirection targets can be tracked.

#### 4.1.2.8 Destination MAC Rewrite When Deploying Policy-Based Forwarding

For Layer 2 Policy-Based Forwarding (PBF) redirect actions, a far-end router may discard redirected packets when the PBF changes the destination IP interface the packet arrives on. This happens when a far-end IP interface uses a different MAC address than the IP interface reachable via normal forwarding (for example, one of the routers does not support a configurable MAC address per IP interface). To avoid the discards, operators can deploy egress destination MAC rewrite functionality for VPLS SAPs (**config>service>vpls>sap>egress>dest-mac-rewrite**). [Figure 27](#) shows a sample deployment.



**Figure 27 Layer 2 Policy-Based Forwarding (PBF) redirect action**



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When enabled, all unicast packets have their destination MAC rewritten to operator-configured value on an Layer 2 switch VPLS SAP. Multicast and broadcast packets are unaffected. The feature:

- Is supported for regular and split-horizon group Ethernet SAPs in a regular VPLS Service
- Is expected to be deployed on a SAP that faces far-end IP interface (either a SAP that is the target of PBF action, as shown in [Figure 27](#), or a VPLS SAP of a downstream Layer 2 switch that is connected to a far-end router—not shown).
- Applies to any unicast egress traffic including LI and mirror.

Restrictions:

- Is mutually exclusive with SAP MAC ingress and egress loopback feature: **tools perform service id service-id loopback eth sap sap-id {ingress | egress} mac-swap ieee-address**

### 4.1.2.9 Network-port VPRN Filter Policy

Network-port Layer 3 service-aware filter feature allows operators to deploy VPRN service aware ingress filtering on network ports. A single ingress filter of **scope template** can each be defined for IPv4 and for IPv6 against a VPRN service. The filter applies to all unicast traffic arriving on auto-bind and explicit-spoke network interfaces for that service. The network interface can be either Inter-AS, or Intra-AS. The filter does not apply to traffic arriving on access interfaces (SAP, spoke-sdp, network-ingress (CsC, rVPLS, eVPN).

The same filter can be used on access interfaces of the specific VPRN, can embed other filters (including OpenFlow), can be chained to a system filter, and can be used by other Layer 2 or Layer 3 services.

The filter is deployed on all line cards (chassis network mode D is required). There are no limitations related to filter match/action criteria or embedding. The filter is programmed on line cards against ILM entries for this service. All label-types are supported. If an ILM entry has a filter index programmed, that filter is used when the ILM is used in packet forwarding; otherwise, no filter is used on the service traffic.

Restrictions:

- Network port Layer 3 service-aware filters do not support flowspec and LI (cannot use filter inside LI infrastructure nor have LI sources within the VPRN filter).

### 4.1.2.10 ISID MAC Filters

ISID filters are a type of MAC filters that allows filtering based on the ISID values rather than Layer 2 criteria used by MAC filters of type **normal** or **vid**. ISID filters can be deployed on iVPLS PBB SAPs and ePipe PBB SAPs in the following scenarios:

The MMRP usage of the MRP policy ensures automatically that traffic using Group BMAC is not flooded between domains. However, there could be small transitory periods when traffic originated from PBB BEB with unicast BMAC destination may be flooded in the BVPLS context as unknown unicast in the BVPLS context for both iVPLS and PBB Epipe. To restrict distribution of this traffic for local PBB services, ISID filters can be deployed. The MAC filter configured with ISID match criterion can be applied to the same interconnect endpoints (BVPLS SAP or PW) as the MRP policy to restrict the egress transmission of any type of frames that contains a local ISID. The ISID filters will be applied as required on a per B-SAP or B-PW basis, just in the egress direction.

The ISID match criteria are exclusive with any other criteria under **mac-filter**. A new **mac-filter** type attribute is defined to control the use of ISID match criteria and must be set to ISID to allow the use of ISID match criteria.

#### 4.1.2.11 VID MAC Filters

VID filters are a type of MAC filters that extend the capability of current Ethernet ports with null or default SAP tag configuration to match and take action on VID tags. Service delimiting tags (for example, QinQ 1/1/1:10.20 or dot1q 1/1/1:10, where outer tag 10 and inner tags 20 are service delimiting) allow fine granularity control of frame operations based on the VID tag. Service delimiting tags are exact match and are stripped from the frame as shown in [Figure 28](#). Exact match or service delimiting tags do not require VID filters. VID filters can only be used to match on frame tags that are after the service delimiting tags.

With VID filters, operators can choose to match VID tags for up to two tags on ingress, egress, or both.

- The outer tag is the first tag in the packet that is carried transparently through the service.
- The inner tag is the second tag in the packet that is carried transparently through the service.

VID filters add the capability to perform VID value filter policies on default tags (1/1/1:\*, or 1/1/1:x.\*, or 1/1/1:\*.0) or null tags (1/1/1, 1/1/1:0, or 1/1/1:x.0). The matching is based on the port configuration and the SAP configuration.

At ingress, the system looks for the two outer-most tags in the frame. If present, any service delimiting tags are removed and not visible to VID MAC filtering. For example:

- 1/1/1:x.y SAP has no tag left for VID MAC filter to match on (outer-tag and inner-tag = 0)
- 1/1/1:x.\* SAP has potentially one tag in the \* position for VID MAC filter to match on
- SAP such as 1/1/1, 1/1/1:\*, or 1/1/1:\*. \* can have as many as two tags for VID MAC filter to match on
- For the remaining tags, the left (outer-most) tag is what is used as the outer tag in the MAC VID filter. The following tag is used as the inner tag in the filter. If any of these positions do not have tags, a value of 0 is used in the filter. At egress, the VID MAC filter is applied to the frame prior to adding the additional service tags.

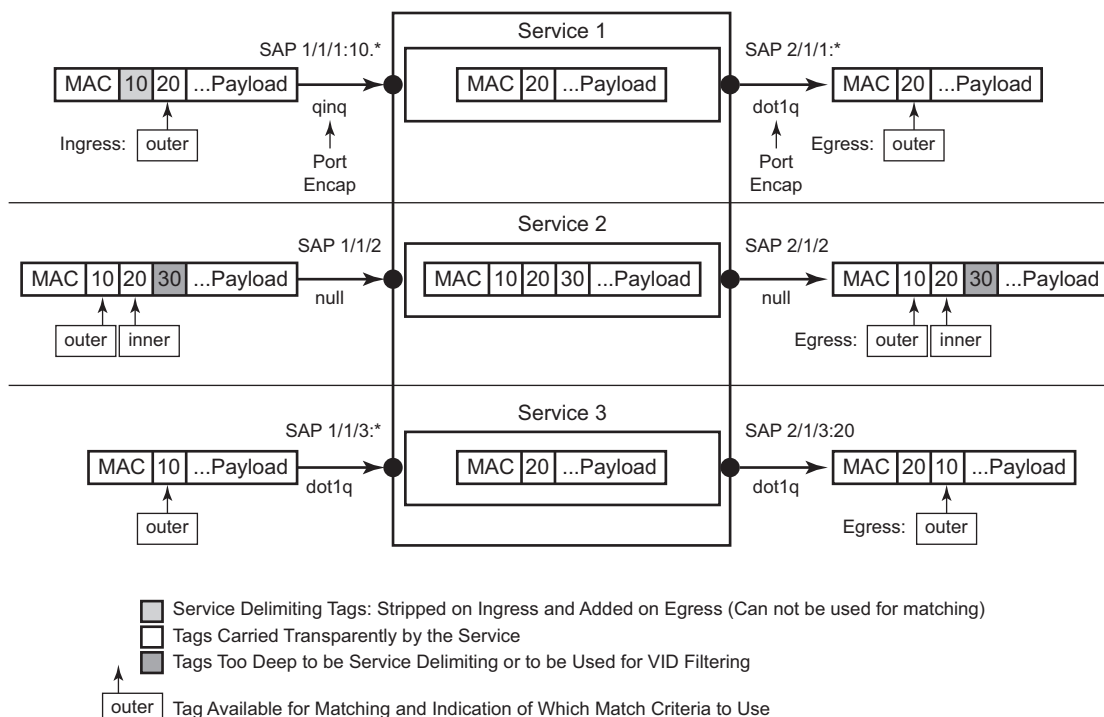
In the industry, the QinQ tags are often referred to as the C-VID (customer VID) and S-VID (service VID). The terms outer tag and inner tag allow flexibility without having to refer to C-TAG and S-TAG explicitly. The position of inner and outer tags is relative to the port configuration and SAP configuration. Matching of tags is allowed for up to the first two tags on a frame because service delimiting tags may be 0, 1, or 2 tags.

The meaning of inner and outer has been designed to be consistent for egress and ingress when the number of non-service delimiting tags is consistent. Service 1 in [Figure 28](#) shows a conversion from QinQ to a single dot1q example where there is one non-service delimiting tag on ingress and egress. Service 2 shows a symmetric example with two non-service delimiting tags (plus and additional tag for illustration) to two non-service delimiting tags on egress. Service 3 shows a single non-service delimiting tag on ingress and two tags with one non-service delimiting tag on ingress and egress.

SAP-ingress QoS setting allows for MAC-criteria type VID, which uses the VID filter matching capabilities of QoS and VID Filters (see the *7450 ESS*, *7750 SR*, *7950 XRS*, and *VSR Quality of Service Guide*).

A VID filter entry can also be used as a debug or lawful intercept mirror source entry.

**Figure 28 VID Filtering Examples**



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VID filters are available on Ethernet SAPs for Epipe, VPLS, or I-VPLS including eth-tunnel and eth-ring services.

#### 4.1.2.11.1 Arbitrary Bit Matching of VID Filters

In addition to matching an exact value, a VID filter mask allows masking any set of bits. The masking operation is  $((\text{value and vid-mask}) = (\text{tag and vid-mask}))$ . For example: A value of 6 and a mask of 7 would match all VIDs with the lower 3 bits set to 6. VID filters allow explicit matching of VIDs and matching of any bit pattern within the VID tag.

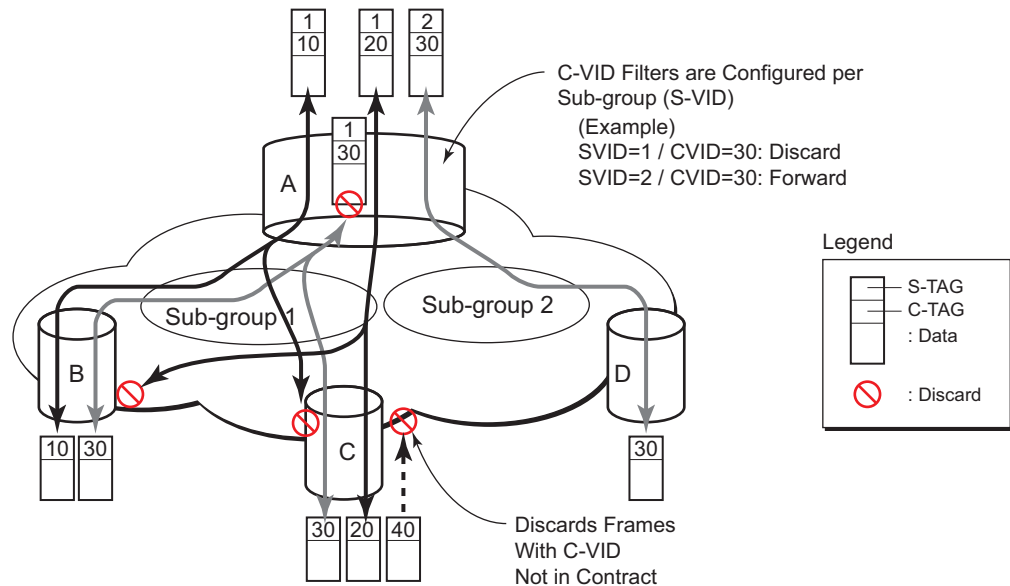
When using VID filters on SAPs, only VID filters are allowed on this SAP. Filters of type normal and ISID are not allowed.

An additional check for the "0" VID tag may be required when using certain wild card operations. For example, frames with no tags on null encapsulated ports will match a value of 0 in outer tag and inner tag because there are no tags in the frame for matching. If a zero tag is possible but not wanted, it can be explicitly filtered using exact match on "0" prior to testing other bits for "0".

**config>system>ethernet>new-qinq-untagged-sap** is a special QinQ function for single tagged QinQ frames with a null second tag. Using this in combination with VID filters is not recommended. The outer tag is the only tag available for filtering on egress for frames arriving from MPLS SDPs or from PBB services, even though additional tags may be carried transparently.

### 4.1.2.11.2 Port Group Configuration Example

**Figure 29 Port Groups**



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Figure 29 shows a customer use example where some VLANs are prevented from ingressing or egressing certain ports. In the example, port A sap 1/1/1:1.\* would have a filter as shown below while port A sap 1/1/1:2.\* would not.:

```
mac-filter 4 create
 default-action forward
 type vid
 entry 1 create
 match frame-type ethernet_II
 outer-tag 30 4095
 exit
 action drop
 exit
exit
```

### 4.1.2.12 IP Exception Filters

IP exception filters scan all outbound traffic entering an NGE domain and allow packets that match the exception filter criteria to transit the NGE domain unencrypted. For information on IP exception filters supported by NGE nodes, refer to section [2.8.5, Router Encryption Exceptions using ACLs](#).

The most basic IP exception filter policy must have the following:

- an exception filter policy ID
- scope, either exclusive or template
- at least one filter entry with a specified matching criteria

### 4.1.2.13 Redirect Policies

SR OS-based routers support configuring of IPv4 and IPv6 redirect policies. Redirect policies allow specifying multiple redirect target destinations and defining status check test methods used to validate the ability for a destination to receive redirected traffic. This destination monitoring allows routers to react to target destination failures. To specify an IPv4 redirect policy, define all destinations to be IPv4. To specify an IPv6 redirect policy, define all destinations to be IPv6. IPv4 redirect policies can only be deployed in IPv4 filter policies. IPv6 redirect policy can only be deployed in IPv6 filter policies.

Redirect policies support the following destination tests:

- **ping test** – with configurable interval, drop-count, and time-out
- **unicast-rt-test** – unicast routing reachability, supported only when router instance is configured for a specific redirect policy. The test yields true if the route to the specified destination exists in RTM for the configured router instance.

Each destination is assigned an initial or base priority describing this destination's relative importance within the policy. The destination with the highest priority value is selected as most-preferred destination and programmed on line cards in filter policies using this redirect policy as an action. Only destinations that are not disabled by the programmed test (if configured) are considered when selecting the most-preferred destination.

In some deployments, it may not be necessary to switch from a currently active, most-preferred redirect-policy destination when a new more-preferred destination becomes available. To support such deployments, operators can enable the sticky destination functionality (**config>filter>redirect-policy>sticky-dest**). When enabled, the currently active destination remains active unless it goes down or an operator forces the switch using the **tools>perform>filter>redirect-policy>activate-best-dest** command. An optional sticky destination *hold-time-up* is available to delay programming the sticky destination in the redirect policy (transition from **action forward** to PBR action to the most-preferred destination). When the timer is enabled, the first destination that comes up will not be programmed and instead the timer is started. Once the timer expires, the most-preferred destination at that time will be programmed (which may be a different destination from the one that started the timer). Note the following:

- When the manual switchover to most-preferred destination is executed as described above, the hold-time-up is stopped.
- When the timer value is changed, the new value takes immediate effect and the timer is restarted with the new value (or expired if **no-hold-time-up** is configured).



**Note:** The **unicast-rt-test** command will fail when performed in the context of a VPRN routing instance when the destination is routable only through **grt-leak** functionality. **ping-test** is recommended in such cases.

Feature restrictions:

- Redirect policy is supported for ingress IPv4 and IPv6 filter policies only.
- Different platforms support different scale for redirect policies. Contact your local Nokia representative to ensure the planned deployment does not exceed recommended scale.

#### 4.1.2.13.1 Router Instance Support for Redirect Policies

There are two modes of deploying redirect policies on VPRN interfaces. The functionality supported depends on the configuration of the **redirect-policy** router option with **config>filter>redirect-policy>router**:

- Redirect policy with router option enabled (recommended):
  - When a PBR destination is up, the PBR lookup is performed in the redirect policy's configured routing instance. When that instance differs from the incoming interface where the filter policy using the specific redirect policy is deployed, the PBR action is equivalent to forward next-hop router filter policy action.
  - When all PBR destinations are down (or a hardware does not support action router), **action forward** is programmed and the PBR lookup is performed in the routing instance of the incoming interface where the filter policy using the specific redirect policy is deployed.
  - Any destination tests configured are executed in the routing context specified by the redirect policy.
  - Changing router configuration for a redirect policy brings all destinations with a test configured down. The destinations are brought up once the test confirms reachability based on the new redirect policy router configuration.
- Redirect policy without router option disabled (**no router**) or with router options not supported (legacy):



- When a PBR destination is up, the PBR lookup is performed in the routing instance of the incoming interface where the filter policy using the specific redirect policy is deployed.
- When all PBR destinations are down, **action forward** is programmed and the PBR lookup is performed in the routing instance of the incoming interface where the filter policy using the specific redirect policy is deployed.
- Any destination tests configured are always executed in the Base router instance regardless of the router instance of the incoming interface where the filter policy using the specific redirect policy is deployed.

Restrictions:

- Only **unicast-rt-test** and **ping-test** are supported when the router option is enabled.

#### 4.1.2.13.2 Binding Redirect Policies

Redirect policies can switch from a specific destination to a new destination in a coordinated manner as opposed to independently as a function of the reachability test results of their configured destinations. This is achieved by binding together destinations of redirect policies using the **config>filter>redirect-policy-binding** command. SR OS combines the reachability test results (either TRUE or FALSE) from each of the bound destinations and forms a master test result which prevails over each independent result. The combined result can be obtained by applying either an AND function or an OR function. For the AND function, all destinations must be UP (reachability test result equals TRUE) for each destination to be considered UP. Conversely, a single destination must be DOWN for each to be considered DOWN; for the OR case, a single destination needs to be UP for each destination to be considered UP. Apart from the master test, which overrides the test result of each destination forming a binding, redirect policies are unaltered. For stickiness capability, switching towards a more-preferred destination in a specified redirect policy does not occur until the timers (if any) of each of the associated destinations have expired.

There is no specific constraint regarding destinations that can be bound together. For example, it is possible to bind destinations of different address families (IPv4 or IPv6), destinations with no test, destinations with multiple tests, or destinations of redirect policies which are administratively down. However, some specific scenarios exist when binding redirect policies:

- A destination that is in the Administratively down state is considered DOWN (that is, as if its test result was negative, even if no test had been performed).

- An Administratively down redirect policy is equivalent to a policy with all destinations in an Administratively down state. The system will do a simple forward.
- A destination with no test is considered always UP.
- If a destination has multiple tests, all tests must be positive for the destination to be considered UP (logical AND between its own tests results).
- Destination tests are performed even if a redirect policy has not been applied (that is, not declared as an action of a filter which itself has been applied).

#### 4.1.2.14 HTTP-Redirect (Captive Portal)

SR OS routers support redirecting HTTP traffic by using the line card ingress IP and IPv6 filter policy action **http-redirect**. This capability is mainly used in a **subscriber-management** context to redirect a subscriber web session to a captive portal landing page.

Examples of use-cases include redirecting a subscriber after initial connection to a new network to accept the terms of service, or a subscriber out of quota redirection.

Traffic matching the **http-redirect** filter entry is sent to the SF/CPM for HTTP redirection:

- The SF/CPM completes the TCP three-way handshake for new TCP sessions on behalf of the intended server, and responds to the HTTP GET request with an 302 redirect. Therefore, the subscriber web session is redirected to the portal landing page configured in the **http-redirect** filter action.
- Non TCP flows are ignored
- TCP flows other than HTTP, matching an **http-redirect** filter action, are TCP reset after the three-way handshake. Therefore, it is recommended to configure the **http-redirect** filter entry to match only TCP port 80. HTTPs uses TLS as underlying protocol, and cannot be redirected to a landing page.

Additional subscriber information may be required by the captive portal. This information can be appended as variables in the **http-redirect** URL and automatically substituted with the relevant subscriber session data, as follows:

- \$IP - subscriber host IP address
- \$MAC - subscriber host MAC address
- \$URL - original requested URL
- \$SAP - subscriber SAP
- \$SUB - subscriber identification string

- \$CID - circuit-ID, or interface-ID of the subscriber host (hexadecimal format)
- \$RID - remote-ID of the subscriber host (hexadecimal format)
- \$SAPDESC - configured SAP description

The recommended filter configuration to redirect HTTP traffic page is described below using ingress ip-filter policy "10":

- entry 10: Allows DNS UDP port 53 to a list of allowed DNS servers. Allowing DNS is mandatory for a web client to resolve a URL in the first place. The UDP port directionality indicates DNS request. The destination IP match criteria is optional, creating a list that includes the operator DNS, and the most common open DNS servers provide the most security, allowing, alternatively, UDP dst-port 53 alone is another option.
- entry 20: Allows HTTP TCP port 80 traffic to the portal landing page defined as a prefix-list. The TCP port directionality indicates an HTTP request. Optionally, the operator can create an additional entry to allow TCP port 443 in case the landing page uses both HTTP and HTTPS.
- entry 30: Redirects all TCP port 80 traffic, other than entry 20, to the landing page URL [http://www.mydomain.com/redirect.html?subscriber=\\$SUB&ipaddress=\\$IP&mac=\\$MAC&location=\\$SAP](http://www.mydomain.com/redirect.html?subscriber=$SUB&ipaddress=$IP&mac=$MAC&location=$SAP).
- entry 40: Drops explicitly any other IP flows, as in the following configuration example:

```
ip-filter 10 name "10" create
 entry 10 create
 description "Allow DNS Traffic to DNS servers"
 match protocol udp
 dst-ip ip-prefix-list "dns-servers"
 dst-port eq 53
 exit
 action
 forward
 exit
 exit
 entry 20 create
 description "Allow HTTP traffic to redirect portal"
 match protocol tcp
 dst-ip ip-prefix-list "portal-servers"
 dst-port eq 80
 exit
 action
 forward
 exit
 exit
 entry 30 create
 description "HTTP Redirect all other TCP 80 flows"
 match protocol tcp
 dst-port eq 80
 exit
 action
 http-redirect "http://www.mydomain.com/
 redirect.html?subscriber=$SUB&ipaddress=$IP&mac=$MAC&location=$SAP."
```

```
 exit
 exit
 entry 40 create
 description "Drop anything else"
 action
 drop
 exit
 exit
exit
```

Also, the router supports two redirect scale modes that are configurable at the system level. The **optimized-mode** improves the number of HTTP redirect sessions supported by system as compared to the **no optimized-mode**, as follows:

```
A>config>system>cpm-http-redirect#

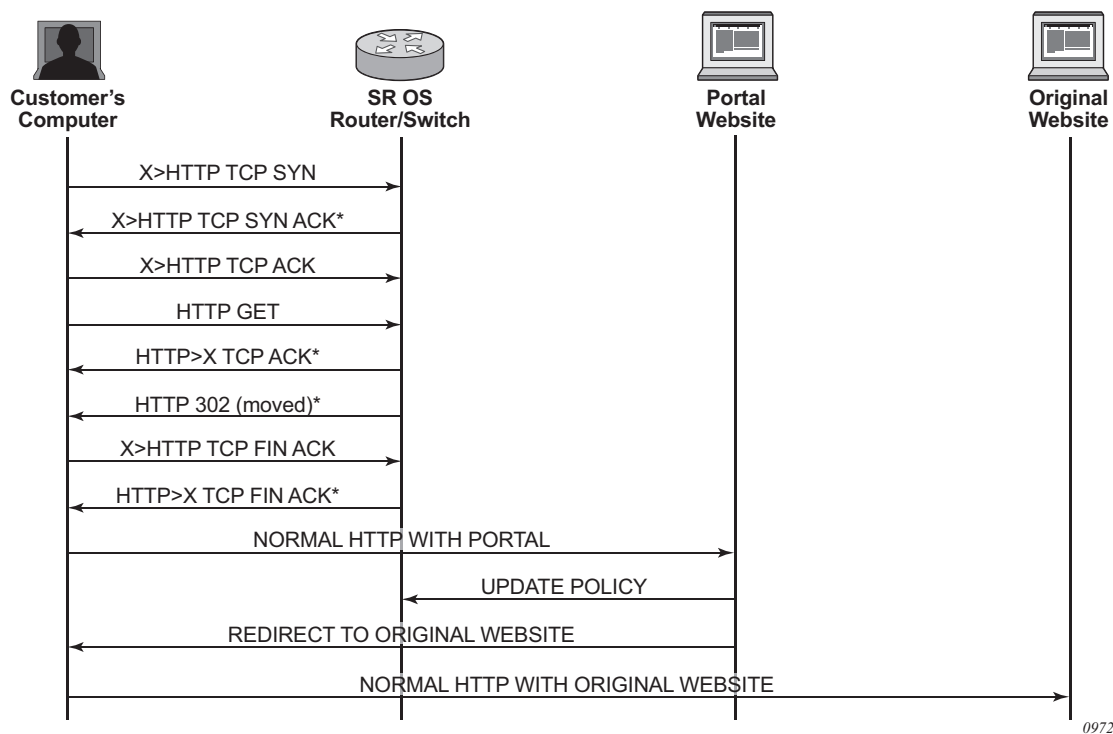
optimized-mode

```

#### 4.1.2.14.1 Traffic Flow

The following example provides a brief scenario of a subscriber connecting to a new network, where it is required to authenticate or accept the network terms of use, before getting access to Internet:

1. The subscriber typically receives an IP address upon connecting to the network using DHCP, and is assigned a filter policy to redirect HTTP traffic to a web portal.
2. The subscriber HTTP session TCP traffic is intercepted by the router. The CPM completes the TCP three-way handshake on behalf of the destination HTTP server, and responds to the HTTP request with an HTTP 302 "Moved Temporarily" response. This response contains the URL of the web portal configured in the filter policy.
3. Upon receiving this redirect message, the subscriber web browser closes the original TCP session, and opens a new TCP session to the redirection portal.
4. The subscriber can now authenticate or accept the terms of use. Once done, the subscriber filter policy is dynamically modified.
5. The subscriber can now connect to the original Internet site.

**Figure 30 Web Redirect Traffic Flow**


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#### 4.1.2.15 Filter Policy-based ESM Service Chaining

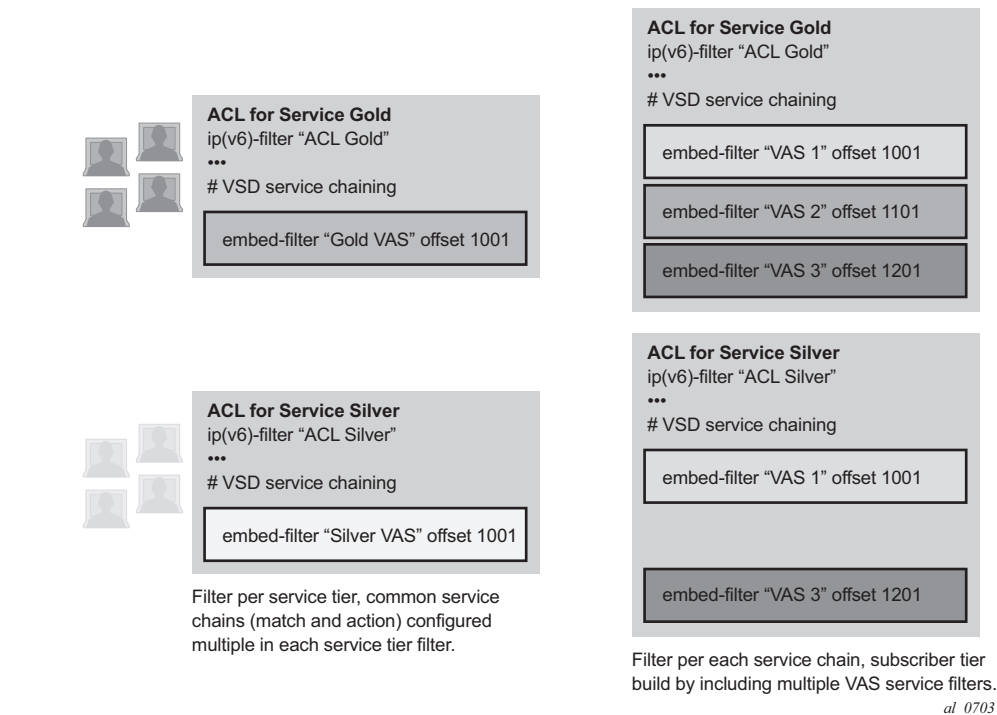
In some deployments, operators may select to redirect ESM subscribers to Value Added Services (VAS). Various deployment models can be used but often subscribers are assigned to a specific residential tier-of-service, which also defines the VAS available to subscribers of the specific tier. The subscribers are redirected to VAS based on tier-of-service rules but such an approach can be hard to manage when many VAS services/tiers of service are desired. Often the only way to identify a subscriber's traffic with a specific tier-of-service is to preallocate IP/IPv6 address pools to a specific service tier and use those addresses in VAS PBR match criteria. This creates an application-services to network infrastructure dependency that can be hard to overcome, especially if fast and flexible application service delivery is desired.

Filter policy-based ESM service chaining removes ESM VAS steering to network infrastructure inter-dependency. An operator can configure per tier of service or per individual VAS service upstream and downstream service chaining rules without a need to define subscriber or tier-of-service match conditions. [Figure 31](#) shows a possible ACL model (embedded filters are used for VAS service chaining rules).

On the left in [Figure 31](#), the per-tier-of-service ACL model is depicted. Each tier of service (Gold or Silver) has a dedicated embedded VAS filter (“Gold VAS”, “Silver VAS”) that contains all steering rules for all service chains applicable to the specific tier. Each VAS filter is then embedded by the ACL filter used by a specific tier. A subscriber is subject to VAS service chain rules based on the per-tier ACL assigned to that subscriber (for example, via RADIUS). If a new VAS rule needs to be added, an operator must program that rule in all applicable tiers. Upstream and downstream rules can be configured in a single filter (as shown) or can use dedicated ingress and egress filters.

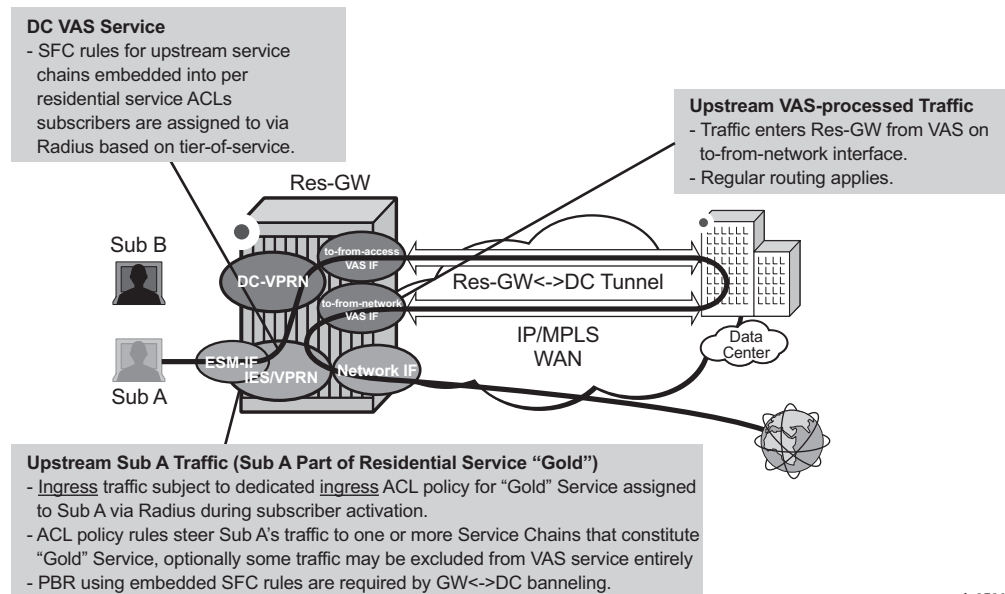
On the right in [Figure 31](#), the per-VAS-service ACL model is depicted. Each VAS has a dedicated embedded filter (“VAS 1”, “VAS 2”, “VAS 3”) that contains all steering rules for all service chains applicable to that VAS service. A tier of service is then created by embedding multiple VAS-specific filters: Gold: VAS 1, VAS 2, VAS 3; Silver: VAS 1 and VAS 3. A subscriber is subject to VAS service chain rules based on the per-tier ACL assigned to that subscriber. If a new VAS rule needs to be added, an operator needs to program that rule in a single VAS-specific filter only. Again, upstream and downstream rules can be configured in a single filter (as shown) or can use dedicated ingress and egress filters.

**Figure 31** ACL filter modeling for ESM Service Chaining



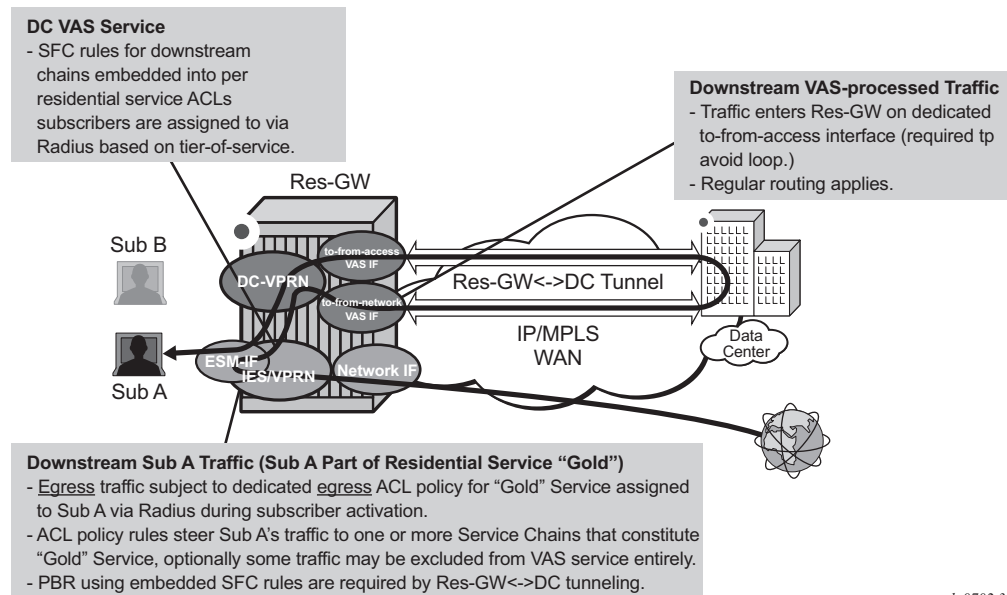
[Figure 32](#) shows upstream VAS service chaining steering using filter policies. Upstream subscriber traffic entering Res-GW is subject to the subscriber's ingress ACL filter assigned to that subscriber by a policy server. If the ACL contains VAS steering rules, the VAS-rule-matching subscriber traffic is steered for VAS processing over a dedicated to-from-access VAS interface in the same or a different routing instance. After the VAS processing, the upstream traffic can be returned to Res-GW by a to-from-network interface (shown in [Figure 32](#)) or can be injected to WAN to be routed toward the final destination (not shown).

**Figure 32 Upstream ESM ACL-policy based service chaining**



al\_0701

[Figure 33](#) shows downstream VAS service chaining steering using filter policies. Downstream subscriber traffic entering Res-GW is forwarded to a subscriber-facing line card. On that card, the traffic is subject to the subscriber's egress ACL filter policy processing assigned to that subscriber by a policy server. If the ACL contains VAS steering rules, the VAS rule-matching subscriber's traffic is steered for VAS processing over a dedicated to-from-network VAS interface (in the same or a different routing instance). After the VAS processing, the downstream traffic must be returned to Res-GW via a "to-from-network" interface (shown in [Figure 33](#)) to ensure the traffic is not redirected to VAS again when the subscriber-facing line card processes that traffic.

**Figure 33 Downstream ESM ACL-policy based service chaining**

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Ensuring the correct settings for the VAS interface type, for upstream and downstream traffic redirected to a VAS and returned after VAS processing, is critical for achieving loop-free network connectivity for VAS services. The available configuration options (**config>service>vprn>if>vas-if-type**, **config>service>ies>if>vas-if-type** and **config>router>if>vas-if-type**) are described below:

- deployments that use two separate interfaces for VAS connectivity (recommended, and required if local subscriber-to-subscriber VAS traffic support is required)

**–to-from-access**

- upstream traffic arriving from subscribers over access interfaces must be redirected to a VAS PBR target reachable over this interface for upstream VAS processing
- downstream traffic destined for subscribers after VAS processing must arrive on this interface, so that the traffic is subject to regular routing but is not subject to Application Assurance diversion, nor to egress subscriber PBR
- the interface must not be used for downstream pre-VAS traffic; otherwise, routing loops will occur

**–to-from-network**



- downstream traffic destined for subscribers arriving from network interfaces must be redirected to a VAS PBR target reachable over this interface for downstream VAS processing
- upstream traffic after VAS processing, if returned to the router, must arrive on this interface so that regular routing can be applied
- deployments that use a single interface for VAS connectivity (optional, no local subscriber-to-subscriber VAS traffic support)

**–to-from-both**

- both upstream traffic arriving from access interfaces and downstream traffic arriving from the network are redirected to a PBR target reachable over this interface for upstream/downstream VAS processing
- after VAS processing, traffic must arrive on this interface (optional for upstream), so that the traffic is subject to regular routing but is not subject to AA diversion, nor to egress subscriber PBR
- the interface must be used for downstream pre-VAS traffic; otherwise, routing loops will occur

The ESM filter policy-based service chaining allows operators to do the following:

- Steer upstream and downstream traffic per-subscriber with full ACL-flow-defined granularity without the need to specify match conditions that identify subscriber or tier-of-service
- Steer both upstream and downstream traffic on a single Res-GW
- Flexibly assign subscribers to tier-of-service by changing the ACL filter policy a specific subscriber uses
- Flexibly add new services to a subscriber or tier-of-service by adding the subscriber-independent filter rules required to achieve steering
- Achieve isolation of VAS steering from other ACL functions like security through the use of embedded filters
- Deploy integrated Application Assurance (AA) as part of a VAS service chain—both upstream and downstream traffic is processed by AA before a VAS redirect
- Select whether to use IP-Src/IP-Dst address hash or IP-Src/IP-Dst address plus TCP/UDP port hash when LAG/ECMP connectivity to DC is used. Layer 4 inputs are not used in hash with IPv6 packets with extension headers present.

ESM filter policy-based traffic steering supports the following:

- IPv4 and IPv6 steering of unicast traffic using IPv4 and IPv6 ACLs
- **action forward redirect-policy** or **action forward next-hop router** for IP steering with TCAM-based load-balancing, fail-to-wire, and sticky destination

- **action forward esi sf-ip vas-interface router** for an integrated service chaining solution

Operational notes:

- Downstream traffic steered toward a VAS on the subscriber-facing IOM is reclassified (FC and profile) based on the subscriber egress QoS policy, and is queued toward the VAS based on the network egress QoS configuration. Packets sent toward VAS will not have DSCP remarked (since they are not yet forwarded to a subscriber). DSCP remarking based on subscriber's egress QoS profile will only apply to traffic ultimately forwarded to the subscriber (after VAS or not subject to VAS).
- If mirroring of subscriber traffic is configured using ACL entry/subscriber/SAP/port mirror, the mirroring will apply to traffic ultimately forwarded to subscriber (after VAS or not subject to VAS). Traffic that is being redirected to VAS cannot be mirrored using an ACL filter implementing PBR action (the same egress ACL filter entry being a mirror source and specifying egress PBR action is not supported).
- Use dedicated ingress and egress filter policies to prevent accidental match of an ingress PBR entry on egress, and vice-versa, that will result in forwarding/dropping of traffic matching the entry (based on the filter's default action configuration).

Restrictions:

- This feature is not supported with HSMDAs on subscriber ingress.
- This feature is not supported when the traffic is subject to non-AA ISA on Res-GW.
- Traffic that matches an egress filter entry with an egress PBR action cannot be mirrored, cannot be sampled using cflowd, and cannot be logged using filter logging while being redirected to VAS on a sub-facing line card.
- This feature is not supported with LAC/LNS ESM (PPPoE subscriber traffic encapsulated into or de-encapsulated from L2TP tunnels).
- This feature is not supported for system filter policies.

#### 4.1.2.16 Policy-Based Forwarding for Deep Packet Inspection in VPLS

The purpose policy-based forwarding is to capture traffic from a customer and perform a deep packet inspection (DPI) and forward traffic, if allowed, by the DPI.

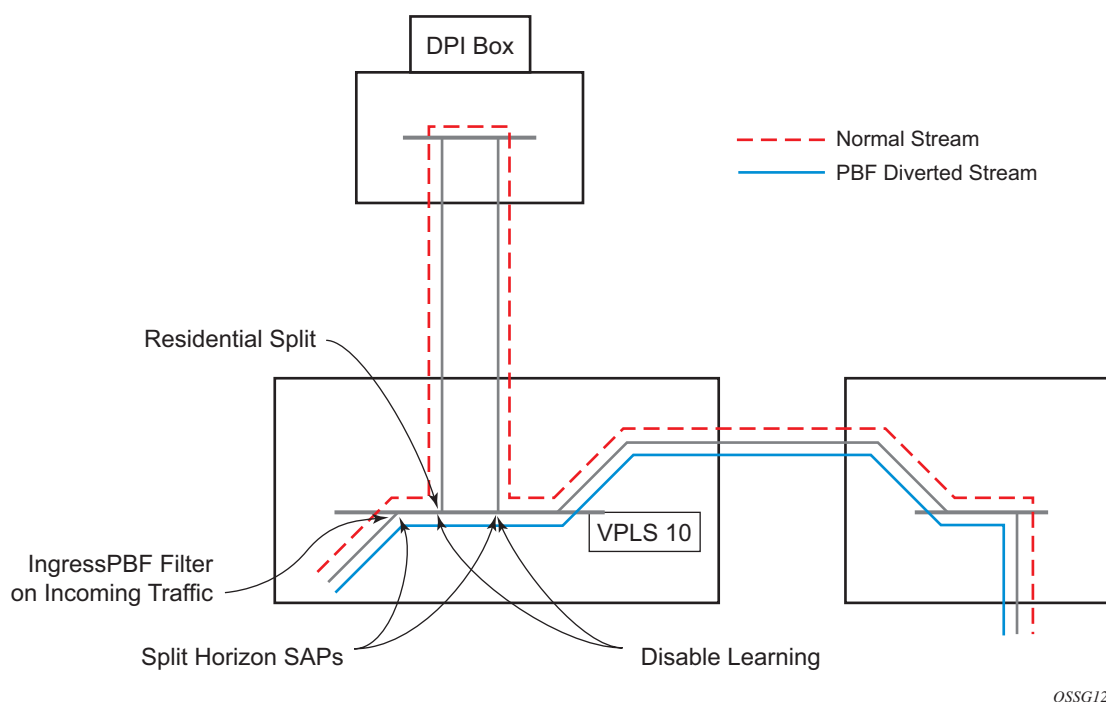
In the following example, the split horizon groups are used to prevent flooding of traffic. Traffic from customers enter at SAP 1/1/5:5. Due to the mac-filter 100 that is applied on ingress, all traffic with dot1p 07 marking will be forwarded to SAP 1/1/22:1, which is the DPI.

DPI performs packet inspection/modification and either drops the traffic or forwards the traffic back into the box through SAP 1/1/21:1. Traffic will then be sent to spoke-sdp 3:5.

SAP 1/1/23:5 is configured to see if the VPLS service is flooding all the traffic. If flooding is performed by the router then traffic would also be sent to SAP 1/1/23:5 (which it should not).

Figure 34 shows an example to configure policy-based forwarding for deep packet inspection on a VPLS service. For information about configuring services, refer to the *7450 ESS, 7750 SR, 7950 XRS, and VSR Layer 2 Services and EVPN Guide: VLL, VPLS, PBB, and EVPN*.

**Figure 34 Policy-Based Forwarding for Deep Packet Inspection**



OSSG125

The following displays a VPLS service configuration with DPI example:

```
*A:ALA-48>config>service# info

...
vpls 10 customer 1 create
```

```

 service-mtu 1400
 split-horizon-group "dpi" residential-group create
 exit
 split-horizon-group "split" create
 exit
 stp
 shutdown
 exit
 sap 1/1/21:1 split-horizon-group "split" create
 disable-learning
 static-mac 00:00:00:31:11:01 create
 exit
 sap 1/1/22:1 split-horizon-group "dpi" create
 disable-learning
 static-mac 00:00:00:31:12:01 create
 exit
 sap 1/1/23:5 create
 static-mac 00:00:00:31:13:05 create
 exit
 no shutdown
 exit
...

*A:ALA-48>config>service#

```

The following displays a MAC filter configuration example:

```

*A:ALA-48>config>filter# info

...
 mac-filter 100 create
 default-action forward
 entry 10 create
 match
 dot1p 7 7
 exit
 log 101
 action forward sap 1/1/22:1
 exit
 exit
...

*A:ALA-48>config>filter#

```

The following displays the MAC filter added to the VPLS service configuration:

```

*A:ALA-48>config>service# info

...
 vpls 10 customer 1 create
 service-mtu 1400
 split-horizon-group "dpi" residential-group create
 exit
 split-horizon-group "split" create
 exit
 stp
 shutdown
 exit

```

```

exit
sap 1/1/5:5 split-horizon-group "split" create
 ingress
 filter mac 100
 exit
 static-mac 00:00:00:31:15:05 create
exit
sap 1/1/21:1 split-horizon-group "split" create
 disable-learning
 static-mac 00:00:00:31:11:01 create
exit
sap 1/1/22:1 split-horizon-group "dpi" create
 disable-learning
 static-mac 00:00:00:31:12:01 create
exit
sap 1/1/23:5 create
 static-mac 00:00:00:31:13:05 create
exit
spoke-sdp 3:5 create
exit
no shutdown
exit
....

*A:ALA-48>config>service#

```

### 4.1.2.17 Storing Filter Entries

FP2-, FP3-, and FP4-based cards store filter policy entries in dedicated memory banks in hardware, also referred to as CAM tables:

- IP/MAC ingress
- IP/MAC egress
- IPv6 ingress
- IPv6 egress

#### 4.1.2.17.1 FP4-based Cards

To optimize both scale and performance, policy entries configured by the operator are compressed by each FP4 line card prior to being installed in hardware.

This compression can result, in an unexpected scenario typically only achieved in a lab environment, in an overload condition where entries for a filter policy on a line card FP are not programmed. This overload condition can occur when applying a filter policy for the first time on a line card FP or when adding entries to a filter policy.

### Applying a Filter Policy

A policy is installed for the first time on a line card FP if no router interface, service interface, SAP, spoke SDP, mesh SDP, or ESM subscriber host was using the policy on this FP.

A policy installed for the first time on a line card FP can lead to a compression failure resulting in an overload condition for this policy on this FP. In this case, none of the entries for the affected filter policy are programmed and traffic is forwarded as if no filter was installed.

### Adding Filter Entries

Adding an additional entry to a filter policy can lead to a compression failure resulting in an overload condition.

In this case, the newly added entry is not programmed on the affected FP. Additional entries added to the same policy after the first overload condition are also not programmed on the affected FP as the system attempts to install all outstanding additions in order.

**Note:** A trap is raised if a policy is in overload, there is no interactive error message.

The CPM filter management task controls the maximum number of filter entries per FP. If the operator attempts to go over the scaling limit, the system will return an interactive error message

### Removing Filter Entries

Removing filter entries from a filter policy is always successful.

### Resolving Overload

The overload condition should be resolved by the network operator before adding new entries in the affected policy.

To identify the affected policy, the system logs the overload event providing slot number, FP number, and impacted memory bank. Based on this information, the **tools>dump>filter>overload** command allows the operator to identify the affected policy and policy entries in the system.

To resolve the overload condition, the network operator can remove the newly added entries from the affected policy or assign a different policy.

---

## 4.2 Configuring Filter Policies with CLI

This section provides information to configure filter policies using the command line interface.

### 4.2.1 Common Configuration Tasks

This section provides a brief overview of the tasks that must be performed for all IPv4, IPv6, and MAC filter configurations and provides the CLI commands.

#### 4.2.1.1 Creating an IPv4 Filter Policy

A filter policy has the following attributes:

- Policy ID and policy name
- Scope: template, exclusive, embedded, system
- Type: normal, src-mac, packet-length
- One or more filter entries defining match criteria and action
- Default action to define how packets that do not match any of the filter entries are handled

Use the following CLI syntax to create a template IPv4 filter policy:

**CLI Syntax:**    `config>filter# ip-filter filter-id [create]  
                                  description description-string  
                                  scope {exclusive | template}  
                                  default-action {drop | forward}`

##### 4.2.1.1.1 IPv4 Filter Entry

Within a filter policy, configure filter entries which contain criteria against which ingress, egress traffic is matched. The action specified in the entry determine how the packets are handled, such as drop or forward.

- Enter a filter entry ID.
- Configure the filter action.
- Configure the filter matching criteria.

The following displays an IPv4 filter entry configuration example:

```
A:ALA-7>config>filter>ip-filter# info

description "filter-main"
scope exclusive
entry 10 create
 description "no-91"
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.0.100/24
 exit
 action drop
exit

A:ALA-7>config>filter>ip-filter#
```

### Cflowd Filter Sampling

Within a filter entry, you can specify that traffic matching the associated IPv4 filter entry is sampled if the IPv4 interface is set to cflowd acl mode. Enabling **filter-sample** enables the cflowd tool.

The following displays an IPv4 filter entry configuration example:

```
A:ALA-7>config>filter>ip-filter# info

description "filter-main"
scope exclusive
entry 10 create
 description "no-91"
 filter-sample
 interface-disable-sample
 match
 exit
 action forward redirect-policy redirect1
exit

A:ALA-7>config>filter>ip-filter#
```

Within a filter entry, you can also specify that traffic matching the associated IPv4 filter entry is not sampled by cflowd if the IPv4 interface is set to cflowd interface mode. The following displays an IPv4 filter entry configuration example:

```
A:ALA-7>config>filter>ip-filter# info

description "filter-main"
scope exclusive
entry 10 create
 description "no-91"
 no filter-sample
 no interface-disable-sample

```



```

 match
 exit
 action forward redirect-policy redirect1
 exit

A:ALA-7>config>filter>ip-filter#

```

### 4.2.1.2 Creating an IPv6 Filter Policy

IPv6 filter policy configuration mimics IP filter policy configuration. See [Creating an IPv4 Filter Policy](#).

### 4.2.1.3 Creating a MAC Filter Policy

Each filter policy must have the following:

- The filter policy type specified (MAC normal, MAC isid, MAC vid)
- A filter policy ID
- A default action, either drop or forward
- Filter policy scope, either exclusive or template
- At least one filter entry, with a match criterion defined

#### 4.2.1.3.1 MAC Filter Policy

The following example shows a MAC filter policy configuration:

```

A:ALA-7>config>filter# info

...
 mac-filter 90 create
 description "filter-west"
 scope exclusive
 type normal
 exit

A:ALA-7>config>filter#

```

#### 4.2.1.3.2 MAC ISID Filter Policy

The following example shows an ISID filter policy configuration:

```
A;ALA-7>config>filter# info

mac-filter 90 create
 description "filter-wan-man"
 scope template
 type isid
 entry 1 create
 description "drop-local-isids"
 match
 isid 100 to 1000
 exit
 action drop
 exit
 entry 2 create
 description "allow-wan-isids"
 match
 isid 150
 exit
 action forward
 exit
```

#### 4.2.1.3.3 MAC VID Filter Policy

The following example shows a VID filter policy configuration:

```
A:TOP_NODE>config>filter>mac-filter# info

default-action forward
type vic
entry 1 create
 match frame-type ethernet_II
 ouiter-tag 85 4095
 exit
 action drop
exit
entry 2 create
 match frame-type ethernet_II
 ouiter-tag 43 4095
 exit
 action drop
exit

A:TOP_NODE>config>filter>mac-filter#
```

#### 4.2.1.3.4 MAC Filter Entry

Within a filter policy, configure filter entries that contain criteria against which ingress, egress, or network traffic is matched. The action specified in the entry determines how the packets are handled, such as dropping or forwarding.

- Enter a filter entry ID. The system does not dynamically assign a value.

- Assign an action.
- Specify matching criteria.

The following displays a MAC filter entry configuration example:

```
A:sim1>config>filter# info

 mac-filter 90 create
 entry 1 create
 description "allow-104"
 match
 exit
 action drop
 exit
 exit

A:sim1>config>filter#
```

#### 4.2.1.4 Creating an IP Exception Filter Policy

Configuring and applying IP exception filter policies is optional. Each exception filter policy must have the following:

- an exception filter policy ID
- scope specified, either exclusive or template
- at least one filter entry with matching criteria specified

##### 4.2.1.4.1 IP Exception Filter Policy

Use the following CLI syntax to create an IP exception filter policy:

**CLI Syntax:**     config>filter# ip-exception *filter-id* [create]  
                               description *description-string*  
                               scope {exclusive | template}

**Example:**        config>filter# ip-exception 1 create  
                               config>filter>ip-except# description "IP-exception"  
                               config>filter>ip-except# scope template

The following example displays a template IP exception filter policy configuration.

```
A:domain1>config>filter# info

...
 ip-exception 1 create
 description "IP-exception"
```

```

 scope template
 exit
 ...

A:domain1>config>filter#

```

#### 4.2.1.4.2 IP Exception Entry Matching Criteria

Within an exception filter policy, configure exception entries that contain criteria against which ingress, egress, and network traffic is matched. Packets that match the entry criteria are allowed to transit the NGE domain in clear text.

- Enter an exception filter entry ID. The system does not dynamically assign a value.
- Specify matching criteria.

Use the following CLI syntax to configure IP exception filter matching criteria:

**CLI Syntax:**

```

config>filter# ip-exception filter-id
 entry entry-id [create]
 description description-string
 match
 dst-ip {ip-address/mask | ip-address ipv4-
 address-mask}
 dst-port {lt | gt | eq} dst-port-number
 dst-port range dst-port-number dst-port-
 number
 icmp-code icmp-code
 icmp-type icmp-type
 src-ip {ip-address/mask | ip-address ipv4-
 address-mask}
 src-port {lt | gt | eq} src-port-number
 src-port range src-port-number src-port-
 number

```

**Example:**

```

config>filter>ip-except# entry 1 create
config>filter>ip-except>entry# match
config>filter>ip-except>entry>match# src-ip 10.10.10.10/
32
config>filter>ip-except>entry>match# dst-ip 10.10.10.91/
24
config>filter>ip-except>entry>match# exit

```

The following example displays a matching configuration.

```

A:domain1>config>filter>ip-exception# info

```

```

 description "exception-main"
 scope exclusive
 entry 1
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.10.10/32
 exit
 exit

A:domain1>config>filter>ip-except#

```

### 4.2.1.5 Creating a Match List for Filter Policies

IP filter policies support usage of match lists as a single match criteria. To create a match list you must:

- Specify a type of a match list (IPv4 address prefix for example).
- Define a unique match list name (IPv4PrefixBlacklist for example).
- Specify at least one list argument (a valid IPv4 address prefix for example).

The following example shows an IPv4 address prefix list configuration and its usage in an IPv4 filter policy:

```

*A:ala-48>config>filter# info

 match-list
 ip-prefix-list "IPv4PrefixBlacklist"
 description "default IPv4 prefix blacklist"
 prefix 10.0.0.0/21
 prefix 10.254.0.0/24
 exit
 exit
ip-filter 10 name "IPv4PrefixBlacklistFilter"
 scope template
 entry 10
 match
 src-ip ip-prefix-list IPv4PrefixBlacklist
 exit
 action drop
 exit
 exit

```

### 4.2.1.6 Applying Filter Policies

Filter policies can be associated with the entities listed in [Table 53](#).

**Table 53**      **Applying Filter Policies**

| IPv4 and IPv6 Filter Policies                          | MAC Filter Policies           |
|--------------------------------------------------------|-------------------------------|
| Epipe SAP, spoke SDP                                   | Epipe SAP, spoke SDP          |
| Fpipe SAP, spoke SDP                                   | N/A                           |
| IES interface SAP, spoke SDP, R-VPLS                   | N/A                           |
| Ipipe SAP, spoke SDP                                   | N/A                           |
| VPLS mesh SDP, spoke SDP, SAP                          | VPLS mesh SDP, spoke SDP, SAP |
| VPRN interface SAP, spoke SDP, R-VPLS, network ingress | N/A                           |
| Network interface                                      | N/A                           |

#### 4.2.1.6.1 Applying IPv4/IPv6 and MAC Filter Policies to a Service

IP and MAC filter policies are applied by associating them with a SAP and/or spoke-sdp in ingress and/or egress direction as needed. Filter ID is used to associate an existing filter policy, or if defined, a Filter Name for that filter policy can be used in the CLI.

The following output displays IP and MAC filters assigned to an ingress and egress SAP and spoke SDP:

```
A:ALA-48>config>service>epipe# info

 sap 1/1/1.1.1 create
 ingress
 filter ip 10
 exit
 egress
 filter mac 92
 exit
 exit
 spoke-sdp 8:8 create
 ingress
 filter ip "epipe sap default filter"
 exit
 egress
 filter mac 91
 exit
 exit
 no shutdown

A:ALA-48>config>service>epipe#
```

The following output displays an IPv6 filters assigned to an IES service interface:

```
A:ALA-48>config>service>ies# info

 interface "testA" create
 address 192.22.1.1/24
 sap 2/1/3:0 create
 exit
 ipv6
 ingress
 filter ipv6 100
 egress
 filter ipv6 100
 exit
 exit
...

A:ALA-48>config>service>ies#
```

#### 4.2.1.6.2 Applying IPv4/IPv6 Filter Policies to a Network Port

IP filter policies can be applied to network IPv4/IPv6 interfaces. MAC filters cannot be applied to network IP interfaces or to routable IES services. Similarly to applying filter policies to service, IPv4/IPv6 filter policies are applied to network interfaces by associating a policy with ingress and/or egress direction as desired. Filter ID is used to associate an existing filter policy, or if defined, a Filter Name for that Filter ID policy can be used in the CLI.

The following displays an IP filter applied to an interface at ingress.

```
A:ALA-48>config>router# info
#-----
IP Configuration
#-----
...
 interface "to-104"
 address 10.0.0.103/24
 port 1/1/1
 ingress
 filter ip 10
 exit
 egress
 filter ip "default network egress policy"
 exit
 exit
...
#-----
A:ALA-48>config>router#
```

The following displays IPv4 and IPv6 filters applied to an interface at ingress and egress.

```
A:config>router>if# info

 port 1/1/1
```

```

 ipv6
 address 3FFE::101:101/120
 exit
 ingress
 filter ip 2
 filter ipv6 1
 exit
 egress
 filter ip 2
 filter ipv6 1
 exit

A:config>router>if#

```

### 4.2.1.7 Creating a Redirect Policy

Configuring and applying redirect policies is optional. Each redirect policy must have the following:

- A destination IP address
- A priority (default is 100)

Configuring a ping test is recommended.

The following displays a redirection policy configuration:

```

A:ALA-7>config>filter# info

 redirect-policy "redirect1" create
 destination 10.10.10.104 create
 priority 105
 exit
 no shutdown
 exit
 destination 10.10.10.105 create
 priority 95
 ping-test
 timeout 30
 drop-count 5
 exit
 no shutdown
 exit
 destination 10.10.10.106 create
 priority 90
 exit
 no shutdown
 exit
 ...

A:ALA-7>config>filter#

```



## 4.2.1.8 Configuring Filter-Based GRE Tunneling

Traffic matching an IP filter can be tunneled with GRE using the following mechanisms.

- Configure a GRE tunnel template.
- Associate the GRE tunnel template with the forwarding action of an IPv4 or IPv6 filter using the **forward gre-tunnel** *gre-tunnel-template* command.

The *gre-tunnel-template* defines the parameters to create the GRE header used to encapsulate matching IP traffic.

- One or more destination IP addresses must be defined in the *gre-tunnel-template*.
  - If more than one destination is configured, then traffic is hashed across all available destinations.
  - Traffic is routed to the selected destination address based on the route table in the forwarding context of the IP filter.
- The source address can be configured to any value and is not validated against a local IP address on the local router.
- The optional **gre-key** field can be populated with the ifIndex of the ingress interface on which the matching IP packet was received.
- An optional template parameter, **skip-ttl-decrement**, allows the TTL of the encapsulated IP packet to be not decremented when encapsulated into the GRE header.

The following is an example configuration:

```
*A:Nokia-C>config>filter>ip-filter$ default-action
gre-tunnel-template "test" create
description "10.20.1.5"
ipv4
source-address 10.20.1.3
destination-address 9.9.9.9
destination-address 10.20.1.5
destination-address 13.13.13.13
exit
exit
ip-filter 1 name "1" create
entry 1 create
action
exit
pbr-down-action-override forward
exit
entry 2 create
action
forward gre-tunnel "test"
exit
exit
```

---

exit

## 4.3 Filter Management Tasks

This section describes filter policy management tasks.

### 4.3.1 Renumbering Filter Policy Entries

The system exits the matching process when the first match is found and then executes the actions in accordance with the specified action. Because the ordering of entries is important, the numbering sequence may need to be rearranged. Entries should be numbered from the most explicit to the least explicit.

The following example shows renumbering of filter entries.

**Example:**

```
config>filter>ip-filter# renum 10 15
config>filter>ip-filter# renum 20 10
config>filter>ip-filter# renum 40 1
```

The following displays the original filter entry order, followed by the reordered filter entries:

```
A:ALA-7>config>filter# info

...
 ip-filter 11 create
 description "filter-main"
 scope exclusive
 entry 10 create
 description "no-91"
 filter-sample
 interface-disable-sample
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.10.103/24
 exit
 action forward redirect-policy redirect1
 exit
 entry 20 create
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.0.100/24
 exit
 action drop
 exit
 entry 30 create
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.0.200/24
 exit
 action forward
```

```
 exit
 entry 40 create
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.10.106/24
 exit
 action drop
 exit
 exit
...

A:ALA-7>config>filter#

A:ALA-7>config>filter# info

...
 ip-filter 11 create
 description "filter-main"
 scope exclusive
 entry 1 create
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.10.106/24
 exit
 action drop
 exit
 entry 10 create
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.0.100/24
 exit
 action drop
 exit
 entry 15 create
 description "no-91"
 filter-sample
 interface-disable-sample
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.10.103/24
 exit
 action forward redirect-policy
 redirect1
 exit
 entry 30 create
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.0.200/24
 exit
 action forward
 exit
 exit
...

A:ALA-7>config>filter#
```

## 4.3.2 Modifying a Filter Policy

There are several ways to modify an existing filter policy. A filter policy can be modified dynamically as part of subscriber management dynamic insertion/removal of filter policy entries (see the *7450 ESS, 7750 SR, and VSR Triple Play Service Delivery Architecture Guide* for details). A filter policy can be modified indirectly by configuration change to a match list the filter policy uses (as described earlier in this guide). In addition, a filter policy can be directly edited as described below.

To access a specific IP (v4/v6), or MAC filter, you must specify the filter ID, or if defined, filter name. Use the **no** form of the command to remove the command parameters or return the parameter to the default setting.

**Example:**

```
config>filter>ip-filter# description "New IP filter
info"
config>filter>ip-filter# entry 2 create
config>filter>ip-filter>entry$ description "new entry"
config>filter>ip-filter>entry# action drop
config>filter>ip-filter>entry# match dst-ip
10.10.10.104/32
config>filter>ip-filter>entry# exit
config>filter>ip-filter#
```

The following output displays the modified IP filter output:

```
A:ALA-7>config>filter# info

...
ip-filter 11 create
description "New IP filter info"
scope exclusive
entry 1 create
match
dst-ip 10.10.10.91/24
src-ip 10.10.10.106/24
exit
action drop
exit
entry 2 create
description "new entry"
match
dst-ip 10.10.10.104/32
exit
action drop
exit
entry 10 create
match
dst-ip 10.10.10.91/24
src-ip 10.10.0.100/24
exit
action drop
```

```
exit
entry 15 create
 description "no-91"
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.10.103/24
 exit
 action forward
exit
entry 30 create
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.0.200/24
 exit
 action forward
exit
exit
..

A:ALA-7>config>filter#
```

### 4.3.3 Deleting a Filter Policy

Before you can delete a filter, you must remove the filter association from all the applied ingress and egress SAPs and network interfaces by executing **no filter** command in all context where the filter is used.

**Example:**

```
config>service# epipe 5
config>service>epipe# sap 1/1/2:3
config>service>epipe>sap# ingress
config>service>epipe>sap>ingress# no filter
```

After you have removed the filter from the SAPs network interfaces, you can delete the filter as shown in the following example.

**Example:**

```
config>filter# no ip-filter 11
```

### 4.3.4 Modifying a Redirect Policy

To access a specific redirect policy, you must specify the policy name. Use the **no** form of the command to remove the command parameters or return the parameter to the default setting.

**Example:**

```
config>filter# redirect-policy redirect1
```

```

config>filter>redirect-policy# description "New redirect
info"
config>filter>redirect-policy# destination 10.10.10.104
config>filter>redirect-policy>dest# priority 105
config>filter>redirect-policy>dest# ping-test timeout 20
config>filter>redirect-policy>dest# ping-test drop-count
7

A:ALA-7>config>filter# info

...
 redirect-policy "redirect1" create
 description "New redirect info"
 destination 10.10.10.104 create
 priority 105
 ping-test
 timeout 20
 drop-count 7
 exit
 no shutdown
 exit
destination 10.10.10.105 create
 priority 95
 ping-test
 timeout 30
 drop-count 5
 exit
 no shutdown
exit
no shutdown
exit
...

A:ALA-7>config>filter#

```

### 4.3.5 Deleting a Redirect Policy

Before you can delete a redirect policy from the filter configuration, you must remove the policy association from the IP filter.

The following example shows the command usage to replace the configured redirect policy (**redirect1**) with a different redirect policy (**redirect2**) and then removing the **redirect1** policy from the filter configuration.

**Example:**

```

config>filter>ip-filter 11
config>filter>ip-filter# entry 1
config>filter>ip-filter>entry# action forward redirect-
policy redirect2
config>filter>ip-filter>entry# exit
config>filter>ip-filter# exit

```

```
config>filter# no redirect-policy redirect1

A:ALA-7>config>filter>ip-filter# info

description "This is new"
scope exclusive
entry 1 create
 filter-sample
 interface-disable-sample
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.10.106/24
 exit
 action forward redirect-policy redirect2
exit
entry 2 create
 description "new entry"
...

A:ALA-7>config>filter>ip-filter#
```

### 4.3.6 Copying Filter Policies

When changes are to be made to an existing filter policy applied to a one or more SAPs/network interfaces, Nokia recommends to first copy the applied filter policy, then modify the copy and then overwrite the applied policy with the modified copy. This ensures that a policy being modified is not applied when partial changes are done as any filter policy edits are applied immediately to all services where the policy is applied.

New filter policies can also be created by copying an existing policy and renaming the new filter.

The following displays the command usage to copy an existing IP filter (**11**) to create a new filter policy (**12**) that can then be edited. And once edits are completed, it can be used to overwrite existing policy (**11**).

**Example:**      config>filter# copy ip-filter 11 to 12

```
A:ALA-7>config>filter# info

...
ip-filter 11 create
 description "This is new"
 scope exclusive
 entry 1 create
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.10.106/24
```



---

```
 exit
 action drop
 exit
 entry 2 create
...
ip-filter 12 create
 description "This is new"
 scope exclusive
 entry 1 create
 match
 dst-ip 10.10.10.91/24
 src-ip 10.10.10.106/24
 exit
 action drop
 exit
 entry 2 create
...

A:ALA-7>config>filter#
```



## 4.4 Filter Configuration Command Reference

- [Command Hierarchies](#)
- [Command Descriptions](#)

### 4.4.1 Command Hierarchies

- [IPv4 Filter Policy Commands](#)
- [IPv6 Filter Policy Commands](#)
- [MAC Filter Commands](#)
- [GRE Tunnel Template Configuration Commands](#)
- [System Filter Policy Commands](#)
- [Redirect Policy Configuration Commands](#)
- [Match Filter List Commands](#)
- [Log Filter Commands](#)
- [Copy Filter Commands](#)
- [Model-Driven Automatic ID Commands](#)

#### 4.4.1.1 IPv4 Filter Policy Commands

```

config
— filter
— ip-filter filter-id [name filter-name] [create]
— no ip-filter {filter-id | filter-name}
— [no] chain-to-system-filter
— default-action {drop | forward}
— description description-string
— no description
— embed-filter ip-filter-id [offset offset] [{active | inactive}]
— no embed-filter ip-filter-id
— embed-filter flowspec [group group-id] [router {router-instance | service-
name vprn-service-name}] [offset offset] [{active | inactive}]
— no embed-filter flowspec [group group-id]
— embed-filter open-flow ofs-name [{system | service {service-id | service-
name} | sap sap-id}] [offset offset] [{active | inactive}]
— no embed-filter open-flow ofs-name [{system | service {service-id | service-
name} | sap sap-id}]
— embed-filter vsd vsd-filter-id [offset offset] [{active | inactive}]
— no embed-filter vsd vsd-filter-id
— entry entry-id [create]

```

- **no entry** *entry-id*
  - **[no] action** **[secondary]**
    - **drop**
    - **drop packet-length** {lt | gt | eq} *packet-length-value*
    - **drop packet-length range** *packet-length-value packet-length-value*
    - **drop pattern expression** *expression mask mask offset-type offset-type offset-value offset-value*
    - **drop ttl** {lt | gt | eq} *ttl-value*
    - **drop ttl range** *ttl-value ttl-value*
    - **drop-extracted-traffic**
    - **[no] extended-action**
      - **remark dscp** *dscp-name*
    - **fc** *fc-name*
    - **no fc**
    - **forward**
    - **forward bonding-connection** *connection-id*
    - **forward esi esi sf-ip ip-address vas-interface interface-name router router-instance**
    - **forward esi esi sf-ip ip-address vas-interface interface-name router service-name service-name**
    - **forward esi esi service-id vpls-service-id**
    - **forward gre-tunnel** *gre-tunnel-name*
    - **forward lsp** *lsp-name*
    - **forward next-hop** *ip-address*
    - **forward next-hop ip-address router router-instance**
    - **forward next-hop ip-address router service-name service-name**
    - **forward next-hop indirect ip-address**
    - **forward next-hop indirect ip-address router router-instance**
    - **forward next-hop indirect ip-address router service-name service-name**
    - **forward next-hop interface ip-int-name**
    - **forward redirect-policy** *policy-name*
    - **forward router** *router-instance*
    - **forward router service-name** *service-name*
    - **forward sap** *sap-id*
    - **forward sdp** *sdp-id:vc-id*
    - **forward vprn-target bgp-nh ip-address router router-instance [adv-prefix ip-address/mask] [lsp lsp-name]**
    - **forward vprn-target bgp-nh ip-address router service-name service-name [adv-prefix ip-address/mask] [lsp lsp-name]**
    - **forward-when pattern expression expression mask mask offset-type offset-type offset-value offset-value**
    - **gtp-local-breakout**
    - **http-redirect** *rdr-url-string* **[allow-radius-override]**
    - **ignore-match**
    - **nat** **[nat-policy nat-policy-name]**
    - **rate-limit** *value*
    - **rate-limit value packet-length** {lt | gt | eq} *packet-length-value*
    - **rate-limit value packet-length range packet-length-value packet-length-value**

- **rate-limit** *value pattern expression pattern expression mask*  
*mask offset-type offset-type offset-value offset-value*
- **rate-limit** *value ttl {lt | gt | eq} ttl-value*
- **rate-limit** *value ttl range ttl-value ttl-value*
- **reassemble**
- **remark dscp** *dscp-name*
- **tcp-mss-adjust**
- **description** *description-string*
- **no description**
- **egress-pbr** {**default-load-balancing** | **l4-load-balancing**}
- **no egress-pbr**
- **[no] filter-sample**
- **[no] interface-disable-sample**
- **log** *log-id*
- **no log**
- **match** [**protocol** *protocol-id*]
- **no match**
  - **dscp** *dscp-name*
  - **no dscp**
  - **dst-ip** {*ip-address/mask* | *ip-address ipv4-address-mask* | **ip-prefix-list** *prefix-list-name*}
  - **no dst-ip**
  - **dst-port** {**lt** | **gt** | **eq**} *dst-port-number*
  - **dst-port** **port-list** *port-list-name*
  - **dst-port** **range** *dst-port-number dst-port-number*
  - **no dst-port**
  - **fragment** {**true** | **false**}
  - **no fragment**
  - **icmp-code** *icmp-code*
  - **no icmp-code**
  - **icmp-type** *icmp-type*
  - **no icmp-type**
  - **ip-option** *ip-option-value [ip-option-mask]*
  - **no ip-option**
  - **multiple-option** {**true** | **false**}
  - **no multiple-option**
  - **option-present** {**true** | **false**}
  - **no option-present**
  - **packet-length** {**lt** | **gt** | **eq**} *packet-length-value*
  - **packet-length** **range** *packet-length-value packet-length-value*
  - **no packet-length**
  - **port** {**lt** | **gt** | **eq**} *port-number*
  - **port** **port-list** *port-list-name*
  - **port** **range** *port-number port-number*
  - **no port**
  - **src-ip** {*ip-address/mask* | *ip-address ipv4-address-mask* | **ip-prefix-list** *prefix-list-name*}
  - **no src-ip**
  - **src-port** {**lt** | **gt** | **eq**} *src-port-number*
  - **src-port** **port-list** *port-list-name*
  - **src-port** **range** *src-port-number src-port-number*
  - **no src-port**
  - **src-route-option** {**true** | **false**}
  - **no src-route-option**

---

```

— tcp-ack {true | false}
— no tcp-ack
— tcp-cwr {true | false}
— no tcp-cwr
— tcp-ece {true | false}
— no tcp-ece
— tcp-fin {true | false}
— no tcp-fin
— tcp-ns {true | false}
— no tcp-ns
— tcp-psh {true | false}
— no tcp-psh
— tcp-rst {true | false}
— no tcp-rst
— tcp-syn {true | false}
— no tcp-syn
— tcp-urg {true | false}
— no tcp-urg
— pbr-down-action-override filter-action
— no pbr-down-action-override
— sticky-dest hold-time-up
— sticky-dest no-hold-time-up
— no sticky-dest
— renum old-entry-id new-entry-id
— scope {exclusive | template | embedded | system}
— no scope
— shared-radius-filter-wmark low low-watermark high high-watermark
— no shared-radius-filter-wmark
— sub-insert-credit-control start-entry entry-id count count
— no sub-insert-credit-control
— sub-insert-radius start-entry entry-id count count
— no sub-insert-radius
— sub-insert-shared-pccrule start-entry entry-id count count
— no sub-insert-shared-pccrule
— sub-insert-shared-radius start-entry entry-id count count
— no sub-insert-shared-radius
— sub-insert-wmark low low-watermark high high-watermark
— no sub-insert-wmark
— type {normal | src-mac | packet-length}

```

### 4.4.1.2 IPv6 Filter Policy Commands

These commands do not apply to the 7450 ESS (except in mixed mode).

```

config
 — filter
 — ipv6-filter filter-id [name filter-name] [create]
 — no ipv6-filter {filter-id | filter-name}
 — [no] chain-to-system-filter
 — default-action {drop | forward}
 — description description-string
 — no description
 — embed-filter ipv6-filter-id [offset offset] [{active | inactive}]
 — no embed-filter ipv6-filter-id
 — embed-filter flowspec [group group-id] [router {router-instance | service-

 name vprn-service-name}] [offset offset] [{active | inactive}]
 — no embed-filter flowspec [group group-id]
 — embed-filter open-flow ofs-name [{system | service {service-id | service-

 name} | sap sap-id}] [offset offset] [{active | inactive}]
 — no embed-filter open-flow ofs-name [{system | service {service-id | service-

 name} | sap sap-id}]
 — embed-filter vsd vsd-filter-id [offset offset] [{active | inactive}]
 — no embed-filter vsd vsd-filter-id
 — entry entry-id [create]
 — no entry entry-id
 — [no] action [secondary]
 — drop
 — drop hop-limit {lt | gt | eq} hop-limit-value
 — drop hop-limit range hop-limit-value hop-limit-value
 — drop pattern expression expression mask mask offset-type

 offset-type offset-value offset-value
 — drop payload-length {lt | gt | eq} payload-length-value
 — drop payload-length range payload-length-value payload-length-value
 — drop extracted-traffic
 — [no] extended-action
 — remark dscp dscp-name
 — fc fc-name
 — no fc
 — forward
 — forward bonding-connection connection-id
 — forward esi esi sf-ip ipv6-address vas-interface interface-

 name router router-instance
 — forward esi esi sf-ip ipv6-address vas-interface interface-

 name router service-name service-name
 — forward esi esi service-id vpls-service-id
 — forward gre-tunnel gre-tunnel-name
 — forward lsp lsp-name
 — forward next-hop ipv6-address
 — forward next-hop ipv6-address router router-instance
 — forward next-hop ipv6-address router service-name service-

 name
 — forward next-hop indirect ipv6-address

```

- **forward** next-hop indirect *ipv6-address* **router** *router-instance*
- **forward** next-hop indirect *ipv6-address* **router** **service-name**  
*service-name*
- **forward** redirect-policy *policy-name*
- **forward** **router** *router-instance*
- **forward** **router** **service-name** *service-name*
- **forward** **sap** *sap-id*
- **forward** **sdp** *sdp-id:vc-id*
- **forward** **vpn-target** **bgp-nh** *ip-address* **router** *router-instance*  
[**adv-prefix** *ipv6-address/prefix-length*] [**lsp** *lsp-name*]
- **forward** **vpn-target** **bgp-nh** *ip-address* **router** **service-name**  
*service-name* [**adv-prefix** *ipv6-address/prefix-length*]  
[**lsp** *lsp-name*]
- **forward-when** **pattern** *expression* *expression* **mask** *mask*  
**offset-type** *offset-type* **offset-value** *offset-value*
- **http-redirect** *rdr-url-string* [**allow-radius-override**]
- **ignore-match**
- **nat** **nat-type** *nat-type* [**nat-policy** *nat-policy-name*]
- **rate-limit** *value*
- **rate-limit** *value* **hop-limit** {**lt** | **gt** | **eq**} *hop-limit-value*
- **rate-limit** *value* **hop-limit** **range** *hop-limit-value* *hop-limit-value*
- **rate-limit** *value* **pattern** *expression* *pattern* *expression* **mask**  
*mask* **offset-type** *offset-type* **offset-value** *offset-value*
- **rate-limit** *value* **payload-length** {**lt** | **gt** | **eq**} *payload-length-*  
*value*
- **rate-limit** *value* **payload-length** **range** *payload-length-value*  
*payload-length-value*
- **remark** **dscp** *dscp-name*
- **tcp-mss-adjust**
- **description** *description-string*
- **no** **description**
- **egress-pbr** {**default-load-balancing** | **l4-load-balancing**}
- **no** **egress-pbr**
- [**no**] **filter-sample**
- [**no**] **interface-disable-sample**
- **log** *log-id*
- **no** **log**
- **match** [**next-header** *next-header*]
- **no** **match**
  - **ah-ext-hdr** {**true** | **false**}
  - **no** **ah-ext-hdr**
  - **dscp** *dscp-name*
  - **no** **dscp**
  - **dst-ip** {*ipv6-address/prefix-length* | *ipv6-address* *ipv6-address-*  
*mask* | **ipv6-prefix-list** *prefix-list-name*}
  - **no** **dst-ip**
  - **dst-port** {**lt** | **gt** | **eq**} *dst-port-number*
  - **dst-port** **port-list** *port-list-name*
  - **dst-port** **range** *dst-port-number* *dst-port-number*
  - **no** **dst-port**
  - **esp-ext-hdr** {**true** | **false**}
  - **no** **esp-ext-hdr**
  - **flow-label** *flow-label* [*mask*]
  - **no** **flow-label**



- **fragment** {true | false | first-only | non-first-only}
- **no fragment**
- **hop-by-hop-opt** {true | false}
- **no hop-by-hop-opt**
- **icmp-code** *icmp-code*
- **no icmp-code**
- **icmp-type** *icmp-type*
- **no icmp-type**
- **packet-length** {lt | gt | eq} *packet-length-value*
- **packet-length range** *packet-length-value packet-length-value*
- **no packet-length**
- **port** {lt | gt | eq} *port-number*
- **port port-list** *port-list-name*
- **port range** *port-number port-number*
- **no port**
- **routing-type0** {true | false}
- **no routing-type0**
- **src-ip** {*ipv6-address/prefix-length* | *ipv6-address ipv6-address-mask* | **ipv6-prefix-list** *prefix-list-name*}
- **no src-ip**
- **src-port** {lt | gt | eq} *src-port-number*
- **src-port port-list** *port-list-name*
- **src-port range** *src-port-number src-port-number*
- **no src-port**
- **tcp-ack** {true | false}
- **no tcp-ack**
- **tcp-cwr** {true | false}
- **no tcp-cwr**
- **tcp-ece** {true | false}
- **no tcp-ece**
- **tcp-fin** {true | false}
- **no tcp-fin**
- **tcp-ns** {true | false}
- **no tcp-ns**
- **tcp-psh** {true | false}
- **no tcp-psh**
- **tcp-rst** {true | false}
- **no tcp-rst**
- **tcp-syn** {true | false}
- **no tcp-syn**
- **tcp-urg** {true | false}
- **no tcp-urg**
- **pbr-down-action-override** *filter-action*
- **no pbr-down-action-override**
- **sticky-dest** *hold-time-up*
- **sticky-dest no-hold-time-up**
- **no sticky-dest**
- **renum** *old-entry-id new-entry-id*
- **scope** {exclusive | template | embedded | system}
- **no scope**
- **shared-radius-filter-wmark** *low low-watermark high high-watermark*
- **no shared-radius-filter-wmark**
- **sub-insert-credit-control** *start-entry entry-id count count*
- **no sub-insert-credit-control**

- **sub-insert-radius** **start-entry** *entry-id* **count** *count*
- **no sub-insert-radius**
- **sub-insert-shared-pccrule** **start-entry** *entry-id* **count** *count*
- **no sub-insert-shared-pccrule**
- **sub-insert-shared-radius** **start-entry** *entry-id* **count** *count*
- **no sub-insert-shared-radius**
- **sub-insert-wmark** **low** *low-watermark* **high** *high-watermark*
- **no sub-insert-wmark**
- **type** {normal | src-mac | packet-length}

#### 4.4.1.3 MAC Filter Commands

```

config
 — filter
 — mac-filter filter-id [name filter-name] [create]
 — no mac-filter {filter-id | filter-name}
 — default-action {drop | forward}
 — description description-string
 — no description
 — embed-filter vsd vsd-filter-id [offset offset] [{active | inactive}]
 — no embed-filter vsd vsd-filter-id
 — entry entry-id [create]
 — no entry entry-id
 — [no] action [secondary]
 — drop
 — forward
 — forward esi esi service-id vpls-service-id
 — forward sap sap-id
 — forward sdp sdp-id:vc-id
 — ignore-match
 — rate-limit value
 — description description-string
 — no description
 — log log-id
 — no log
 — match [frame-type {802dot3 | 802dot2-llc | 802dot2-snap |
 ethernet_II}]
 — no match
 — dot1p dot1p-value [dot1p-mask]
 — no dot1p
 — dsap dsap-value [dsap-mask]
 — no dsap
 — dst-mac ieee-address [ieee-address-mask]
 — no dst-mac
 — etype 0x0600..0xffff
 — no etype
 — inner-tag value [vid-mask]
 — no inner-tag
 — isid value [to higher-value]
 — no isid
 — outer-tag value [vid-mask]

```

- **no outer-tag**
- **snap-oui** {zero | non-zero}
- **no snap-oui**
- **snap-pid** *snap-pid*
- **no snap-pid**
- **src-mac** *ieee-address* [*ieee-address-mask*]
- **no src-mac**
- **ssap** *ssap-value* [*ssap-mask*]
- **no ssap**
- **pbr-down-action-override** *filter-action*
- **no pbr-down-action-override**
- **sticky-dest** *hold-time-up*
- **sticky-dest** no-hold-time-up
- **no sticky-dest**
- **renum** *old-entry-id* *new-entry-id*
- **scope** {exclusive | template}
- **no scope**
- **type** *filter-type*

#### 4.4.1.4 GRE Tunnel Template Configuration Commands

- ```
config
— filter
  — gre-tunnel-template name [create]
  — no gre-tunnel-template name
    — description description-string
    — no description
    — ipv4
      — [no] destination-address ip-address
      — gre-key if-index
      — no gre-key
      — [no] skip-ttl-decrement
      — source-address ip-address
      — no source-address
```

4.4.1.5 System Filter Policy Commands

- ```
config
— filter
 — system-filter
 — [no] ip ip-filter-id
 — [no] ipv6 ipv6-filter-id
```

### 4.4.1.6 Redirect Policy Configuration Commands

```

config
 — filter
 — redirect-policy redirect-policy-name [create]
 — no redirect-policy redirect-policy-name
 — description description-string
 — no description
 — destination ip-address [create]
 — no destination ip-address
 — description description-string
 — no description
 — [no] ping-test
 — drop-count consecutive-failures [hold-down seconds]
 — no drop-count
 — interval [seconds]
 — no interval
 — source-address [ip-address]
 — no source-address
 — timeout [seconds]
 — no timeout
 — priority [priority]
 — no priority
 — [no] shutdown
 — [no] unicast-rt-test
 — [no] notify-dest-change
 — router router-instance
 — router service-name service-name
 — no router
 — [no] shutdown
 — sticky-dest hold-time-up
 — sticky-dest no-hold-time-up
 — no sticky-dest
 — redirect-policy-binding name [create]
 — no redirect-policy-binding name
 — binding-operator {and | or}
 — no binding-operator
 — redirect-policy redirect-policy-name destination ip-address
 — no redirect-policy redirect-policy-name [destination ip-address]

```

### 4.4.1.7 Match Filter List Commands

```

config
 — filter
 — match-list
 — ip-prefix-list ip-prefix-list-name [create]
 — no ip-prefix-list ip-prefix-list-name
 — [no] apply-path
 — bgp-peers criterion-index group reg-exp neighbor reg-exp

```

- **bgp-peers** *criterion-index* **router** *router-instance* **group** *reg-exp*  
**neighbor** *reg-exp*
- **bgp-peers** *criterion-index* **router** **service-name** *service-name*  
**group** *reg-exp* **neighbor** *reg-exp*
- **no** **bgp-peers** *criterion-index*
- **description** *description-string*
- **no** **description**
- [no] **prefix** *ip-prefix/prefix-length*
- [no] **prefix-exclude** *ip-prefix/prefix-length*
- **ipv6-prefix-list** *ipv6-prefix-list-name* [**create**]
- **no** **ipv6-prefix-list** *ipv6-prefix-list-name*
  - [no] **apply-path**
    - **bgp-peers** *criterion-index* **group** *reg-exp* **neighbor** *reg-exp*
    - **bgp-peers** *criterion-index* **router** *router-instance* **group** *reg-exp*  
**neighbor** *reg-exp*
    - **bgp-peers** *criterion-index* **router** **service-name** *service-name*  
**group** *reg-exp* **neighbor** *reg-exp*
    - **no** **bgp-peers** *criterion-index*
  - **description** *description-string*
  - **no** **description**
  - [no] **prefix** *ipv6-prefix/prefix-length*
  - [no] **prefix-exclude** *ipv6-prefix/prefix-length*
- **port-list** *port-list-name* [**create**]
- **no** **port-list** *port-list-name*
  - **description** *description-string*
  - **no** **description**
  - [no] **port** *port-number*
  - [no] **port** **range** *start end*

#### 4.4.1.8 Log Filter Commands

- config
  - filter
    - **log** *log-id* [**create**]
    - **no** **log** *log-id*
      - **description** *description-string*
      - **no** **description**
      - **destination** **memory** *num-entries*
      - **destination** **syslog** *syslog-id*
      - **no** **destination**
      - [no] **shutdown**
      - **summary**
        - [no] **shutdown**
        - **summary-crit** *dst-addr*
        - **summary-crit** *src-addr*
        - **no** **summary-crit**
    - [no] **wrap-around**

### 4.4.1.9 Copy Filter Commands

```
config
 — filter
 — copy
 — ip-filter src-filter-id [src-entry src-entry-id] to dst-filter-id [dst-entry dst-entry-id] [overwrite]
 — ipv6-filter src-filter-id [src-entry src-entry-id] to dst-filter-id [dst-entry dst-entry-id] [overwrite]
 — mac-filter src-filter-id [src-entry src-entry-id] to dst-filter-id [dst-entry dst-entry-id] [overwrite]
```

### 4.4.1.10 Model-Driven Automatic ID Commands

```
config
 — filter
 — md-auto-id
 — filter-id-range start filter-id end filter-id
 — no filter-id-range
```

## 4.4.2 Command Descriptions

- [Generic Commands](#)
- [IPv4 Filter Policy Commands](#)
- [IPv6 Filter Policy Commands](#)
- [MAC Filter Commands](#)
- [GRE Tunnel Template Configuration Commands](#)
- [System Filter Policy Commands](#)
- [Redirect Policy Configuration Commands](#)
- [Match Filter List Commands](#)
- [Log Filter Commands](#)
- [Copy Filter Commands](#)
- [Model-Driven Automatic ID Commands](#)

### 4.4.2.1 Generic Commands

#### description

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>description</b> <i>description-string</i><br><b>no description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>gre-tun-tmp<br>config>filter>ip-exception<br>config>filter>ip-exception>entry<br>config>filter>ip-filter<br>config>filter>ipv6-filter<br>config>filter>ip-filter>entry<br>config>filter>ipv6-filter>entry<br>config>filter>log<br>config>filter>mac-filter<br>config>filter>mac-filter>entry<br>config>filter>redirect-policy<br>config>filter>redirect-policy>destination<br>config>filter>match-list>ip-prefix-list<br>config>filter>match-list>ipv6-prefix-list<br>config>filter>match-list>port-list |
| <b>Description</b> | This command creates a text description stored in the configuration file for a configuration context.<br><br>The <b>no</b> form of the command removes any description string from the context.                                                                                                                                                                                                                                                                                                                        |
| <b>Default</b>     | no description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <i>description-string</i> — The description character string. Allowed values are any string up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes.                                                                                                                                                                                                                     |

### 4.4.2.2 IPv4 Filter Policy Commands

#### ip-filter

|                    |                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip-filter</b> <i>filter-id</i> [ <b>name</b> <i>filter-name</i> ] [ <b>create</b> ]<br><b>no ip-filter</b> { <i>filter-id</i>   <i>filter-name</i> } |
| <b>Context</b>     | config>filter                                                                                                                                           |
| <b>Description</b> | This command creates a configuration context for the specified IPv4 filter policy.                                                                      |

The **no** form of the command deletes the IPv4 filter policy. A filter policy cannot be deleted until it is removed from all objects where it is applied.

- Default** No IPv4 filter policy is created by default.
- Parameters** *filter-id* — Specifies the IPv4 filter policy ID expressed as a decimal integer.
- Values** 1 to 65535
- name** — Configures an optional filter name, up to 64 characters in length, to a given filter. This filter name can then be used in configuration references, display, and show commands throughout the system. A defined filter name can help the service provider or administrator to identify and manage filters within the SR OS platforms. To create a filter, you must assign a filter ID, however, after it is created, either the filter ID or filter name can be used to identify and reference a filter. If a name is not specified at creation time, then SR OS assigns a string version of the *filter-id* as the name. Filter names may not begin with an integer (0 to 9).
- Values** *name*: 64 characters maximum
- filter-name* — Specifies a string of up to 64 characters uniquely identifying this IPv4 filter policy.
- create** — This keyword is required to create the configuration context. Once it is created, the context can be enabled with or without the **create** keyword.

## chain-to-system-filter

- Syntax** [no] chain-to-system-filter
- Context** config>filter>ip-filter  
config>filter>ipv6-filter
- Description** This command chains this filter to a currently active system filter. When the filter is chained to the system filter, the system filter rules are executed first, and the filter rules are only evaluated if no match on the system filter was found.
- The **no** form of the command detaches this filter from the system filter.
- Operational note:**
- If no system filter is currently active, the command has no effect.
- Default** no chain-to-system-filter

## default-action

- Syntax** default-action {drop | forward}



|                    |                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter<br>config>filter>mac-filter                                                                                                                                                                                                                  |
| <b>Description</b> | This command defines the default action to be applied to packets not matching any entry in this ACL filter policy or to packets for that match a PBF/PBR filter entry for which the PBF/PBR target is down and <b>pbr-down-action-override</b> per-entry is set to <b>filter-default-action</b> . |
| <b>Default</b>     | default-action drop                                                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <b>drop</b> — Specifies the default action is to drop a packet.<br><b>forward</b> — Specifies the default action is to forward a packet.                                                                                                                                                          |

## embed-filter

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>IPv4:</b><br><b>embed-filter</b> <i>ip-filter-id</i> [ <b>offset</b> <i>offset</i> ] [{ <b>active</b>   <b>inactive</b> }]<br><b>no embed-filter</b> <i>ip-filter-id</i><br><b>IPv6:</b><br><b>embed-filter</b> <i>ipv6-filter-id</i> [ <b>offset</b> <i>offset</i> ] [{ <b>active</b>   <b>inactive</b> }]<br><b>no embed-filter</b> <i>ipv6-filter-id</i><br><b>IPv4:</b><br><b>embed-filter flowspec</b> [ <b>group</b> <i>group-id</i> ] [ <b>router</b> { <i>router-instance</i>   <b>service-name</b> <i>vprn-service-name</i> }] [ <b>offset</b> <i>offset</i> ] [{ <b>active</b>   <b>inactive</b> }]<br><b>no embed-filter flowspec</b> [ <b>group</b> <i>group-id</i> ]<br><b>embed-filter open-flow</b> <i>ofs-name</i> [{ <b>system</b>   <b>service</b> { <i>service-id</i>   <i>service-name</i> }   <b>sap</b> <i>sap-id</i> }] [ <b>offset</b> <i>offset</i> ] [{ <b>active</b>   <b>inactive</b> }]<br><b>no embed-filter open-flow</b> <i>ofs-name</i> [{ <b>system</b>   <b>service</b> { <i>service-id</i>   <i>service-name</i> }   <b>sap</b> <i>sap-id</i> }]<br><b>embed-filter vsd</b> <i>vsd-filter-id</i> [ <b>offset</b> <i>offset</i> ] [{ <b>active</b>   <b>inactive</b> }]<br><b>no embed-filter vsd</b> <i>vsd-filter-id</i> |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter<br>config>filter>mac-filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | This command embeds a previously defined IPv4, IPv6, or MAC embedded filter policy or Hybrid OpenFlow switch instance into this exclusive, template, or system filter policy at the specified offset value. Rules derived from the BGP flowspec can also be embedded into template filter policies only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |



**Note:** For MAC filters, embedding is supported for VSD filters or filter entries only.

The **embed-filter open-flow** *ofs-name* form of this command enables OpenFlow (OF) in GRT either by embedding the specified OpenFlow switch (OFS) instance with **switch-defined-cookie** disabled, or by embedding rules with `sros-cookie:type "grt-cookie"`, value 0, from the specified OFS instance with **switch-defined-cookie** enabled. The embedding filter can only be deployed in GRT context or be unassigned.

The **embed-filter open-flow** *ofs-name system* form of this command enables OF in system filters by embedding rules with `sros-cookie:type "system-cookie"`, value 0, from the specified OFS instance with **switch-defined-cookie** enabled. The embedding filter can only be of scope **system**.

The **embed-filter open-flow** *ofs-name service* {*service-id* | *service-name*} form of this command enables OF in VPRN/VPLS filters by embedding rules with `sros-cookie:type "service-cookie"`, value **service-id**, from the specified OFS instance with **switch-defined-cookie** enabled—per service rules. The embedding filter can only be deployed in the specified VPRN/VPLS service. A single VPLS service can only support OF rules per SAP or per service.

The **embed-filter open-flow** *ofs-name sap* *sap-id* form of this command enables OF in VPLS SAP filters by embedding rules with `sros-cookie:type "service-cookie"`, value *service-id* and flow match conditions specifying the *sap-id* from the specified OFS instance with **switch-defined-cookie** enabled—per SAP OF rules. The embedding filter must be of type **exclusive** and can only be deployed on the specified SAP in the context of the specified VPLS service. A single VPLS service can only support OF rules per SAP or per service.

The **no embed-filter open-flow** *ofs-name* form of this command removes the OF embedding for the GRT context.

The **embed-filter flowspec** form of this command enables the embedding of rules derived from BGP flowspec routes into the filter policy that is being configured. The optional **group** parameter specifies that only flowspec routes tagged with an interface-set extended community containing this group ID should be selected for embedding. The optional **router** parameter specifies the routing instance source of the BGP flowspec routes; if the parameter is not specified, the routing instance is derived automatically from the context in which the filter policy is applied. Flowspec rules associated with one routing instance cannot be embedded in a filter applied to an interface of a different routing instance. After flowspec rules associated with one routing instance are embedded into a filter, that filter policy cannot be applied to an interface of a different routing instance.

The **no embed-filter flowspec** form of this command removes the flowspec filter embedding from this filter policy.

The **embed-filter vsd** *vsd-filter-id* command refers to the VSD filter ID encoded `_tmnx_vsd_filter-id`. The filter is created dynamically and managed exclusively using the Python script, so rules can be inserted and removed in the correct VSD filters. The command is supported with IP, IPv6, and MAC filters. For more information about VSD filter provisioning, automation, and the Python script, refer to the *7450 ESS, 7750 SR, 7950 XRS, and VSR Layer 2 Services and EVPN Guide: VLL, VPLS, PBB, and EVPN*.

The **no embed-filter vsd** *vsd-filter-id* form of this command removes the VSD filter embedding from this filter policy.

The **no embed-filter** *filter-id* form of this command removes the embedding from this filter policy.

See the description of embedded filter policies in this guide for further operational details.

- Parameters**
- IPv4:** *ip-filter-id* — Specifies a previously defined IPv4 policy for embedding in this filter.
  - IPv6:** *ipv6-filter-id* — Specifies a previously defined IPv6 policy for embedding in this filter.
  - offset** — Specifies that an embedded filter entry X will have an entry X + offset in the embedding filter.
    - Values** 0 to 2097151
    - Default** 0
  - active** — Specifies that embedded filter entries are to be included in this embedding filter policy and activated on applicable line cards—default if no keyword is specified and omitted from **info** command output (but not **info detail**), or when saving the configuration.
  - inactive** — Specifies that no embedded filter policy entries are to be included in this embedding filter policy. The embedding is configured but will not do anything.
  - flowspec** — This keyword indicates that rules derived from BGP flowspec routes should be embedded into (or removed from, in case of the **no** form) the filter.
  - group-id** — Specifies that only flowspec routes with an interface-set extended community with this value of *group-id* should be selected for embedding.
    - Values** 0 to 16383
  - router-instance** — Specifies a router instance.
  - vprn-service-name** — Specifies the VPRN service name used for embedding Flowspec rules.
  - open-flow** — Indicates that rules derived from OpenFlow should be embedded into (or removed from, in case of the **no** form) the filter.
  - ofs-name** — Specifies the name of the currently configured Hybrid OpenFlow Switch (OFS) instance.
 

Not including the **system**, **service** or **sap** parameters will specify OF in a GRT instance context by default. This allows embedding of OF rules into filters deployed in GRT instances from OFS with **switch-defined-cookie** disabled, or embedding rules from OFS with **switch-defined-cookie** enabled, when the FlowTable cookie encodes sros-cookie:type “grt-cookie”.
  - system** — Used for OF control of system filters. Allows embedding of OF rules into system filters from OFS with **switch-defined-cookie** enabled. Only the rules with cookie value encoding “system-cookie” are embedded.
  - service-id** — Specifies an existing VPRN or VPLS service ID that the embedding filter can be used for.

**service-name** — Specifies an existing VPRN or VPLS service name that the embedding filter can be used for.

**Values** 1 to 2147483647

**service-name** — Specifies an existing VPRN or VPLS service name up to 64 characters that the embedding filter can be used for.

**sap-id** — Used for OF control of VPLS services when a PortID and VLAN ID match is required. Allows embedding of OF rules with a PortID and VLAN ID match into exclusive VPLS SAP filters. Only the rules with cookie value encoding the VPLS service, and flow table match encoding the specified SAP, are embedded into the filter. The embedding filter can only be deployed in the context of the specified SAP.

**sap-id** — Specifies an existing SAP that the embedding filter can be used for.

**vsd-filter-id** — Creates an embedded filter (filter ID: `_tmnx_vsd_<filter-id>`) for population by Nuage VSD.

## entry

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>entry</b> <i>entry-id</i> [ <b>create</b> ]<br><b>no entry</b> <i>entry-id</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter<br>config>filter>mac-filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>This command creates or edits an IPv4, IPv6, MAC, or IP exception filter entry. Multiple entries can be created using unique <i>entry-id</i> numbers within the filter. Entries must be sequenced from most to least explicit.</p> <p>An entry may not have any match criteria defined (in which case everything matches) but must have at least the keyword <b>action</b> for it to be considered complete. Entries without the <b>action</b> keyword will be considered incomplete and hence will be rendered inactive.</p> <p>The <b>no</b> form of the command removes the specified entry from the filter. Entries removed from the filter are immediately removed from all services or network ports where that filter is applied.</p> |
| <b>Parameters</b>  | <p><b>entry-id</b> — Uniquely identifies a match criteria and the corresponding action. It is recommended that multiple entries be given <i>entry-id</i> in staggered increments. This allows users to insert a new entry in an existing policy without requiring to renumber all the existing entries. The parameter is expressed as a decimal integer.</p> <p><b>Values</b> 1 to 2097151</p> <p><b>create</b> — This keyword is required to create the configuration context. Once the context is created, the user can enable the context with or without the <b>create</b> keyword.</p>                                                                                                                                                     |

## action

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] action [secondary]</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>filter>ip-filter>entry<br>config>filter>ipv6-filter>entry<br>config>filter>mac-filter>entry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command enters the context to configure a primary (no option specified) or secondary (<b>secondary</b> option specified) action to be performed on packets matching this filter entry. An ACL filter entry remains inactive (is not programmed in hardware) until a specific action is configured for that entry.</p> <p>A primary action supports any filter entry action, a secondary action is used for redundancy and defines a redundant L3 PBR action for an L3 PBR primary action or a redundant L2 PBF action for a L2 PBF primary action.</p> <p>The <b>no</b> form of this command removes the specific action configured in the context of the action command. The primary action cannot be removed if a secondary action exists.</p> |
| <b>Default</b>     | no action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <b>secondary</b> — Specifies a secondary action to be performed on packets matching this filter entry. A secondary action can only be configured if a primary action is configured.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## drop

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>drop</b><br><b>drop packet-length {lt   gt   eq} packet-length-value</b><br><b>drop packet-length range packet-length-value packet-length-value</b><br><b>drop pattern expression expression mask mask offset-type offset-type offset-value</b><br><i>offset-value</i><br><b>drop ttl {lt   gt   eq} ttl-value</b><br><b>drop ttl range ttl-value ttl-value</b>                                                                                                                       |
| <b>Context</b>     | config>filter>ip-filter>entry>action                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command configures the drop action for the traffic that matches this filter entry.</p> <p>Traffic can, also, be dropped based on <i>pkt-length</i>, <i>packet-length range</i>, <i>ttl</i>, <i>ttl range</i>, or a pattern of conditional match criteria.</p> <p>Packets that match the filter entry match criteria, and not the conditional match criteria value, are implicitly forwarded with no further match in the following filter entries.</p> <p>For pattern match:</p> |

- the expression is left-aligned for odd number bytes, for example, the expression 0xABC is programmed 0x0ABC in the line card
- the 'data' offset requires protocol UDP or TCP to be selected in the filter entry match criteria.

**Parameters**    **packet-length** — Specifies drop packets matching both the filter entry match criteria and the *packet-length value* defined in the **drop** action statement. Packets matching the filter entry match criteria and not matching the *packet-length value*, as defined in the **drop** action statement, are implicitly forwarded with no further match in the following filter entries.

**Values**    lt — Specifies “less than”. The **lt** parameter cannot be used with the lowest possible numerical value for the parameter.  
                  gt — Specifies “greater than”. The **gt** parameter cannot be used with the highest possible numerical value for the parameter.  
                  eq — Specifies “equal to”.

*packet-length-value* — Specifies the packet length value for the rate limit action.

**Values**    0 to 65535

**range** — Specifies an inclusive range. When **range** is used, the start of the range (the first value entered) must be smaller than the end of the range (the second value entered).

*expression* — Specifies the hexadecimal pattern to match; up to eight bytes.

**Values**    0x0000000000000001 to 0xffffffffffffff

*mask* — Specifies the mask for the pattern expression, up to eight bytes.

**Values**    0x0000000000000001 to 0xffffffffffffff

*offset-type* — Specifies the starting point reference for the offset-value of this pattern.

**Values**    layer-3, layer-4, data, dns-qtype

*offset-value* — Specifies the offset value for the pattern expression. Dns-qtype supports offset value of 0.

**Values**    0 to 255

*ttl-value* — Specifies drop packets matching both the filter entry match criteria and the TTL value defined in the drop action statement. Packets matching the filter entry match criteria and not matching the TTL value, as defined in the drop action statement, are implicitly forwarded with no further match in the following filter entries.

**Values**    0 to 255

## drop-extracted-traffic

**Syntax**    **drop-extracted-traffic**

**Context**    config>filter>ip-filter>entry>action

```
config>filter>ipv6-filter>entry>action
```

**Description** This command specifies that a packet matching this filter entry is dropped if extracted to the CPM. Packets matching the filter entry match criteria and not extracted to the CPM are forwarded with no further match in the following filter entries.

## extended-action

**Syntax** **[no] extended-action**

**Context** config>filter>ip-filter>entry>action  
config>filter>ipv6-filter>entry>action

**Description** This command enables the context to configure an extended action for a filter entry's PBR action (configured under **config>filter>ip-filter>entry>action** and **config>filter>ipv6-filter>entry>action** context). The extended action is executed in addition to the configured PBR action.

The **no** form of the command removes the extended action.

**Default** no extended-action

## remark

**Syntax** **remark dscp dscp-name**

**Context** config>filter>ip-filter>entry>action  
config>filter>ipv6-filter>entry>action  
config>filter>ip-filter>entry>action>extended-action  
config>filter>ipv6-filter>entry>action>extended-action

**Description** This command enables and configures the remarking of the DiffServ Code Points of packets matching the criteria of the IPv4/IPv6 filter policy entry, in conjunction with a PBR action. Packets are remarked regardless of QoS-based in-profile or out-of-profile classification. QoS-based DSCP remarking is overridden. If the status of the PBR target is tracked and it is down, the extended action will not be executed; otherwise, the extended action will be performed.

**Parameters** *dscp-name* — Specifies the DSCP value to write.

**Values** be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63

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**fc**

|                    |                                                                                                                                                                         |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>fc</b> <i>fc-name</i><br><b>no fc</b>                                                                                                                                |
| <b>Context</b>     | config>filter>ip-filter>entry>action<br>config>filter>ipv6-filter>entry>action                                                                                          |
| <b>Description</b> | This command assigns a forwarding class to packets matching the filter entry.<br><br>The <b>no</b> version of this command removes the forwarding class marking action. |
| <b>Parameters</b>  | <i>fc-name</i> — Specifies the forwarding class name.<br><br><b>Values</b> be, l2, af, l1, h2, ef, h1, nc                                                               |

**forward**

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>forward</b><br><b>forward bonding-connection</b> <i>connection-id</i><br><b>IPv4:</b><br><b>forward esi esi sf-ip</b> <i>ip-address</i> <b>vas-interface</b> <i>interface-name</i> <b>router</b> <i>router-instance</i><br><b>IPv6:</b><br><b>forward esi esi sf-ip</b> <i>ipv6-address</i> <b>vas-interface</b> <i>interface-name</i> <b>router</b> <i>router-instance</i><br><b>IPv4:</b><br><b>forward esi esi sf-ip</b> <i>ip-address</i> <b>vas-interface</b> <i>interface-name</i> <b>router</b> <b>service-name</b> <i>service-name</i><br><b>IPv6:</b><br><b>forward esi esi sf-ip</b> <i>ipv6-address</i> <b>vas-interface</b> <i>interface-name</i> <b>router</b> <b>service-name</b> <i>service-name</i><br><b>forward esi esi service-id</b> <i>vpls-service-id</i><br><b>forward gre-tunnel</b> <i>gre-tunnel-name</i><br><b>forward lsp</b> <i>lsp-name</i><br><b>IPv4:</b><br><b>forward next-hop</b> <i>ip-address</i><br><b>IPv6:</b><br><b>forward next-hop</b> <i>ipv6-address</i><br><b>IPv4:</b><br><b>forward next-hop</b> <i>ip-address</i> <b>router</b> <i>router-instance</i><br><b>IPv6:</b><br><b>forward next-hop</b> <i>ipv6-address</i> <b>router</b> <i>router-instance</i><br><b>IPv4:</b><br><b>forward next-hop</b> <i>ip-address</i> <b>router</b> <b>service-name</b> <i>service-name</i><br><b>IPv6:</b><br><b>forward next-hop</b> <i>ipv6-address</i> <b>router</b> <b>service-name</b> <i>service-name</i> |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | <p><b>IPv4:</b><br/> <b>forward next-hop indirect</b> <i>ip-address</i></p> <p><b>IPv6:</b><br/> <b>forward next-hop indirect</b> <i>ipv6-address</i></p> <p><b>IPv4:</b><br/> <b>forward next-hop indirect</b> <i>ip-address</i> <b>router</b> <i>router-instance</i></p> <p><b>IPv6:</b><br/> <b>forward next-hop indirect</b> <i>ipv6-address</i> <b>router</b> <i>router-instance</i></p> <p><b>IPv4:</b><br/> <b>forward next-hop indirect</b> <i>ip-address</i> <b>router</b> <b>service-name</b> <i>service-name</i></p> <p><b>IPv6:</b><br/> <b>forward next-hop indirect</b> <i>ipv6-address</i> <b>router</b> <b>service-name</b> <i>service-name</i></p> <p><b>forward next-hop interface</b> <i>ip-int-name</i></p> <p><b>forward redirect-policy</b> <i>policy-name</i></p> <p><b>forward router</b> <i>router-instance</i></p> <p><b>forward router</b> <b>service-name</b> <i>service-name</i></p> <p><b>forward sap</b> <i>sap-id</i></p> <p><b>forward sdp</b> <i>sdp-id:vc-id</i></p> <p><b>IPv4:</b><br/> <b>forward vprn-target bgp-nh</b> <i>ip-address</i> <b>router</b> <i>router-instance</i> [<b>adv-prefix</b> <i>ip-address/mask</i>] [<b>isp</b> <i>isp-name</i>]</p> <p><b>IPv6:</b><br/> <b>forward vprn-target bgp-nh</b> <i>ip-address</i> <b>router</b> <i>router-instance</i> [<b>adv-prefix</b> <i>ipv6-address/prefix-length</i>] [<b>isp</b> <i>isp-name</i>]</p> <p><b>IPv4:</b><br/> <b>forward vprn-target bgp-nh</b> <i>ip-address</i> <b>router</b> <b>service-name</b> <i>service-name</i> [<b>adv-prefix</b> <i>ip-address/mask</i>] [<b>isp</b> <i>isp-name</i>]</p> <p><b>IPv6:</b><br/> <b>forward vprn-target bgp-nh</b> <i>ip-address</i> <b>router</b> <b>service-name</b> <i>service-name</i> [<b>adv-prefix</b> <i>ipv6-address/prefix-length</i>] [<b>isp</b> <i>isp-name</i>]</p> |
| <b>Context</b>     | config>filter>ip-filter>entry>action<br>config>filter>ipv6-filter>entry>action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | This command sets the context for specific forward commands to be performed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <p><i>connection-id</i> — Specifies that the packet should be forwarded over the specified connection (specified by the connection ID under the bonding group interface), if that connect is available. Outside of a bonding egress context, the behavior of this filter is undefined.</p> <p><b>Values</b>      1, 2</p> <p><b>esi service-id</b> — Specifies that the packet matching the entry is forwarded to an ESI-identified first appliance in Nuage service chain using EVPN-resolved VXLAN tunnel in the specified VPLS service.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

**esi sf-ip vas-interface router** — Specifies that the packet matching the entry is forwarded to ESI/SF-IP identified first appliance in Nuage service chain using EVPN-resolved VXLAN tunnel over the configured VAS interface in the specified VPRN service.

**gre-tunnel-name** — Specifies the GRE tunnel name up to 32 characters.

**lsp** — Specifies that the packet matching the entry is forwarded using the specified lsp.

**next-hop** — Specifies that the packet matching the entry is forwarded in the routing context of the incoming interface using direct or indirect IPv4 address in the routing lookup.

**next-hop router** — Specifies that the packet matching the entry is forwarded in the configured routing context using direct or indirect IPv4 address in the routing lookup.

**next-hop interface** — Specifies that the packet matching the entry is forwarded using the configured local interface.

**redirect-policy** — Specifies that the packet matching the entry is forwarded using forward next-hop or forward nexthop router and the IP address of destination selected by the configured redirect policy.

If no destination is selected, packets are subject to action forward.

**router** — Specifies that the packet matching the entry is routed in the configured routing instance and not in the incoming interface routing instance.

**sap** — Specifies that the packet matching the entry is forwarded using the configured SAP.

**sdp** — Specifies that the packet matching the entry is forwarded using the configured SDP.

**vpri-target** — Specifies that the packet matching the entry is redirected towards a designated BGP next-hop (**bgp-nh**). The user may specify an LSP (**lsp lsp-name**) to use towards that next-hop. If no LSP is specified, the system will automatically select one. The user must specify the routing context (**router {router-instance | service-name service-name}**) in which the system will perform the lookups in order to derive the proper VPRN service label. The user may specify an advertised prefix route (**adv-prefix ip-address/prefix-length**). This is needed in case label per VRF is not the label allocation method configured at the BGP peer.

**esi** — Specifies a 10-byte Ethernet Segment Identifier.

**ip-address/mask** — Specifies an IPv4 advertised route in the CIDR notation. The IPv4 address is in dotted decimal notation.

**Values** ip-address a.b.c.d (host bits must be 0)  
mask: 0 to 32

**ipv6-address/prefix-length** — Specifies an IPv6 advertised route in the CIDR notation.

**Values** ipv6-address:  
• x:x:x:x:x:x:x (eight 16-bit pieces)  
• x:x:x:x:x:d.d.d.d, where “x” is [0..FFFF]H, and “d” is [0..255]

prefix-length: 0 to 128

**bgp-nh** *ip-address* — Specifies the IPv4 address (in dotted decimal notation) of the target BGP next-hop.

**Values**      *ip-address* d.d.d.d

*ip-address* — Specifies the IPv4 address of a direct or indirect next hop to which to forward matching packets.

*ipv6-address* — Specifies the IPv6 address of a direct or indirect next hop to which to forward matching packets.

*ip-int-name* — Specifies the name of an egress IP interface where matching packets will be forwarded from. This parameter is only valid for unnumbered point-to-point interfaces. If the string contains special characters (such as #, \$, spaces), the entire string must be enclosed within double quotes.

*interface-name* — Specifies the (maximum 32-character) name of an egress R-VPLS IP interface used to forward the packets using ESI redirect for VPRN/IES service.

*lsp-name* — Specifies an existing RSVP-TE, MPLS-TP, or SR-TE LSP that supports LSP redirect.

*policy-name* — Specifies an IPv4 redirect policy configured in the config>filter>redirect-policy context.

*sap-id* — Specifies an existing VPLS Ethernet SAP.

*sdp-id:vc-id* — Specifies an existing VPLS SDP.

*router-instance* — Specifies “Base” or an existing VPRN service ID. For the **forward vprn-target bgp-nh** command, *router-instance* must specify an existing VPRN service ID.

*service-name* — Specifies an existing VPRN service name.

*vpls-service-id* — Specifies an existing VPLS service ID or service name.

## forward-when

|                    |                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>forward-when</b> <b>pattern</b> <b>expression</b> <i>expression</i> <b>mask</b> <i>mask</i> <b>offset-type</b> <i>offset-type</i> <b>offset-value</b> <i>offset-value</i>                                                                                                                  |
| <b>Context</b>     | config>filter>ip-filter>entry>action<br>config>filter>ipv6-filter>entry>action                                                                                                                                                                                                                |
| <b>Description</b> | This command configures the forward-when action for the traffic that matches this filter entry.                                                                                                                                                                                               |
| <b>Parameters</b>  | <p><b>pattern</b> — Specifies the traffic that can be forwarded based on a pattern found in the packet header or data payload.</p> <p><i>expression</i> — Specifies the hexadecimal pattern to match, up to eight bytes.</p> <p><b>Values</b>      0x0000000000000000 to 0xffffffffffffff</p> |

*mask* — Specifies the mask for the pattern expression, up to eight bytes.

**Values** 0x0000000000000000 to 0xffffffffffffff

*offset-type* — Specifies the starting point reference for the offset-value of this pattern.

**Values** layer-3, layer-4, data, dns-qtype

*offset-value* — Specifies the offset value for the pattern expression.

**Values** 0 to 255

## gtp-local-breakout

|                    |                                                                       |
|--------------------|-----------------------------------------------------------------------|
| <b>Syntax</b>      | <b>gtp-local-breakout</b>                                             |
| <b>Context</b>     | config>filter>ip-filter>entry                                         |
| <b>Description</b> | This command specifies the filter entry action to gtp-local-breakout. |

## http-redirect

|                    |                                                                                |
|--------------------|--------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>http-redirect</b> <i>rdr-url-string</i> [ <b>allow-radius-override</b> ]    |
| <b>Context</b>     | config>filter>ip-filter>entry>action<br>config>filter>ipv6-filter>entry>action |
| <b>Description</b> | This command sets the filter entry action to http-redirect.                    |

## ignore-match

|                    |                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ignore-match</b>                                                                                                                         |
| <b>Context</b>     | config>filter>ip-filter>entry>action<br>config>filter>ipv6-filter>entry>action<br>config>filter>mac-filter>entry>action                     |
| <b>Description</b> | This command sets the filter entry action to <b>ignore-match</b> , as a result this filter entry is ignored and not programmed in hardware. |

## nat

|                |                                                                                |
|----------------|--------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>nat</b> [ <b>nat-policy</b> <i>nat-policy-name</i> ]                        |
| <b>Context</b> | config>filter>ip-filter>entry>action<br>config>filter>ipv6-filter>entry>action |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command enables NAT traffic diversion based on IPv4 filters (LSN44) or IPv6 filters (DS-Lite, NAT64). The filter contains a matching condition based on any combination of the 5 tuple. Traffic will be diverted to NAT based on such defined matching condition. Filter fields outside of the 5 tuples are not valid and it will be ignored in filter based traffic diversion to NAT.</p> <p>The pool selection for the outside IP address and port along with other mapping characteristics can be specified by the means on the NAT policy.</p> |
| <b>Parameters</b>  | <p><i>nat-policy-name</i> — Specifies the NAT policy name up to 32 characters.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## rate-limit

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>rate-limit</b> <i>value</i></p> <p><b>rate-limit</b> <i>value</i> <b>packet-length</b> {<i>lt</i>   <i>gt</i>   <i>eq</i>} <i>packet-length-value</i></p> <p><b>rate-limit</b> <i>value</i> <b>packet-length range</b> <i>packet-length-value</i> <i>packet-length-value</i></p> <p><b>rate-limit</b> <i>value</i> <b>pattern expression</b> <i>expression</i> <b>mask</b> <i>mask</i> <b>offset-type</b> <i>offset-type</i> <b>offset-value</b> <i>offset-value</i></p> <p><b>rate-limit</b> <i>value</i> <b>ttl</b> {<i>lt</i>   <i>gt</i>   <i>eq</i>} <i>tll-value</i></p> <p><b>rate-limit</b> <i>value</i> <b>ttl range</b> <i>tll-value</i> <i>tll-value</i></p>                                                                                                               |
| <b>Context</b>     | <p>config&gt;filter&gt;ip-filter&gt;entry&gt;action</p> <p>config&gt;filter&gt;mac-filter&gt;entry&gt;action</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command sets the rate limit value for traffic matching this filter entry.</p> <p>Traffic can, also, be rate-limited based on <i>pkt-length</i>, <i>packet-length range</i>, <i>tll</i>, <i>tll range</i>, or a pattern of conditional match criteria.</p> <p>Packets that match the filter entry match criteria, but do not match the conditional match criteria value, are implicitly forwarded with no further match in the following filter entries.</p> <p>For pattern match:</p> <ul style="list-style-type: none"> <li>the expression is left-aligned for the odd number bytes, for example, the expression 0xABC is programmed 0x0ABC in the line card</li> <li>the 'data' offset requires protocol UDP or TCP to be selected in the filter entry match criteria.</li> </ul> |
| <b>Parameters</b>  | <p><i>value</i> — Specifies the <b>rate-limit</b> <i>value</i> in kb/s. A rate of 0 results in all traffic being dropped. A rate of <b>max</b> results in all traffic being forwarded.</p> <p><b>Values</b> 0 to 20000000000 kb/s, max</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

**packet-length** — Specifies rate-limit packets matching both the filter entry match criteria and the *packet-length value* defined in the **rate-limit** action statement. Packets matching the filter entry match criteria and not matching the *packet-length value*, as defined in the **rate-limit** action statement, are implicitly forwarded with no further match in the following filter entries.

**Values**     *lt* — Specifies “less than”. The **lt** parameter cannot be used with the lowest possible numerical value for the parameter.  
                  *gt* — Specifies “greater than”. The **gt** parameter cannot be used with the highest possible numerical value for the parameter.  
                  *eq* — Specifies “equal to”.

*packet-length-value* — Specifies the packet length value for the rate limit action.

**Values**     0 to 65535

**range** — Specifies an inclusive range. When **range** is used, the start of the range (the first value entered) must be smaller than the end of the range (the second value entered).

*expression* — Specifies the hexadecimal pattern to match; up to eight bytes.

**Values**     0x0000000000000001 to 0xffffffffffffff

*mask* — Specifies the mask for the pattern expression, up to eight bytes.

**Values**     0x0000000000000001 to 0xffffffffffffff

*offset-type* — Specifies the starting point reference for the offset-value of this pattern.

**Values**     layer-3, layer-4, data, dns-qtype

*offset-value* — Specifies the offset value for the pattern expression. Dns-qtype supports offset value of 0.

**Values**     0 to 255

*ttl-value* — Specifies rate-limit packets matching both the filter entry match criteria and the TTL value defined in the *rate-limit* action statement. Packets matching the filter entry match criteria and not matching the TTL value, as defined in the *rate-limit* action statement, are implicitly forwarded with no further match in the following filter entries.

**Values**     0 to 255

## reassemble

|                    |                                                          |
|--------------------|----------------------------------------------------------|
| <b>Syntax</b>      | <b>reassemble</b>                                        |
| <b>Context</b>     | config>filter>ip-filter>entry>action                     |
| <b>Description</b> | This command sets the filter entry action to reassemble. |

## tcp-mss-adjust

|                    |                                                                                                           |
|--------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tcp-mss-adjust</b>                                                                                     |
| <b>Context</b>     | config>filter>ip-filter>entry>action<br>config>filter>ipv6-filter>entry>action                            |
| <b>Description</b> | This command activates adjustment of maximum segment size (MSS) option of TCP packets matching the entry. |

## egress-pbr

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>egress-pbr {default-load-balancing   I4-load-balancing}</b><br><b>no egress-pbr</b>                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>filter>ip-filter>entry<br>config>filter>ipv6-filter>entry                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | This command specifies that the configured PBR action is applicable to egress processing. The command should only be enabled in ACL policies used by residential subscribers. Enabling <b>egress-pbr</b> on filters not deployed for residential subscribers is not blocked but may lead to unexpected behavior and should be avoided.<br><br>The <b>no</b> form of this command removes the <b>egress-pbr</b> designation of the filter entry's action. |
| <b>Default</b>     | no egress-pbr                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <b>default-load-balancing</b> — Sets load-balancing to the default (hash based on SA/DA of the packet).<br><b>I4-load-balancing</b> — Includes TCP/UDP port (if available) in the hash.                                                                                                                                                                                                                                                                  |

## filter-sample

|                    |                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] filter-sample</b>                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>filter>ip-filter>entry<br>config>filter>ipv6-filter>entry                                                                                                                                                                                                         |
| <b>Description</b> | This command enables cflowd sampling for packets matching this filter entry.<br><br>If the cflowd is either not enabled or set to <b>cflowd interface</b> mode, this command is ignored.<br><br>The <b>no</b> form disables the cflowd sampling using this filter entry. |
| <b>Default</b>     | no filter-sample                                                                                                                                                                                                                                                         |

---

## interface-disable-sample

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] interface-disable-sample</b>                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>filter>ip-filter>entry<br>config>filter>ipv6-filter>entry                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b> | <p>This command disables cflowd sampling for packets matching this filter entry, for the IP interface set to <b>cflowd interface</b> mode. This allows the option to not sample specific types of traffic when interface sampling is enabled.</p> <p>If the cflowd is either not enabled or set to <b>cflowd acl</b> mode, this command is ignored.</p> <p>The <b>no</b> form of this command enables sampling.</p> |
| <b>Default</b>     | no interface-disable-sample                                                                                                                                                                                                                                                                                                                                                                                         |

## log

|                    |                                                                                                                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>log <i>log-id</i></b><br><b>no log</b>                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>filter>ip-filter>entry<br>config>filter>ipv6-filter>entry<br>config>filter>mac-filter>entry                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command associates a filter log to the current filter policy entry and therefore enables logging for that filter entry.</p> <p>The filter log must exist before a filter entry can be enabled to use the filter log.</p> <p>The <b>no</b> form of the command disables logging for the filter entry.</p> |
| <b>Default</b>     | no log                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <i>log-id</i> — Specifies the filter log ID expressed as a decimal integer.                                                                                                                                                                                                                                      |
| <b>Values</b>      | 101 to 199                                                                                                                                                                                                                                                                                                       |

## match

|                    |                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>match [protocol <i>protocol-id</i>]</b><br><b>no match</b>                                                                                                                         |
| <b>Context</b>     | config>filter>ip-filter>entry                                                                                                                                                         |
| <b>Description</b> | This command enables the context to enter match criteria for the filter entry. When the match criteria have been satisfied the action associated with the match criteria is executed. |



A **match** context may consist of multiple match criteria, but multiple **match** statements cannot be entered per entry. More precisely, the command can be entered multiple times but this only results in modifying the *protocol-id*, and does not affect the underlying match criteria configuration.

The **no** form of the command removes all the match criteria from the filter entry and sets the *protocol-id* of the match command to **none** (keyword). As per above, **match protocol none** is however not equivalent to **no match**.

- Default** match protocol none
- Parameters** *protocol-id* — Configures an IP protocol to be used as an IP filter match criterion. The protocol type, such as TCP or UDP, is identified by its respective protocol number.
- Values** protocol-number: [0..255]D  
[0x0..0xFF]H  
[0b0..0b11111111]B  
protocol-name: 0 to 255 in decimal format. Values can also be specified in hexadecimal format, in binary format, or using the following keywords:  
IPv4 filter keywords: none (default), icmp, igmp, ip, tcp, egp, igp, udp, rdp, ipv6, ipv6-route, ipv6-frag, idrp, rsvp, gre, ipv6-icmp, ipv6-no-nxt, ipv6-opts, iso-ip, eigrp, ospf-igp, ether-ip, encap, pnni, pim, vrrp, l2tp, stp, ptp, isis, crtp, crudp, sctp  
IP exception filter keywords: none, icmp, igmp, ospf-igp, pim, rsvp, tcp, udp, vrrp  
\* — udp/tcp wildcard

**Table 54 Protocol ID Descriptions**

| Protocol   | Protocol ID | Description                                           |
|------------|-------------|-------------------------------------------------------|
| icmp       | 1           | Internet Control Message                              |
| igmp       | 2           | Internet Group Management                             |
| ip         | 4           | IP in IP (encapsulation)                              |
| tcp        | 6           | Transmission Control                                  |
| egp        | 8           | Exterior Gateway Protocol                             |
| igp        | 9           | Any private interior gateway (used by Cisco for IGRP) |
| udp        | 17          | User Datagram                                         |
| rdp        | 27          | Reliable Data Protocol                                |
| ipv6       | 41          | IPv6                                                  |
| ipv6-route | 43          | Routing Header for IPv6                               |

**Table 54 Protocol ID Descriptions (Continued)**

| Protocol    | Protocol ID | Description                          |
|-------------|-------------|--------------------------------------|
| ipv6-frag   | 44          | Fragment Header for IPv6             |
| idrp        | 45          | Inter-Domain Routing Protocol        |
| rsvp        | 46          | Reservation Protocol                 |
| gre         | 47          | General Routing Encapsulation        |
| ipv6-icmp   | 58          | ICMP for IPv6                        |
| ipv6-no-nxt | 59          | No Next Header for IPv6              |
| ipv6-opts   | 60          | Destination Options for IPv6         |
| iso-ip      | 80          | ISO Internet Protocol                |
| eigrp       | 88          | EIGRP                                |
| ospf-igp    | 89          | OSPFIGP                              |
| ether-ip    | 97          | Ethernet-within-IP Encapsulation     |
| encap       | 98          | Encapsulation Header                 |
| pnni        | 102         | PNNI over IP                         |
| pim         | 103         | Protocol Independent Multicast       |
| vrrp        | 112         | Virtual Router Redundancy Protocol   |
| l2tp        | 115         | Layer Two Tunneling Protocol         |
| stp         | 118         | Spanning Tree Protocol               |
| ptp         | 123         | Performance Transparency Protocol    |
| isis        | 124         | ISIS over IPv4                       |
| crtcp       | 126         | Combat Radio Transport Protocol      |
| crudp       | 127         | Combat Radio User Datagram           |
| sctp        | 132         | Stream Control Transmission Protocol |

**dscp**

**Syntax** **dscp** *dscp-name*  
**no dscp**

**Context** config>filter>ip-filter>entry>match  
config>filter>ipv6-filter>entry>match

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command configures a DiffServ Code Point (DSCP) name to be used as an IP filter match criterion.</p> <p>The <b>no</b> form of the command removes the DSCP match criterion.</p>                                                                                                                                                                                                                                                                                                                       |
| <b>Default</b>     | no dscp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><i>dscp-name</i> — Configures a DSCP name. The DiffServ code point may only be specified by its name.</p> <p><b>Values</b> be, ef, cp1, cp2, cp3, cp4, cp5, cp6, cp7, cp9, cs1, cs2, cs3, cs4, cs5, nc1, nc2, af11, af12, af13, af21, af22, af23, af31, af32, af33, af41, af42, af43, cp11, cp13, cp15, cp17, cp19, cp21, cp23, cp25, cp27, cp29, cp31, cp33, cp35, cp37, cp39, cp41, cp42, cp43, cp44, cp45, cp47, cp49, cp50, cp51, cp52, cp53, cp54, cp55, cp57, cp58, cp59, cp60, cp61, cp62, cp63</p> |

## dst-ip

|                    |                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>IPv4:</b></p> <p><b>dst-ip</b> {<i>ip-address/mask</i>   <i>ip-address ipv4-address-mask</i>   <b>ip-prefix-list</b> <i>prefix-list-name</i>}</p> <p><b>IPv6:</b></p> <p><b>dst-ip</b> {<i>ipv6-address/prefix-length</i>   <i>ipv6-address ipv6-address-mask</i>   <b>ipv6-prefix-list</b> <i>prefix-list-name</i>}</p> <p><b>no dst-ip</b></p>                                                     |
| <b>Context</b>     | <p>config&gt;filter&gt;ip-filter&gt;entry&gt;match</p> <p>config&gt;filter&gt;ipv6-filter&gt;entry&gt;match</p>                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command configures a destination address range to be used as a filter policy match criterion.</p> <p>To match on the destination address, specify the address and its associated mask, e.g., 10.1.0.0/16. The conventional notation of 10.1.0.0 255.255.0.0 can also be used for IPv4.</p> <p>The <b>no</b> form of this command removes the destination IPv4 or IPv6 address match criterion.</p> |
| <b>Default</b>     | no dst-ip                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><i>ip-address</i> — Specifies the destination IPv4 address in dotted decimal notation.</p> <p><b>Values</b> a.b.c.d</p> <p><i>mask</i> — Specifies the length in bits of the subnet mask.</p> <p><b>Values</b> 1 to 32</p> <p><i>ipv4-address-mask</i> — Specifies the subnet mask in dotted decimal notation.</p> <p><b>Values</b> a.b.c.d (dotted quad equivalent of mask length)</p>                 |

**ip-prefix-list** or **ipv6-prefix-list** *prefix-list-name* — Specifies to use a list of IP prefixes referred to by *prefix-list-name*, which is a string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

**ipv6-address** — Specifies the IPv6 prefix for the IP match criterion in hex digits.

**Values**      x:x:x:x:x:x:x (eight 16-bit pieces)  
                  x:x:x:x:x:d.d.d.d  
                  x:            [0..FFFF]H  
                  d:            [0..255]D

**prefix-length** — Specifies the IPv6 prefix length for the *ipv6-address* as a decimal integer.

**Values**      1 to 128

**ipv6-address-mask** — Specifies the eight 16-bit hexadecimal pieces representing bit match criteria.

**Values**      x:x:x:x:x:x:x (eight 16-bit pieces)  
                  x:x:x:x:x:d.d.d.d  
                  x:            [0..FFFF]H  
                  d:            [0..255]D

## dst-port

**Syntax**      **dst-port** {**lt** | **gt** | **eq**} *dst-port-number*  
                  **dst-port port-list** *port-list-name*  
                  **dst-port range** *dst-port-number dst-port-number*  
                  **no dst-port**

**Context**      config>filter>ip-filter>entry>match  
                  config>filter>ipv6-filter>entry>match

**Description**      This command configures a destination TCP, UDP, or SCTP port number or port range for an IP filter or IP exception match criterion. An entry containing Layer 4 non-zero match criteria will not match non-initial (2nd, 3rd, etc) fragments of a fragmented packet since only the first fragment contains the Layer 4 information. Similarly an entry containing the “**dst-port eq 0**” match criterion, may match non-initial fragments when the destination port value is not present in a packet fragment and other match criteria are also met.

The **no** form of the command removes the destination port match criterion.

**Default**      no dst-port

**Parameters**      **lt** — Specifies that all port numbers less than the *dst-port-number* match.  
                  **gt** — Specifies that all port numbers greater than the *dst-port-number* match.  
                  **eq** — Specifies that the *dst-port-number* must be an exact match.

*dst-port-number* — Specifies the destination port number to be used as a match criteria expressed as a decimal integer, as well as in hexadecimal or binary format. The following value is for decimal integer format only.

**Values** 0 to 65535

*port-list-name* — Specifies to use a list of ports referred to by *port-list-name*, which is a string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

*dst-port-number dst-port-number* — Specifies inclusive port range between two *dst-port-number* values.

## fragment

|                    |                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>IPv4:</b><br><b>fragment {true   false}</b><br><b>IPv6:</b><br><b>fragment {true   false   first-only   non-first-only}</b><br><b>no fragment</b>                                                                                                                                                                                                           |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | This command specifies match criterion for fragmented packets.<br><br>The <b>no</b> form of the command removes the match criterion.                                                                                                                                                                                                                           |
| <b>Default</b>     | no fragment                                                                                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <b>true</b> — Specifies to match on all fragmented IPv4 or IPv6 packets.<br><b>false</b> — Specifies to match on all non-fragmented IPv4 or IPv6 packets.<br><b>first-only</b> — Matches if a packet is an initial fragment of a fragmented IPv6 packet.<br><b>non-first-only</b> — Matches if a packet is a non-initial fragment of a fragmented IPv6 packet. |

## icmp-code

|                |                                                                              |
|----------------|------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>icmp-code <i>icmp-code</i></b><br><b>no icmp-code</b>                     |
| <b>Context</b> | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match |

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|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>Configures matching on ICMP/ICMPv6 code field in the ICMP/ICMPv6 header of an IPv4 or IPv6 packet as a filter match criterion or configures matching on the ICMP code field in the ICMP header of an IPv4 packet as an exception filter match criterion. An entry containing Layer 4 non-zero match criteria will not match non-initial (2nd, 3rd, etc.) fragments of a fragmented packet since only the first fragment contains the Layer 4 information. Similarly an entry containing "<b>icmp-code 0</b>" match criterion, may match non-initial fragments when the Layer 4 header is not present in a packet fragment and other match criteria are also met.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | no icmp-code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><i>icmp-code</i> — Specifies the ICMP/ICMPv6 code value that must be present to match. Value can be expressed as a decimal integer, as well as in hexadecimal or binary format, or even using keywords. The following value shows decimal integer only.</p> <p><b>Values</b>      0 to 255</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## icmp-type

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>icmp-type</b> <i>icmp-type</i></p> <p><b>no icmp-type</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | <p>config&gt;filter&gt;ip-filter&gt;entry&gt;match</p> <p>config&gt;filter&gt;ipv6-filter&gt;entry&gt;match</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command configures matching on the ICMP/ICMPv6 type field in the ICMP/ICMPv6 header of an IPv4 or IPv6 packet as a filter match criterion or configures matching on the ICMP type field in the ICMP header of an IPv4 packet as an exception filter match criterion. An entry containing Layer 4 non-zero match criteria will not match non-initial (2nd, 3rd, etc.) fragments of a fragmented packet since only the first fragment contains the Layer 4 information. Similarly an entry containing "<b>icmp-type 0</b>" match criterion, may match non-initial fragments when the Layer 4 header is not present in a packet fragment and other match criteria are also met.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | no icmp-type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><i>icmp-type</i> — Specifies the ICMP/ICMPv6 type value that must be present to match. Value can be expressed as a decimal integer, as well as in hexadecimal or binary format, or even using keywords. The following value shows decimal integer only.</p> <p><b>Values</b>      0 to 255</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## ip-option

|               |                                                                   |
|---------------|-------------------------------------------------------------------|
| <b>Syntax</b> | <b>ip-option</b> <i>ip-option-value</i> [ <i>ip-option-mask</i> ] |
|---------------|-------------------------------------------------------------------|

**no ip-option**

- Context** config>filter>ip-filter>entry>match
- Description** This command configures matching packets with a specific IP option or a range of IP options in the first option of the IP header as an IP filter match criterion.
- The option-type octet contains 3 fields:
- 1 bit copied flag (copy options in all fragments)
  - 2 bits option class
  - 5 bits option number
- The **no** form of the command removes the match criterion.
- Default** no ip-option
- Parameters** *ip-option-value* — Specifies the 8 bit option-type as a decimal integer, binary, or hexadecimal format. The mask is applied as an AND to the option byte, the result is compared with the option-value.
- The decimal value entered for the match should be a combined value of the eight bit option type field and not just the option number. Therefore, to match on IP packets that contain the Router Alert option (option number = 20), enter the option type of 148 (10010100).
- Values** 0 to 255
- ip-option-mask* — Specifies an optional parameter that can be used when specifying a range of option numbers to use as the match criteria.
- This 8 bit mask can be configured using the following formats:

**Table 55** ip-option-mask Formats

| Format Style | Format Syntax | Example   |
|--------------|---------------|-----------|
| Decimal      | DDD           | 20        |
| Hexadecimal  | 0xHH          | 0x14      |
| Binary       | 0BBBBBBBB     | 0b0010100 |

- Default** 255 (decimal) (exact match)
- Values** 1 to 255 (decimal)

multiple-option

- Syntax** multiple-option {true | false}

**no multiple-option**

|                    |                                                                                                                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>filter>ip-filter>entry>match                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command configures matching packets that contain one or more than one option fields in the IP header as an IP filter match criterion.</p> <p>The <b>no</b> form of the command removes the checking of the number of option fields in the IP header as a match criterion.</p> |
| <b>Default</b>     | no multiple-option                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <p><b>true</b> — Specifies matching on IP packets that contain more than one option field in the header.</p> <p><b>false</b> — Specifies matching on IP packets that do not contain multiple option fields present in the header.</p>                                                 |

## option-present

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>option-present {true   false}</b><br><b>no option-present</b>                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>filter>ip-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command configures matching packets that contain any IP options in the IP header as an IP filter match criterion.</p> <p>The <b>no</b> form of the command removes the checking of IP options in the IP header as a match criterion.</p>                                                                                                                                                                                               |
| <b>Default</b>     | no option-present                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <p><b>true</b> — Specifies matching on all IP packets that contain any IP options in the IP header. A match will occur for all packets that have any IP option present. An option field of zero is considered as no option present.</p> <p><b>false</b> — Specifies matching on IP packets that do not have any IP option present in the IP header. (an option field of zero). An option field of zero is considered as no option present.</p> |

## packet-length

|                |                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>packet-length {lt   gt   eq} packet-length-value</b><br><b>packet-length range packet-length-value packet-length-value</b><br><b>no packet-length</b> |
| <b>Context</b> | config>filter>ip-filter>entry>match                                                                                                                      |



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|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | This command configures the IPv4 packet length value match criterion.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Default</b>     | no packet-length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><b>lt</b> — Specifies “less than”. The <b>lt</b> parameter cannot be used with the lowest possible numerical value for the parameter.</p> <p><b>gt</b> — Specifies “greater than”. The <b>gt</b> parameter cannot be used with the highest possible numerical value for the parameter.</p> <p><b>eq</b> — Specifies “equal to”.</p> <p><i>packet-length-value</i> — Specifies the packet length value.</p> <p><b>Values</b>      0 to 65535</p> <p><b>range</b> — Specifies an inclusive range. When range is used, the beginning of the range must have a value less than the second value of the range.</p> |

## port

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>port {lt   gt   eq} port-number</b><br><b>port port-list port-list-name</b><br><b>port range port-number port-number</b><br><b>no port</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>This command configures a TCP/UDP/SCTP source or destination port match criterion in IPv4 and IPv6 CPM (SCTP not supported) and/or ACL filter policies. A packet matches this criterion if the packet TCP/UDP/SCTP (as configured by protocol/next-header match) source OR destination port matches either the specified port value or a port in the specified port range or port-list. .</p> <p><b>Operational Note:</b> This command is mutually exclusive with src-port and dst-port commands. Configuring "port eq 0", may match non-initial fragments where the source/destination port values are not present in a packet fragment if other match criteria are also met.</p> <p>The <b>no</b> form of this command deletes the specified port match criterion.</p> |
| <b>Default</b>     | no port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <p><b>lt   gt   eq</b> — Specifies the operator to use relative to <i>port-number</i> for specifying the port number match criteria.</p> <p><b>lt</b> — Specifies that all port numbers less than <i>port-number</i> match.</p> <p><b>gt</b> — Specifies that all port numbers greater than <i>port-number</i> match.</p> <p><b>eq</b> — Specifies that the <i>port-number</i> must be an exact match.</p>                                                                                                                                                                                                                                                                                                                                                                  |

*port-number* — Specifies a source or destination port to be used as a match criterion. The port number can be expressed as a decimal integer, as well as in hexadecimal or binary format. The following value shows a decimal integer only.

**Values** 0 to 65535

**port-list** *port-list-name* — Specifies an inclusive range of source or destination port values to be used as match criteria.

**range** *port-number port-number* — Specifies an inclusive range of source or destination port values to be used as match criteria.

## src-ip

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>IPv4:</b></p> <p><b>src-ip</b> {<i>ip-address/mask</i>   <i>ip-address ipv4-address-mask</i>   <b>ip-prefix-list</b> <i>prefix-list-name</i>}</p> <p><b>IPv6:</b></p> <p><b>src-ip</b> {<i>ipv6-address/prefix-length</i>   <i>ipv6-address ipv6-address-mask</i>   <b>ipv6-prefix-list</b> <i>prefix-list-name</i>}</p> <p><b>no src-ip</b></p>                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | <p>config&gt;filter&gt;ip-filter&gt;entry&gt;match</p> <p>config&gt;filter&gt;ipv6-filter&gt;entry&gt;match</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command configures a source IPv4 or IPv6 address range to be used as an IP filter or IP exception match criterion.</p> <p>To match on the source IPv4 or IPv6 address, specify the address and its associated mask, for example, 10.1.0.0/16 for IPv4. The conventional notation of 10.1.0.0 255.255.0.0 may also be used for IPv4.</p> <p>The <b>no</b> form of the command removes the source IP address match criterion.</p>                                                                                                                                                                                                                                                                                  |
| <b>Default</b>     | no src-ip                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <p><i>ip-address</i> — Specifies the destination IPv4 address specified in dotted decimal notation.</p> <p><b>Values</b> a.b.c.d</p> <p><i>mask</i> — Specifies the length in bits of the subnet mask.</p> <p><b>Values</b> 1 to 32</p> <p><i>ipv4-address-mask</i> — Specifies the subnet mask in dotted decimal notation.</p> <p><b>Values</b> a.b.c.d (dotted quad equivalent of mask length)</p> <p><b>ip-prefix-list</b> or <b>ipv6-prefix-list</b> <i>prefix-list-name</i> — Specifies to use a list of IP prefixes referred to by prefix-list-name, which is a string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.</p> |

*ipv6-address* — Specifies an IPv6 prefix for the IP match criterion in hex digits.

**Values**      x:x:x:x:x:x:x (eight 16-bit pieces)  
                 x:x:x:x:x:d.d.d.d  
                 x:            [0..FFFF]H  
                 d:            [0..255]D

*prefix-length* — Specifies whether a the IPv6 prefix length for the specified *ipv6-address* expressed as a decimal integer.

**Values**      1 to 128

*ipv6-address-mask* — Specifies eight 16-bit hexadecimal pieces representing bit match criteria.

**Values**      x:x:x:x:x:x:x (eight 16-bit pieces)  
                 x:x:x:x:x:d.d.d.d  
                 x:            [0..FFFF]H  
                 d:            [0..255]D

## src-port

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>src-port</b> { <b>lt</b>   <b>gt</b>   <b>eq</b> } <i>src-port-number</i><br><b>src-port port-list</b> <i>port-list-name</i><br><b>src-port range</b> <i>src-port-number src-port-number</i><br><b>no src-port</b>                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>This command configures a source TCP, UDP, or SCTP port number, port range, or port match list for an IP filter or IP exception match criterion. An entry containing Layer 4 non-zero match criteria will not match non-initial (2nd, 3rd, and so on) fragments of a fragmented packet since only the first fragment contains the Layer 4 information. Similarly an entry containing "<b>src-port eq</b> 0" match criterion, may match non-initial fragments when the source port value is not present in a packet fragment and other match criteria are also met.</p> <p>The <b>no</b> form of the command removes the source port match criterion.</p> |
| <b>Default</b>     | no src-port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><b>lt</b>   <b>gt</b>   <b>eq</b> — Specifies the operator to use relative to <i>src-port-number</i> for specifying the port number match criteria.</p> <p><b>lt</b> specifies that all port numbers less than <i>src-port-number</i> match.</p> <p><b>gt</b> specifies that all port numbers greater than <i>src-port-number</i> match.</p> <p><b>eq</b> specifies that <i>src-port-number</i> must be an exact match.</p>                                                                                                                                                                                                                              |

*src-port-number* — Specifies the source port number to be used as a match criteria expressed as a decimal integer, and in hexadecimal or binary format. Below shows decimal integer only.

**Values** 0 to 65535

*port-list-name* — Specifies to use a list of ports referred to by *port-list-name*, which is a string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

*src-port-number src-port-number* — Specifies inclusive port range between two *src-port-number* values.

## src-route-option

|                    |                                                                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>src-route-option {true   false}</b><br><b>no source-route-option</b>                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>ip-filter>entry>match                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command enables source route option match conditions. When enabled, this filter should match if a (strict or loose) source route option is present/not present at any location within the IP header, as per the value of this object. The <b>no</b> form of the command removes the criterion from the match entry. |
| <b>Default</b>     | no src-route-option                                                                                                                                                                                                                                                                                                      |
| <b>Parameters</b>  | <b>true</b> — Enables source route option match conditions.<br><b>false</b> — Disables source route option match conditions.                                                                                                                                                                                             |

## tcp-ack

|                    |                                                                                                                                                                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tcp-ack {true   false}</b><br><b>no tcp-ack</b>                                                                                                                                                                                                                   |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                         |
| <b>Description</b> | This command configures an IP filter match criterion based on the Acknowledgment (ACK) TCP Flag bit, defined in RFC 793, as being set or not in the TCP header of an IP packet.<br><br>The <b>no</b> form of the command removes the criterion from the match entry. |
| <b>Default</b>     | no tcp-ack                                                                                                                                                                                                                                                           |
| <b>Parameters</b>  | <b>true</b> — Specifies matching on IP packets that have the selected TCP flag bit set in the TCP header.                                                                                                                                                            |

**false** — Specifies matching on IP packets that do not have the selected TCP flag bit set in the TCP header.

## tcp-cwr

|                    |                                                                                                                                                                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tcp-cwr {true   false}</b><br><b>no tcp-cwr</b>                                                                                                                                                                                                                               |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                                     |
| <b>Description</b> | This command configures an IP filter match criterion based on the Congestion Window Reduced (CWR) TCP Flag bit, defined in RFC 3168, as being set or not in the TCP header of an IP packet.<br><br>The <b>no</b> form of the command removes the criterion from the match entry. |
| <b>Default</b>     | no tcp-cwr                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <b>true</b> — Specifies matching on IP packets that have the selected TCP flag bit set in the TCP header.<br><br><b>false</b> — Specifies matching on IP packets that do not have the selected TCP flag bit set in the TCP header.                                               |

## tcp-ece

|                    |                                                                                                                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tcp-ece {true   false}</b><br><b>no tcp-ece</b>                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                    |
| <b>Description</b> | This command configures an IP filter match criterion based on the ECN-Echo (ECE) TCP Flag bit, defined in RFC 3168, as being set or not in the TCP header of an IP packet.<br><br>The <b>no</b> form of the command removes the criterion from the match entry. |
| <b>Default</b>     | no tcp-ece                                                                                                                                                                                                                                                      |
| <b>Parameters</b>  | <b>true</b> — Specifies matching on IP packets that have the selected TCP flag bit set in the TCP header.<br><br><b>false</b> — Specifies matching on IP packets that do not have the selected TCP flag bit set in the TCP header.                              |

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## tcp-fin

|                    |                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tcp-fin {true   false}</b><br><b>no tcp-fin</b>                                                                                                                                                                                                         |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                               |
| <b>Description</b> | <p>This command configures an IP filter match criterion based on the FIN TCP Flag bit, defined in RFC 793, as being set or not in the TCP header of an IP packet.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | no tcp-fin                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><b>true</b> — Specifies matching on IP packets that have the selected TCP flag bit set in the TCP header.</p> <p><b>false</b> — Specifies matching on IP packets that do not have the selected TCP flag bit set in the TCP header.</p>                  |

## tcp-ns

|                    |                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>tcp-ns {true   false}</b><br><b>no tcp-ns</b>                                                                                                                                                                                                                       |
| <b>Context</b>     | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match                                                                                                                                                                                           |
| <b>Description</b> | <p>This command configures an IP filter match criterion based on the Nonce Sum (NS) TCP Flag bit, defined in RFC 3540, as being set or not in the TCP header of an IP packet.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | no tcp-ns                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <p><b>true</b> — Specifies matching on IP packets that have the selected TCP flag bit set in the TCP header.</p> <p><b>false</b> — Specifies matching on IP packets that do not have the selected TCP flag bit set in the TCP header.</p>                              |

## tcp-psh

|                |                                                                              |
|----------------|------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>tcp-psh {true   false}</b><br><b>no tcp-psh</b>                           |
| <b>Context</b> | config>filter>ip-filter>entry>match<br>config>filter>ipv6-filter>entry>match |

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|                    |                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command configures an IP filter match criterion based on the Push (PSH) TCP Flag bit, defined in RFC 793, as being set or not in the TCP header of an IP packet.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | no tcp-psh                                                                                                                                                                                                                                                        |
| <b>Parameters</b>  | <p><b>true</b> — Specifies matching on IP packets that have the selected TCP flag bit set in the TCP header.</p> <p><b>false</b> — Specifies matching on IP packets that do not have the selected TCP flag bit set in the TCP header.</p>                         |

## tcp-rst

|                    |                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>tcp-rst {true   false}</b><br/><b>no tcp-rst</b></p>                                                                                                                                                                                                         |
| <b>Context</b>     | <p>config&gt;filter&gt;ip-filter&gt;entry&gt;match<br/>config&gt;filter&gt;ipv6-filter&gt;entry&gt;match</p>                                                                                                                                                       |
| <b>Description</b> | <p>This command configures an IP filter match criterion based on the Reset (RST) TCP Flag bit, defined in RFC 793, as being set or not in the TCP header of an IP packet.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | no tcp-rst                                                                                                                                                                                                                                                         |
| <b>Parameters</b>  | <p><b>true</b> — Specifies matching on IP packets that have the selected TCP flag bit set in the TCP header.</p> <p><b>false</b> — Specifies matching on IP packets that do not have the selected TCP flag bit set in the TCP header.</p>                          |

## tcp-syn

|                    |                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <p><b>tcp-syn {true   false}</b><br/><b>no tcp-syn</b></p>                                                                                                                                                                                                               |
| <b>Context</b>     | <p>config&gt;filter&gt;ip-filter&gt;entry&gt;match<br/>config&gt;filter&gt;ipv6-filter&gt;entry&gt;match</p>                                                                                                                                                             |
| <b>Description</b> | <p>This command configures an IP filter match criterion based on the Synchronize (SYN) TCP Flag bit, defined in RFC 793, as being set or not in the TCP header of an IP packet.</p> <p>The <b>no</b> form of the command removes the criterion from the match entry.</p> |
| <b>Default</b>     | no tcp-syn                                                                                                                                                                                                                                                               |

- Parameters**     **true** — Specifies matching on IP packets that have the selected TCP flag bit set in the TCP header.
- false** — Specifies matching on IP packets that do not have the selected TCP flag bit set in the TCP header.

## tcp-urg

- Syntax**        **tcp-urg {true | false}**  
                  **no tcp-urg**
- Context**        config>filter>ip-filter>entry>match  
                  config>filter>ipv6-filter>entry>match
- Description**    This command configures an IP filter match criterion based on the Urgent (URG) TCP Flag bit, defined in RFC 793, as being set or not in the TCP header of an IP packet.
- The **no** form of the command removes the criterion from the match entry.
- Default**        no tcp-urg
- Parameters**     **true** — Specifies matching on IP packets that have the selected TCP flag bit set in the TCP header.
- false** — Specifies matching on IP packets that do not have the selected TCP flag bit set in the TCP header.

## pbr-down-action-override

- Syntax**        **pbr-down-action-override *filter-action***  
                  **no pbr-down-action-override**
- Context**        config>filter>ip-filter>entry  
                  config>filter>ipv6-filter>entry  
                  config>filter>mac-filter>entry
- Description**    This command allows overriding the default action that is applied for entries with PBR/PBF action defined, when the PBR/PBF target is down.
- The **no** form of the command preserves default behavior when PBR/PBF target is down.
- Default**        no pbr-down-action-override
- Parameters**     *filter-action* — Specifies the packets matching the entry.
- drop** — Specifies that packets matching the entry will be dropped if PBR/PBF target is down.
- forward** — Specifies that packets matching the entry will be forwarded if PBR/PBF target is down.



**filter-default-action** — Specifies that packets matching the entry will be processed as per **default-action** configuration for this filter if PBR/PBF target is down.

## sticky-dest

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sticky-dest</b> <i>hold-time-up</i><br><b>sticky-dest no-hold-time-up</b><br><b>no sticky-dest</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>filter>ip-filter>entry<br>config>filter>ipv6-filter>entry<br>config>filter>mac-filter>entry<br>config>filter>redirect-policy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command configures sticky destination behavior for redundant PBR/PBF actions. Configuring sticky destination has an effect on PBR/PBF actions whether a secondary action is configured.</p> <p>The <i>hold-time-up</i> parameter allows the operator to delay programming of a PBR/PBF action for a specified amount of time. The timer is only started when transitioning from all configured targets being down (that is, the primary target if no secondary target is configured, or both the primary and secondary targets when both are configured) to at least one target being up.</p> <p>When the timer expires, the primary PBR/PBF action is programmed if its target is up. If the primary PBR/PBF target is down and a secondary PBR/PBF action has been configured and its target is up, then this secondary PBR/PBF action is programmed. In all other cases, no specific programming occurs when the timer expires.</p> <p>When sticky destination is configured and the secondary PBR/PBF target is up and its associated action is programmed, it is not automatically replaced by the primary PBR/PBF action when its target transitions from down to up. In this situation, programming the primary PBR/PBF action can be forced using the <b>activate-primary-action</b> tools command.</p> <p>Changing the value of the timer while the timer is running takes effect immediately (that is, the timer is restarted immediately using the new value).</p> <p>The <b>no</b> form of the command disables sticky destination behavior.</p> |
| <b>Default</b>     | no sticky-dest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <i>hold-time-up</i> — Specifies the initial delay in seconds. Zero is equivalent to <b>no-hold-time-up</b> (no delay).<br><b>Values</b> 0 to 65535 seconds                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## renum

**Syntax** **renum** *old-entry-id new-entry-id*

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|                    |                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter<br>config>filter>mac-filter                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | This command renumbers existing MAC, IPv4/IPv6, or IP exception filter entries to properly sequence filter entries.<br>This may be required in some cases since the OS exits when the first match is found and executes the actions according to the accompanying action command. This requires that entries be sequenced correctly from most to least explicit. |
| <b>Parameters</b>  | <i>old-entry-id</i> — Specifies the entry number of an existing entry, as a decimal integer.<br><b>Values</b> 1 to 2097151<br><i>new-entry-id</i> — Specifies the new entry-number to be assigned to the old entry, as a decimal integer.<br><b>Values</b> 1 to 2097151                                                                                          |

## scope

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>scope {exclusive   template   embedded   system}</b><br><b>scope {exclusive   template}</b><br><b>no scope</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter<br>config>filter>mac-filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | This command configures the filter policy scope as exclusive, template, embedded or system.<br><br>The scope of the policy cannot be changed when: <ul style="list-style-type: none"> <li>• the scope is <b>template</b> and the policy is applied to one or more services or network interfaces</li> <li>• the scope is <b>embedded</b> and the policy is embedded by another policy</li> </ul> Changing the scope to/from system is only allowed when a policy is not active and the policy has no entries configured.<br><br>The <b>no</b> form of the command sets the scope of the policy to the default of <b>template</b> . |
| <b>Default</b>     | scope template                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <b>exclusive</b> — Specifies that the policy can only be applied to a single entity. Attempting to assign the policy to a second entity will result in an error message.<br><b>template</b> — Specifies that the policy can be applied to multiple entities.<br><b>embedded</b> — Specifies that the policy cannot be applied directly. The policy defines embedded filter rules, which are embedded by other exclusive/template/system filter policies. The <b>embedded</b> scope is supported for IPv4 and IPv6 filter policies only.                                                                                            |

**system** — Specifies that the policy defines system-wide filter rules. To apply system policy rules, activate system filter and chain exclusive/template ACL filter policy to the system filter. The **system** scope is supported for IPv4 and IPv6 filter policies only.

## shared-radius-filter-wmark

|                    |                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>shared-radius-filter-wmark</b> <i>low low-watermark high high-watermark</i><br><b>no shared-radius-filter-wmark</b>                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | This command configures the low and high watermark for the number of RADIUS shared filters reporting                                                                                                                                                                                                                                                                                                |
| <b>Default</b>     | no shared-radius-filter-wmark                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><i>low-watermark</i> — Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be raised by the agent.</p> <p><b>Values</b> 0 to 8000</p> <p><i>high-watermark</i> — Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be cleared by the agent.</p> <p><b>Values</b> 1 to 8000</p> |

## sub-insert-credit-control

|                    |                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sub-insert-credit-control</b> <i>start-entry entry-id count count</i><br><b>no sub-insert-credit-control</b>                                                          |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                     |
| <b>Description</b> | <p>This command inserts point information for credit control for the filter.</p> <p>The <b>no</b> form of the command reverts to the default.</p>                        |
| <b>Default</b>     | no sub-insert-credit-control                                                                                                                                             |
| <b>Parameters</b>  | <p><i>entry-id</i> — Identifies a filter on this system.</p> <p><b>Values</b> 1 to 2097151</p> <p><i>count</i> — Specifies the count</p> <p><b>Values</b> 1 to 65535</p> |

---

## sub-insert-radius

|                    |                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sub-insert-radius start-entry</b> <i>entry-id</i> <b>count</b> <i>count</i><br><b>no sub-insert-radius</b>                                                                                                              |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                                                                       |
| <b>Description</b> | This command inserts point information for RADIUS for the filter.<br><br>The <b>no</b> form of the command reverts to the default.                                                                                         |
| <b>Default</b>     | no sub-insert-radius                                                                                                                                                                                                       |
| <b>Parameters</b>  | <i>entry-id</i> — Specifies at what place the filter entries received from RADIUS will be inserted in the filter.<br><br><b>Values</b> 1 to 2097151<br><i>count</i> — Specifies the count.<br><br><b>Values</b> 1 to 65535 |

## sub-insert-shared-pccrule

|                    |                                                                                                                                                                                                                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sub-insert-shared-pccrule start-entry</b> <i>entry-id</i> <b>count</b> <i>count</i><br><b>no sub-insert-shared-pccrule</b>                                                                                                                                                                                         |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                                                                                                                                                                  |
| <b>Description</b> | This command defines the range of filter and QoS policy entries that are reserved for shared entries received in Flow-Information AVP via Gx interface (PCC rules – Policy and Charging Control). The <b>no</b> form of this command disables the insertion, which will result in a failure of PCC rule installation. |
| <b>Default</b>     | no sub-insert-shared-pccrule                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <i>entry-id</i> — Specifies the lowest entry in the range.<br><br><b>Values</b> 1 to 2097151<br><i>count</i> — Specifies the number of entries in the range.<br><br><b>Values</b> 1 to 65535                                                                                                                          |

## sub-insert-shared-radius

|               |                                                                                                                             |
|---------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>sub-insert-shared-radius start-entry</b> <i>entry-id</i> <b>count</b> <i>count</i><br><b>no sub-insert-shared-radius</b> |
|---------------|-----------------------------------------------------------------------------------------------------------------------------|

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|                    |                                                                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                          |
| <b>Description</b> | This command configures the insert point for shared host rules from RADIUS.                                                                                                   |
| <b>Default</b>     | no sub-insert-shared-radius                                                                                                                                                   |
| <b>Parameters</b>  | <i>entry-id</i> — Identifies a filter on this system.<br><div> <b>Values</b> 1 to 2097151 </div> <i>count</i> — Specifies the count.<br><div> <b>Values</b> 1 to 65535 </div> |

## sub-insert-wmark

|                    |                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>sub-insert-wmark low <i>low-watermark</i> high <i>high-watermark</i></b><br><b>no sub-insert-wmark</b>                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | This command configures the low and high watermark percentage for inserted filter entry usage reporting.<br><br>The <b>no</b> form of the command reverts to the default.                                                                                                                                                                                                                             |
| <b>Default</b>     | sub-insert-wmark low 90 high 95                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <i>low-watermark</i> — Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be cleared by the agent.<br><div> <b>Values</b> 0 to 100 </div> <i>high-watermark</i> — Specifies the utilization of the filter ranges for filter entry insertion, at which a table full alarm will be raised by the agent.<br><div> <b>Values</b> 0 to 100 </div> |

## type

|                    |                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>type {normal   src-mac   packet-length}</b>                                                                                   |
| <b>Context</b>     | config>filter>ip-filter<br>config>filter>ipv6-filter                                                                             |
| <b>Description</b> | This command configures the filter policy type. The policy type defines the list of match criteria supported in a filter policy. |
| <b>Default</b>     | type normal                                                                                                                      |

- Parameters**
- normal** — Specifies the default filter policy type.
  - src-mac** — Specifies the source MAC filter policy type to match on source MAC addresses in VPLS services.
  - packet-length** — Specifies the packet length filter policy type to match on the total packet length.

### 4.4.2.3 IPv6 Filter Policy Commands

#### ipv6-filter

- Syntax** **ipv6-filter** *filter-id* [**name** *filter-name*] [**create**]  
**no ipv6-filter** {*filter-id* | *filter-name*}
- Context** config>filter
- Description** This command creates a configuration context for the specified IPv6 filter policy.
- The **no** form of the command deletes the IPv6 filter policy. A filter policy cannot be deleted until it is removed from all objects where it is applied.
- Default** No IPv6 filter policy is created by default.
- Parameters** *filter-id* — Specifies the IPv6 filter policy ID expressed as a decimal integer.
- Values** 1 to 65535
- name** — Configures an optional filter name, up to 64 characters in length, to a given filter. This filter name can then be used in configuration references, display, and show commands throughout the system. A defined filter name can help the service provider or administrator to identify and manage filters within the SR OS platforms. To create a filter, you must assign a filter ID, however, after it is created, either the filter ID or filter name can be used to identify and reference a filter. If a name is not specified at creation time, then SR OS assigns a string version of the *filter-id* as the name. Filter names may not begin with an integer (0 to 9).
- Values** *name*: 64 characters maximum
- filter-name* — Specifies a string of up to 64 characters uniquely identifying this IPv6 filter policy.
- create** — This keyword is required to create the configuration context. Once it is created, the context can be enabled with or without the **create** keyword.

## drop

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>drop</b><br><b>drop hop-limit</b> {lt   gt   eq} <i>hop-limit-value</i><br><b>drop hop-limit range</b> <b>hop-limit-value</b> <i>hop-limit-value</i><br><b>drop pattern expression</b> <i>expression</i> <b>mask</b> <i>mask</i> <b>offset-type</b> <i>offset-type</i> <b>offset-value</b> <i>offset-value</i><br><b>drop payload-length</b> {lt   gt   eq} <i>payload-length-value</i><br><b>drop payload-length range</b> <i>payload-length-value</i> <i>payload-length-value</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>filter>ipv6-filter>entry>action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command configures the drop action for the traffic that matches this filter entry.</p> <p>Traffic can, also, be dropped based on <i>payload-length</i>, <i>payload-length range</i>, <i>hop-limit</i>, <i>hop-limit range</i>, or a pattern of conditional match criteria.</p> <p>Packets that match the filter entry match criteria, but do not match the conditional match criteria value, are implicitly forwarded with no further match in the following filter entries.</p> <p>For pattern match:</p> <ul style="list-style-type: none"> <li>the expression is left-aligned for the odd number bytes, for example, the expression 0xABC is programmed 0x0ABC in the line card</li> <li>the 'data' offset requires protocol UDP or TCP to be selected in the filter entry match criteria</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><b>hop-limit</b> — Specifies the hop-limit value for the drop action.</p> <p><b>Values</b>      lt — Specifies “less than”. The <b>lt</b> parameter cannot be used with the lowest possible numerical value for the parameter.<br/> eq — Specifies “equal to”.<br/> gt — Specifies “greater than”. The <b>gt</b> parameter cannot be used with the highest possible numerical value for the parameter.</p> <p><i>hop-limit-value</i> — Specifies the hop-limit value for the drop action.</p> <p><b>Values</b>      0 to 255</p> <p><b>range</b> — Specifies an inclusive range. When the <b>range</b> parameter is used, the start of the range (the first value entered) must be smaller than the end of the range (the second value entered).</p> <p><i>expression</i> — Specifies the hexadecimal pattern to match; up to eight bytes.</p> <p><b>Values</b>      0x0000000000000001 to 0xffffffffffffff</p> <p><i>mask</i> — Specifies the mask for the pattern expression, up to eight bytes.</p> <p><b>Values</b>      0x0000000000000001 to 0xffffffffffffff</p> <p><i>offset-type</i> — Specifies the starting point reference for the offset-value of this pattern.</p> <p><b>Values</b>      layer-3, layer-4, data, dns-qtype</p> |

*offset-value* — Specifies the offset value for the pattern expression. Dns-qtype supports offset value of 0.

**Values** 0 to 255

**payload-length** — Specifies drop packets matching both the filter entry match criteria and the payload-length-value defined in the drop action statement. Packets matching the filter entry match criteria and not matching the payload-length-value, as defined in the drop action statement, are implicitly forwarded with no further match in the following filter entries.

**Values** lt — Specifies “less than”. The **lt** parameter cannot be used with the lowest possible numerical value for the parameter.

gt — Specifies “greater than”. The **gt** parameter cannot be used with the highest possible numerical value for the parameter.

eq — Specifies “equal to”.

*payload-length-value* — Specifies the payload length value for the drop action.

**Values** 0 to 65535

## nat

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>nat nat-type nat-type [nat-policy nat-policy-name]</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>ipv6-filter>entry>action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>This command enables NAT traffic diversion based on IPv4 filters (LSN44) or IPv6 filters (DS-Lite, NAT64). The filter contains a matching condition based on any combination of the 5 tuple. Traffic will be diverted to NAT based on such defined matching condition. Filter fields outside of the 5 tuples are not valid and it will be ignored in filter based traffic diversion to NAT.</p> <p>The pool selection for the outside IP address and port along with other mapping characteristics can be specified by the means on the NAT policy.</p> |
| <b>Parameters</b>  | <p><i>nat-type</i> — Specifies the NAT type.</p> <p><i>nat-policy-name</i> — Specifies the NAT policy name up to 32 characters.</p>                                                                                                                                                                                                                                                                                                                                                                                                                        |

## rate-limit

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b> | <b>rate-limit value</b><br><b>rate-limit value hop-limit {lt   gt   eq} hop-limit-value</b><br><b>rate-limit value hop-limit range hop-limit-value hop-limit-value</b><br><b>rate-limit value pattern expression expression mask mask offset-type offset-type offset-value offset-value</b><br><b>rate-limit value payload-length {lt   gt   eq} payload-length-value</b><br><b>rate-limit value payload-length range payload-length-value payload-length-value</b> |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>filter>ipv6-filter>entry>action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>This command sets the rate limit value for traffic matching this filter entry.</p> <p>Traffic can, also, be rate-limited based on <i>payload-length</i>, <i>payload-length range</i>, <i>hop-limit</i>, <i>hop-limit range</i>, or a pattern of conditional match criteria.</p> <p>Packets that match the filter entry match criteria, but do not match the conditional match criteria value, are implicitly forwarded with no further match in the following filter entries.</p> <p>For pattern match:</p> <ul style="list-style-type: none"> <li>the expression is left-aligned for the odd number bytes, for example, the expression 0xABC is programmed 0x0ABC in the line card.</li> <li>the 'data' offset requires protocol UDP or TCP to be selected in the filter entry match criteria.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><b>value</b> — Specifies the <b>rate-limit value</b> in Kbps. A rate of 0 results in all traffic being dropped. A rate of <b>max</b> results in all traffic being forwarded.</p> <p><b>Values</b> 0 to 2000000000 Kbps, max</p> <p><b>hop-limit</b> — Specifies the hop limit value for the rate limit action.</p> <p><b>Values</b> lt — Specifies “less than”. The <b>lt</b> parameter cannot be used with the lowest possible numerical value for the parameter.<br/> gt — Specifies “greater than”. The <b>gt</b> parameter cannot be used with the highest possible numerical value for the parameter.<br/> eq — Specifies “equal to”.</p> <p><b>hop-limit-value</b> — Specifies the hop limit value for the rate limit action.</p> <p><b>Values</b> 0 to 255</p> <p><b>range</b> — Specifies an inclusive range. When the <b>range</b> parameter is used, the start of the range (the first value entered) must be smaller than the end of the range (the second value entered).</p> <p><b>expression</b> — Specifies the hexadecimal pattern to match; up to eight bytes.</p> <p><b>Values</b> 0x0000000000000001 to 0xffffffffffffff</p> <p><b>mask</b> — Specifies the mask for the pattern expression, up to eight bytes.</p> <p><b>Values</b> 0x0000000000000001 to 0xffffffffffffff</p> <p><b>offset-type</b> — Specifies the starting point reference for the offset-value of this pattern.</p> <p><b>Values</b> layer-3, layer-4, data, dns-qtype</p> <p><b>offset-value</b> — Specifies the offset value for the pattern expression. Dns-qtype supports offset value of 0.</p> <p><b>Values</b> 0 to 255</p> |

**payload-length** — Specifies rate-limit packets matching both the filter entry match criteria and the *payload-length-value* defined in the **rate-limit** action statement. Packets matching the filter entry match criteria and not matching the *payload-length-value*, as defined in the **rate-limit** action statement, are implicitly forwarded with no further match in the following filter entries.

**Values**     *lt* — Specifies “less than”. The *lt* parameter cannot be used with the lowest possible numerical value for the parameter.  
                  *gt* — Specifies “greater than”. The *gt* parameter cannot be used with the highest possible numerical value for the parameter.  
                  *eq* — Specifies “equal to”.

*payload-length-value* — Specifies the payload length value for the rate limit action.

**Values**     0 to 65535

## match

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>match</b> [ <i>next-header next-header</i> ]<br><b>no match</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Context</b>     | config>filter>ipv6-filter>entry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b> | <p>This command enables the context to enter match criteria for the filter entry. When the match criteria have been satisfied the action associated with the match criteria is executed.</p> <p>A <b>match</b> context may consist of multiple match criteria, but multiple <b>match</b> statements cannot be entered per entry. More precisely, the command can be entered multiple times but this only results in modifying the <i>next-header</i>, and does not affect the underlying match criteria configuration.</p> <p>The <b>no</b> form of the command removes all the match criteria from the filter entry and sets the <i>next-header</i> of the match command to <b>none</b> (keyword). As per above, <b>match next-header none</b> is however not equivalent to <b>no match</b>.</p> |
| <b>Default</b>     | match next-header none                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <p><i>next-header</i> — Specifies the IPv6 next header to match. This parameter is analogous to the protocol parameter used in IPv4 filter match command.</p> <p><b>Default Value:</b> none (keyword)</p> <p><b>Values</b>     [1 to 42   45 to 49   52 to 59   61 to 255] — in decimal format. Values can also be specified in hexadecimal format, in binary format, or using the following keywords:<br/> <b>none, icmp, igmp, ip, tcp, egp, igp, udp, rdp, ipv6, idrp, rsvp, gre, ipv6-icmp, ipv6-no-nxt, iso-ip, eigrp, ospf-igp, ether-ip, encap, pnni, pim, vrrp, l2tp, stp, ptp, isis, crtp, crudp, sctp</b><br/>           * — udp/tcp wildcard</p>                                                                                                                                       |

## ah-ext-hdr

|                    |                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ah-ext-hdr {true   false}</b><br><b>no ah-ext-hdr</b>                                                                                                                                                                                                    |
| <b>Context</b>     | config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                       |
| <b>Description</b> | This command enables match on existence of AH Extension Header in the IPv6 filter policy.<br><br>The <b>no</b> form of this command ignores AH Extension Header presence/absence in a packet when evaluating match criteria of a given filter policy entry. |
| <b>Default</b>     | no ah-ext-hdr                                                                                                                                                                                                                                               |
| <b>Parameters</b>  | <b>true</b> — Matches a packet with an AH Extension Header.<br><b>false</b> — Matches a packet without an AH Extension Header.                                                                                                                              |

## esp-ext-hdr

|                    |                                                                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>esp-ext-hdr {true   false}</b><br><b>no esp-ext-hdr</b>                                                                                                                                                                                                    |
| <b>Context</b>     | config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                         |
| <b>Description</b> | This command enables match on existence of ESP Extension Header in the IPv6 filter policy.<br><br>The <b>no</b> form of this command ignores ESP Extension Header presence/absence in a packet when evaluating match criteria of a given filter policy entry. |
| <b>Default</b>     | no esp-ext-hdr                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <b>true</b> — Matches a packet with an ESP Extension Header.<br><b>false</b> — Matches a packet without an ESP Extension Header.                                                                                                                              |

## flow-label

|                    |                                                                                                                                            |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>flow-label <i>flow-label</i> [<i>mask</i>]</b><br><b>no flow-label</b>                                                                  |
| <b>Context</b>     | config>filter>ipv6-filter>entry>match                                                                                                      |
| <b>Description</b> | This command configures the flow-label and optional mask match condition.<br><br>The <b>no</b> form of the command reverts to the default. |
| <b>Default</b>     | no flow-label                                                                                                                              |

---

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <p><i>flow-label</i> — Specifies the flow label to be used as a match criterion. Value can be expressed as a decimal integer, as well as in hexadecimal or binary format. The following value shows decimal integer format only.</p> <p><b>Values</b>     0 to 1048575</p> <p><i>mask</i> — Specifies the flow label mask value for this policy IPv6 Filter entry. Value can be expressed as a decimal integer, as well as in hexadecimal or binary format. The following value shows decimal integer format only.</p> <p><b>Values</b>     0 to 1048575</p> |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## hop-by-hop-opt

|                    |                                                                                                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>hop-by-hop-opt {true   false}</b><br><b>no hop-by-hop-opt</b>                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                              |
| <b>Description</b> | <p>This command enables match on existence of Hop-by-Hop Options Extension Header in the IPv6 filter policy.</p> <p>The <b>no</b> form of this command ignores Hop-by-Hop Options Extension Header presence/absence in a packet when evaluating match criteria of a given filter policy entry.</p> |
| <b>Default</b>     | no hop-by-hop-opt                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><b>true</b> — Matches a packet with a Hop-by-Hop Options Extension header.</p> <p><b>false</b> — Matches a packet without a Hop-by-Hop Options Extension header.</p>                                                                                                                            |

## packet-length

|                    |                                                                                                                                                                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>packet-length {lt   gt   eq} packet-length-value</b><br><b>packet-length range packet-length-value packet-length-value</b><br><b>no packet-length</b>                                                                                                                                                                               |
| <b>Context</b>     | config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | This command configures the IPv6 packet length value match criterion.                                                                                                                                                                                                                                                                  |
| <b>Default</b>     | no packet-length                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><b>lt</b> — Specifies “less than”. The <b>lt</b> parameter cannot be used with the lowest possible numerical value for the parameter.</p> <p><b>gt</b> — Specifies “greater than”. The <b>gt</b> parameter cannot be used with the highest possible numerical value for the parameter.</p> <p><b>eq</b> — Specifies “equal to”.</p> |

*packet-length-value* — Specifies the packet length value.

**Values** 40 to 65575

**range** — Specifies an inclusive range. When range is used, the beginning of the range must have a value less than the second value of the range.

## routing-type0

|                    |                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>routing-type0</b> { <b>true</b>   <b>false</b> }<br><b>no routing-type0</b>                                                                                                                                                                                                                |
| <b>Context</b>     | config>filter>ipv6-filter>entry>match                                                                                                                                                                                                                                                         |
| <b>Description</b> | This command enables match on existence of Routing Type Extension Header type 0 in the IPv6 filter policy.<br><br>The <b>no</b> form of this command ignores Routing Type Extension Header type 0 presence/absence in a packet when evaluating match criteria of a given filter policy entry. |
| <b>Default</b>     | no routing-type0                                                                                                                                                                                                                                                                              |
| <b>Parameters</b>  | <b>true</b> — Specifies whether a packet contains Routing Type Extension Header type 0.<br><b>false</b> — Specifies whether a packet does not contain Routing Type Extension Header type 0.                                                                                                   |

### 4.4.2.4 MAC Filter Commands

## mac-filter

|                    |                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>mac-filter</b> <i>filter-id</i> [ <b>create</b> ] [ <b>name</b> <i>name</i> ]<br><b>mac-filter</b> { <i>filter-id</i>   <i>filter-name</i> }<br><b>no mac-filter</b> { <i>filter-id</i>   <i>filter-name</i> }                                                                             |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | This command, creates a configuration context for the specified MAC filter policy.<br><br>The <b>no</b> form of the command deletes the MAC filter policy. A filter policy cannot be deleted until it is removed from all objects where it is applied.                                        |
| <b>Parameters</b>  | <i>filter-id</i> — Specifies the MAC filter policy ID expressed as a decimal integer.<br><b>Values</b> 1 to 65535<br><b>create</b> — This keyword is required to create the configuration context. After it is created, the context can be enabled with or without the <b>create</b> keyword. |

*name* — Configures an optional filter name, up to 64 characters in length, to a given filter. This filter name can then be used in configuration references, display, and show commands throughout the system. A defined filter name can help the service provider or administrator to identify and manage filters within the SR OS platforms. To create a filter, you must assign a filter ID, however, after it is created, either the filter ID or filter name can be used to identify and reference a filter. If a name is not specified at creation time, then SR OS assigns a string version of the *filter-id* as the name. Filter names may not begin with an integer (0 to 9).

**Values**     *name*: 64 characters maximum

*filter-name* — A string of up to 64 characters uniquely identifying this MAC filter policy

## drop

|                    |                                                        |
|--------------------|--------------------------------------------------------|
| <b>Syntax</b>      | <b>drop</b>                                            |
| <b>Context</b>     | config>filter>mac-filter>entry>action                  |
| <b>Description</b> | This command sets the MAC filter entry action to drop. |

## forward

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>forward</b><br><b>forward esi esi service-id vpls-service-id</b><br><b>forward sap sap-id</b><br><b>forward sdp sdp-id:vc-id</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>filter>mac-filter>entry>action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | This command sets the context for specific forward commands to be performed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <p><i>esi</i> — Specifies a 10-byte Ethernet Segment Identifier.</p> <p><b>service-id</b> — Specifies that a packet matching the entry is forwarded to an ESI-identified first appliance in the Nuage service chain using an EVPN-resolved VXLAN tunnel in the specified VPLS service.</p> <p><i>vpls-service-id</i> — Specifies an existing VPLS service ID or service name.</p> <p><b>sap</b> — Specifies that the packet matching the entry is forwarded using the configured SAP.</p> <p><i>sap-id</i> — Specifies an existing VPLS Ethernet SAP.</p> <p><b>sdp</b> — Specifies that the packet matching the entry is forwarded using the configured SDP.</p> <p><i>sdp-id:vc-id</i> — Specifies an existing VPLS SDP.</p> |

## rate-limit

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>rate-limit</b> <i>value</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>filter>mac-filter>entry>action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | <p>This command sets the rate limit for the traffic matching both the filter entry match criteria and the <i>packet-length-value</i> defined in the <b>rate-limit action</b> statement.</p> <p>Packets matching the filter entry match criteria and not matching the <i>packet-length-value</i> defined in the <b>rate-limit action</b> statement are implicitly forwarded with no further match in subsequent filter entries.</p> <p>Rate limit packets matching both the filter entry match criteria and the <i>tll-value</i> are defined in the <b>action rate-limit</b> statement.</p> <p>Packets matching the filter entry match criteria and not matching the <i>tll-value</i> defined in the <b>rate-limit action</b> statement are implicitly forwarded with no further match in the following filter entries.</p> |
| <b>Parameters</b>  | <p><i>value</i> — Specifies the <b>rate-limit value</b> in kb/s. A rate of 0 results in all traffic being dropped. A rate of <b>max</b> results in all traffic being forwarded.</p> <p><b>Values</b> 0 to 2000000000 kb/s   max</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## match

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>match</b> [frame-type {802dot3   802dot2-llc   802dot2-snap   ethernet_II}]<br><b>no match</b>                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>filter>mac-filter>entry                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command creates the context for entering/editing match criteria for the filter entry and specifies an Ethernet frame type for the entry.</p> <p>A <b>match</b> context may consist of multiple match criteria, but multiple <b>match</b> statements cannot be entered per entry.</p> <p>The <b>no</b> form of the command removes the match criteria for the <i>entry-id</i>.</p>                                                                                                |
| <b>Parameters</b>  | <p><b>frame-type</b> — The <b>frame-type</b> keyword configures an Ethernet frame type to be used for the MAC filter match criteria.</p> <p><b>Default</b> 802dot3</p> <p><b>Values</b> 802dot3, 802dot2-llc, 802dot2-snap, ethernet_II</p> <p><b>802dot3</b> — Specifies the frame type is Ethernet IEEE 802.3.</p> <p><b>802dot2-llc</b> — Specifies the frame type is Ethernet IEEE 802.2 LLC.</p> <p><b>802dot2-snap</b> — Specifies the frame type is Ethernet IEEE 802.2 SNAP.</p> |

**ethernet\_II** — Specifies the frame type is Ethernet Type II.

dot1p

**Syntax**     **dot1p** *dot1p-value* [*dot1p-mask* ]  
              **no dot1p**

**Context**     config>filter>mac-filter>entry>match

**Description**     Configures an IEEE 802.1p value or range to be used as a MAC filter match criterion.

When a frame is missing the 802.1p bits, specifying an dot1p match criterion will fail for the frame and result in a non-match for the MAC filter entry.

The **no** form of the command removes the criterion from the match entry.

Egress **dot1p** value matching will only match if the customer payload contains the 802.1p bits. For example, if a packet ingresses on a null encapsulated SAP and the customer packet is IEEE 802.1Q or 802.1p tagged, the 802.1p bits will be present for a match evaluation. On the other hand, if a customer tagged frame is received on a dot1p encapsulated SAP, the tag will be stripped on ingress and there will be no 802.1p bits for a MAC filter match evaluation; in this case, any filter entry with a dot1p match criterion specified will fail.

**Default**     no dot1p

**Parameters**     *dot1p-value* — Specifies the IEEE 802.1p value in decimal.

**Values**     0 to 7

*dot1p-mask* — Specifies a 3-bit mask that can be configured using the decimal integer, hexadecimal or binary format.

**Table 56**     **dot1p-mask Formats**

| Format Style | Format Syntax | Example |
|--------------|---------------|---------|
| Decimal      | D             | 4       |
| Hexadecimal  | 0xH           | 0x4     |
| Binary       | 0bBBB         | 0b100   |

To select a range from 4 up to 7 specify *dot1p-value* of 4 and a *dot1p-mask* of 0b100 for value and mask.

**Default**     **7 (decimal)**

**Values**     1 to 7 (decimal)



## dsap

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>dsap</b> <i>dsap-value</i> [ <i>dsap-mask</i> ]<br><b>no dsap</b>                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>filter>mac-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>Configures an Ethernet 802.2 LLC DSAP value or range for a MAC filter match criterion.</p> <p>This is a one-byte field that is part of the 802.2 LLC header of the IEEE 802.3 Ethernet Frame.</p> <p>The snap-pid field, etype field, ssap and dsap fields are mutually exclusive and may not be part of the same match criteria.</p> <p>Use the <b>no</b> form of the command to remove the dsap value as the match criterion.</p>                                   |
| <b>Default</b>     | no dsap                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><i>dsap-value</i> — Specifies the 8-bit dsap match criteria value which can be expressed in decimal integer, hexadecimal or binary format.</p> <p><b>Values</b> 0 to 255</p> <p><i>dsap-mask</i> — Specifies an optional parameter that may be used when specifying a range of dsap values to use as the match criteria.</p> <p>This 8 bit mask can be configured using the decimal integer, hexadecimal or binary formats described in <a href="#">Table 57</a>.</p> |

**Table 57 dsap-mask Formats**

| Format Style | Format Syntax | Example    |
|--------------|---------------|------------|
| Decimal      | DDD           | 240        |
| Hexadecimal  | 0xHH          | 0xF0       |
| Binary       | 0bBBBBBBBB    | 0b11110000 |

**Default** **255 (exact match)**  
0x00 to 0xFF

**Values** 0 to 255

## dst-mac

|                |                                                                                      |
|----------------|--------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>dst-mac</b> <i>ieee-address</i> [ <i>ieee-address-mask</i> ]<br><b>no dst-mac</b> |
| <b>Context</b> | config>filter>mac-filter>entry>match                                                 |

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|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | Configures a destination MAC address or range to be used as a MAC filter match criterion.<br><br>The <b>no</b> form of the command removes the destination mac address as the match criterion.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Default</b>     | no dst-mac                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Parameters</b>  | <p><i>ieee-address</i> — Specifies the MAC address to be used as a match criterion.</p> <p><b>Values</b> HH:HH:HH:HH:HH:HH or HH-HH-HH-HH-HH-HH where H is a hexadecimal digit. Note that both upper and lower case are supported.</p> <p><i>ieee-address-mask</i> — Specifies a 48-bit mask to match a range of MAC address values.<br/>To configure so that all packets with a destination MAC OUI value of 00:03:FA are subject to a match condition then the entry should be specified as: 00:03:FA:00:00:00 FF:FF:FF:00:00:00.</p> <p><b>Default</b> ff:ff:ff:ff:ff:ff (exact match)</p> <p><b>Values</b> HH:HH:HH:HH:HH:HH or HH-HH-HH-HH-HH-HH where H is a hexadecimal digit. to 0xFFFFFFFF<br/>Note that both upper and lower case are supported.</p> |

## etype

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>etype</b> <i>0x0600..0xffff</i><br><b>no etype</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>filter>mac-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b> | <p>Configures an Ethernet type II Ethertype value to be used as a MAC filter match criterion.</p> <p>The Ethernet type field is a two-byte field used to identify the protocol carried by the Ethernet frame. For example, 0800 is used to identify the IPv4 packets.</p> <p>The Ethernet type field is used by the Ethernet version-II frames. IEEE 802.3 Ethernet frames do not use the type field. For IEEE 802.3 frames, use the dsap, ssap or snap-pid fields as match criteria.</p> <p>The snap-pid field, etype field, ssap and dsap fields are mutually exclusive and may not be part of the same match criteria.</p> <p>The <b>no</b> form of the command removes the previously entered etype field as the match criteria.</p> |
| <b>Default</b>     | no etype                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Parameters</b>  | <p><i>0x0600..0xffff</i> — Specifies the Ethernet type II frame Ethertype value to be used as a match criterion expressed in decimal integer or hexadecimal format.</p> <p><b>Values</b> 1536 to 65535 or 0x0600 to 0xFFFF</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## inner-tag

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>inner-tag</b> <i>value</i> [ <i>vid-mask</i> ]<br><b>no inner-tag</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter>mac-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command configures the matching of the second tag that is carried transparently through the service. The inner-tag on ingress is the second tag on the frame if there are no service delimiting tags. Inner tag is the second tag before any service delimiting tags on egress but is dependent in the ingress configuration and may be set to 0 even in cases where additional tags are on the frame. This allows matching VLAN tags for explicit filtering or QoS setting when using default or null encapsulations.</p> <p>The inner-tag is not applicable in ingress on dot1Q SAPs. The inner-tag may be populated on egress depending on the ingress SAP type.</p> <p>On QinQ SAPs of null and default that do not strip tags inner-tag will contain the second tag (which is still the second tag carried transparently through the service.) On ingress SAPs that strip any tags, inner-tag will contain 0 even if there are more than 2 tags on the frame.</p> <p>The optional <i>vid-mask</i> is defaulted to 4095 (exact match) but may be specified to allow pattern matching. The masking operation is ((value and vid-mask) == (tag and vid-mask)). A value of 6 and a mask of 7 would match all VIDs with the lower 3 bits set to 6.</p> <p>For QoS the VID type cannot be specified on the default QoS policy.</p> <p>The default vid-mask is set to 4095 for exact match.</p> |
| <b>Default</b>     | no inner-tag                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## isid

|                    |                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>isid</b> <i>value</i> [ <i>to higher-value</i> ]<br><b>no isid</b>                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>filter>mac-filter>entry>match                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command configures an ISID value or a range of ISID values to be matched by the mac-filter parent. The pbb-etype value for the related SAP (inherited from the ethernet port configuration) or for the related SDP binding (inherited from SDP configuration) will be used to identify the ISID tag.</p> <p>The <b>no</b> form of this command removes the ISID match criterion.</p> |
| <b>Default</b>     | no isid                                                                                                                                                                                                                                                                                                                                                                                      |

---

**Parameters**     *value* — Specifies the ISID value, 24 bits as a decimal integer. When just one present identifies a specific ISID to be used for matching.

**Values**        0 to 16777215

**to higher-value** — Identifies a range of ISIDs to be used as matching criteria.

## outer-tag

**Syntax**        **outer-tag** *value* [*vid-mask*]  
**no outer-tag**

**Context**        config>filter>mac-filter>entry>match

**Description**   This command configures the matching of the first tag that is carried transparently through the service. Service delimiting tags are stripped from the frame and outer tag on ingress is the first tag after any service delimiting tags. Outer tag is the first tag before any service delimiting tags on egress. This allows matching VLAN tags for explicit filtering or QoS setting when using default or null encapsulations.

On dot1Q SAPs outer-tag is the only tag that can be matched. On dot1Q SAPs with exact match (sap 2/1/1:50) the outer-tag will be populated with the next tag that is carried transparently through the service or 0 if there is no additional VLAN tags on the frame.

On QinQ SAPs that strip a single service delimiting tag, outer-tag will contain the next tag (which is still the first tag carried transparently through the service.) On SAPs with two service delimiting tags (two tags stripped) outer-tag will contain 0 even if there are more than 2 tags on the frame.

The optional *vid-mask* is defaulted to 4095 (exact match) but may be specified to allow pattern matching. The masking operation is ((value & vid-mask) == (tag & vid-mask)). A value of 6 and a mask of 7 would match all VLANs with the lower 3 bits set to 6.

For QoS the VID type cannot be specified on the default QoS policy.

The default vid-mask is set to 4095 for exact match.

**Default**        no outer-tag

## snap-oui

**Syntax**        **snap-oui** {**zero** | **non-zero**}  
**no snap-oui**

**Context**        config>filter>mac-filter>entry>match

**Description**   This command configures an IEEE 802.3 LLC SNAP Ethernet Frame OUI zero or non-zero value to be used as a MAC filter match criterion.

The **no** form of the command removes the criterion from the match criteria.

**Default** no snap-oui

**Parameters** **zero** — Specifies to match packets with the three-byte OUI field in the SNAP-ID set to zero.  
**non-zero** — Specifies to match packets with the three-byte OUI field in the SNAP-ID not set to zero.

## snap-pid

**Syntax** **snap-pid** *snap-pid*  
**no snap-pid**

**Context** config>filter>mac-filter>entry>match

**Description** Configures an IEEE 802.3 LLC SNAP Ethernet Frame PID value to be used as a MAC filter match criterion.

This is a two-byte protocol id that is part of the IEEE 802.3 LLC SNAP Ethernet Frame that follows the three-byte OUI field.

The snap-pid field, etype field, ssap and dsap fields are mutually exclusive and may not be part of the same match criteria.

The snap-pid match criterion is independent of the OUI field within the SNAP header. Two packets with different three-byte OUI fields but the same PID field will both match the same filter entry based on a snap-pid match criteria.

The **no** form of the command removes the snap-pid value as the match criteria.

**Default** no snap-pid

**Parameters** *snap-pid* — Specifies the two-byte snap-pid value to be used as a match criterion. The value can be expressed in decimal integer or hexadecimal format.

**Values** 0 to 65535 or 0x0000 to 0xFFFF

## src-mac

**Syntax** **src-mac** *ieee-address* [*ieee-address-mask*]  
**no src-mac**

**Context** config>filter>mac-filter>entry>match

**Description** Configures a source MAC address or range to be used as a MAC filter match criterion.

The **no** form of the command removes the source mac as the match criteria.

---

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no src-mac                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Parameters</b> | <p><i>ieee-address</i> — Specifies the 48-bit IEEE MAC address to be used as a match criterion.</p> <p><b>Values</b> HH:HH:HH:HH:HH:HH or HH-HH-HH-HH-HH-HH where H is a hexadecimal digit; both upper and lower case are supported.</p> <p><i>ieee-address-mask</i> — Specifies the 48-bit mask to match a range of MAC address values.</p> <p>To configure so that all packets with a source MAC OUI value of 00:03:FA are subject to a match condition then the entry should be specified as: 00:03:FA:00:00:00 FF:FF:FF:00:00:00</p> <p><b>Default</b> ff:ff:ff:ff:ff:ff (exact match)</p> <p><b>Values</b> HH:HH:HH:HH:HH:HH or HH-HH-HH-HH-HH-HH where H is an hexadecimal digit; both upper and lower case are supported.</p> |

## ssap

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ssap</b> <i>ssap-value</i> [ <i>ssap-mask</i> ]<br><b>no ssap</b>                                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>filter>mac-filter>entry>match                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>This command configures an Ethernet 802.2 LLC SSAP value or range for a MAC filter match criterion.</p> <p>This is a one-byte field that is part of the 802.2 LLC header of the IEEE 802.3 Ethernet Frame.</p> <p>The snap-pid field, etype field, ssap and dsap fields are mutually exclusive and may not be part of the same match criteria.</p> <p>The <b>no</b> form of the command removes the ssap match criterion.</p> |
| <b>Default</b>     | no ssap                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Parameters</b>  | <p><i>ssap-value</i> — Specifies the 8-bit ssap match criteria value in decimal, hexadecimal or binary.</p> <p><b>Values</b> 0 to 255</p> <p><i>ssap-mask</i> — Specifies an optional parameter that may be used when specifying a range of ssap values to use as the match criteria.</p> <p>This 8 bit mask and the ssap value can be configured as described in <a href="#">Table 58</a>.</p>                                  |

**Table 58 8-bit Mask Syntax**

| Format Style | Format Syntax | Example    |
|--------------|---------------|------------|
| Decimal      | DDD           | 240        |
| Hexadecimal  | 0xHH          | 0xF0       |
| Binary       | 0bBBBBBBBB    | 0b11110000 |

**Values** 0 to 255

## type

|                    |                                                                                                                                                                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>type</b> <i>filter-type</i>                                                                                                                                                                                                         |
| <b>Context</b>     | config>filter>mac-filter                                                                                                                                                                                                               |
| <b>Description</b> | This command configures the MAC Filter Policy type as being either normal, ISID or VID.                                                                                                                                                |
| <b>Default</b>     | type normal                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <i>filter-type</i> — Specifies which type of entry this MAC filter can contain.                                                                                                                                                        |
| <b>Values</b>      | <b>normal</b> — regular match criteria are allowed; ISID or VID filter match criteria not allowed<br><b>isid</b> — only ISID match criteria are allowed<br><b>vid</b> — only VID match criteria are allowed on ethernet_II frame types |

## 4.4.2.5 GRE Tunnel Template Configuration Commands

### gre-tunnel-template

|                    |                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>gre-tunnel-template</b> <i>name</i> [create]<br><b>no gre-tunnel-template</b> <i>name</i>                                                                                                                              |
| <b>Context</b>     | config>filter                                                                                                                                                                                                             |
| <b>Description</b> | This command enables the context to configure a GRE tunnel template parameters to be used to tunnel associated traffic.<br><br>The <b>no</b> form of this command removes the GRE tunnel template from the configuration. |
| <b>Parameters</b>  | <i>name</i> — Specifies a GRE tunnel template name up to 32 characters.                                                                                                                                                   |

---

**create** — This keyword is required to create the configuration context. Once it is created, the context can be enabled with or without the **create** keyword.

## ipv4

|                    |                                                                                    |
|--------------------|------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ipv4</b>                                                                        |
| <b>Context</b>     | config>filter>gre-tun-tmp                                                          |
| <b>Description</b> | This command enables the context to configure GRE tunnel template IPv4 parameters. |

## destination-address

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] destination-address</b> <i>ip-address</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>filter>gre-tun-tmp>ipv4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b> | <p>This command defines one or more destinations for the GRE IP header used to encapsulate the matching IPv4/IPv6 packet.</p> <p>Traffic matching the associated IPv4 or IPv6 filter are hashed across all available destination address. If no destination address is available, then matching traffic follows the configured <b>pbr-down-action-override</b> action, if configured.</p> <p>The <b>no</b> form of this command removes the specified destination IP address configuration from the associated GRE tunnel template.</p> |
| <b>Parameters</b>  | <i>ip-address</i> — Specifies up to 16 IPv4 addresses to be used as the destination address.                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## gre-key

|                    |                                                                                                                                                                                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>gre-key if-index</b><br><b>no gre-key</b>                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter>gre-tun-tmp>ipv4                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command enables the population of the GRE key field in the GRE header sent with the encapsulated IP packet.</p> <p>The <b>no</b> form of this command disables the population of the optional GRE key field when the matching IP packet is sent encapsulated in a GRE tunnel.</p> |
| <b>Parameters</b>  | <b>if-index</b> — Causes the GRE key field to be populated with the ifIndex of the ingress interface on which the matching IP packet was received.                                                                                                                                        |



## skip-ttl-decrement

|                    |                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] skip-ttl-decrement</b>                                                                                                                                                                                                                                                                                                                                           |
| <b>Context</b>     | config>filter>gre-tun-tmp>ipv4                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command enables an option to not decrement the TTL of the IP packet matching the IPv4/IPv6 filter, when it is encapsulated into the GRE tunnel header.</p> <p>The <b>no</b> form of this command disables this option (default). This results in the matching of IP packet's TTL field to be decremented before it is encapsulated in the GRE tunnel header.</p> |

## source-address

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>source-address</b> <i>ip-address</i><br><b>no source-address</b>                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>filter>gre-tun-tmp>ipv4                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command defines the source IPv4 address to be used in the GRE IP header used to encapsulate the matching IPv4/IPv6 packet. This IP address can be configured as any value and is not validated against a local IP address. The <b>source-address</b> command must be configured for the template to be valid.</p> <p>The <b>no</b> form of this command removes the source IP address configuration from the associated GRE tunnel template.</p> |
| <b>Parameters</b>  | <i>ip-address</i> — Specifies the IPv4 address (in dotted decimal notation) to be used as the source address.                                                                                                                                                                                                                                                                                                                                            |

### 4.4.2.6 System Filter Policy Commands

## system-filter

|                    |                                                                      |
|--------------------|----------------------------------------------------------------------|
| <b>Syntax</b>      | <b>system-filter</b>                                                 |
| <b>Context</b>     | config>filter                                                        |
| <b>Description</b> | This command enables the context to activate system filter policies. |

## ip

|               |                                    |
|---------------|------------------------------------|
| <b>Syntax</b> | <b>[no] ip</b> <i>ip-filter-id</i> |
|---------------|------------------------------------|

---

|                    |                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>filter>system-filter                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command activates an IPv4 system filter policy. Once activated, all IPv4 ACL filter policies that chain to the system filter (<b>config&gt;filter&gt;ip-filter&gt;chain-to-system-filter</b>) will automatically execute system filter policy rules first.</p> <p>The <b>no</b> form of the command deactivates the system filter policy.</p> |
| <b>Parameters</b>  | <p><i>ip-filter-id</i> — Specifies the existing IPv4 filter policy with scope <b>system</b>. This parameter can either be expressed as a decimal integer, or as an ASCII string of up to 64 characters.</p> <p><b>Values</b> 1 to 65535 or the filter policy name (<i>filter-name</i>, 64 char max)</p>                                               |

## ipv6

|                    |                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] ipv6 <i>ipv6-filter-id</i>                                                                                                                                                                                                                                                                                                                         |
| <b>Context</b>     | config>filter>system-filter                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>This command activates an IPv6 system filter policy. Once activated, all IPv6 ACL filter policies that chain to the system filter (<b>config&gt;filter&gt;ipv6-filter&gt;chain-to-system-filter</b>) will automatically execute system filter policy rules first.</p> <p>The <b>no</b> form of the command deactivates the system filter policy.</p> |
| <b>Parameters</b>  | <p><i>ipv6-filter-id</i> — Specifies the existing IPv6 filter policy with scope <b>system</b>. This parameter can either be expressed as a decimal integer, or as an ASCII string of up to 64 characters in length.</p> <p><b>Values</b> 1 to 65535 or the filter policy name</p>                                                                       |

## filter-name

|                    |                                                                                                                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>filter-name</b> <i>filter-name</i><br><b>no filter-name</b>                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>filter>ip-exception                                                                                                                                                                                                                                                                       |
| <b>Description</b> | This command configures filter-name attribute of a given filter. filter-name, when configured, can be used instead of filter ID to reference the given policy in the CLI.                                                                                                                        |
| <b>Default</b>     | no filter-name                                                                                                                                                                                                                                                                                   |
| <b>Parameters</b>  | <p><i>filter-name</i> — Specifies a string up to 64 characters in length that uniquely identifies this filter policy.</p> <p>The following restrictions apply to the <i>filter-name</i>:</p> <ul style="list-style-type: none"> <li>• Policy names may not begin with a number (0-9).</li> </ul> |

- Policy names may not begin with the underscore “\_” character (e.g. \_myPolicy). Names that start with underscore are reserved for system generated names.
- “fSpec-x” (where x is any number) cannot be used as a user defined filter name.

### 4.4.2.7 Redirect Policy Configuration Commands

#### redirect-policy

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>redirect-policy</b> <i>redirect-policy-name</i> [ <b>create</b> ]<br><b>no redirect-policy</b> <i>redirect-policy-name</i>                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b> | This command, creates a configuration context for the specified redirect policy.<br><br>The <b>no</b> form of the command removes the redirect policy from the filter configuration only if the policy is not referenced in a filter and the filter is not in use (applied to a service or network interface).                                                                                                                                                                                                                                                |
| <b>Parameters</b>  | <i>redirect-policy-name</i> — Specifies the redirect policy name. Allowed values are any string up to 32 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, etc.), the entire string must be enclosed within double quotes. There is no limit to the number of redirect policies that can be configured.<br><br><b>create</b> — This keyword is required to create the configuration context. Once it is created, the context can be enabled with or without the <b>create</b> keyword. |

#### destination

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>destination</b> <i>ip-address</i> [ <b>create</b> ]<br><b>no destination</b> <i>ip-address</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Context</b>     | config>filter>redirect-policy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command defines a destination in a redirect policy. More than one destination can be configured. Whether a destination IPv4/IPv6 address will receive redirected packets depends on the effective priority value after evaluation.<br><br>The most preferred destination is programmed in hardware as action forward next-hop. If all destinations are down (as determined by the supported tests), action forward is programmed in hardware. All destinations within a given policy must be either IPv4 or (exclusive) IPv6. The redirect policy with IPv4 destinations configured can only be used by IPv4 filter policies. The redirect policy with IPv6 destinations configured can only be used by IPv6 filter policies. |
| <b>Default</b>     | no destination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

---

**Parameters** *ip-address* — Specifies the IPv4 address (in dotted decimal notation) or IPv6 address to send the redirected traffic to.

**Values**

|               |                                                                                           |
|---------------|-------------------------------------------------------------------------------------------|
| IPv4 address: | <i>ip-address</i> : a.b.c.d                                                               |
| IPv6-address: | x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:d.d.d.d<br>x: [0..FFFF]H<br>d: [0..255]D |

## ping-test

**Syntax** **[no] ping-test**

**Context** config>filter>redirect-policy>dest

**Description** This command configures parameters to perform connectivity ping tests to validate the ability for the destination to receive redirected traffic.

**Default** no ping-test

## drop-count

**Syntax** **drop-count** *consecutive-failures* [**hold-down** *seconds*]  
**no drop-count**

**Context** config>filter>redirect-policy>dest>ping-test

**Description** This command specifies the number of consecutive requests that must fail for the destination to be declared unreachable and the time to hold destination unreachable before repeating tests.

**Default** drop-count 3 hold-down 0

**Parameters** *consecutive-failures* — Specifies the number of consecutive ping test failures before declaring the destination down.

**Values** 1 to 60

**hold-down** *seconds* — Specifies the amount of time, in seconds, that the system should be held down if any of the test has marked it unreachable.

**Values** 0 to 86400

## interval

**Syntax** **interval** [*seconds*]  
**no interval**

---

|                    |                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>     | config>filter>redirect-policy>dest>ping-test                                                                      |
| <b>Description</b> | This command specifies the amount of time, in seconds, between consecutive requests sent to the far end host.     |
| <b>Default</b>     | interval 1                                                                                                        |
| <b>Parameters</b>  | <i>seconds</i> — Specifies the amount of time, in seconds, between consecutive requests sent to the far end host. |
| <b>Values</b>      | 1 to 60                                                                                                           |

## source-address

|                    |                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>source-address</b> [ <i>ip-address</i> ]<br><b>no source-address</b>                                                                                                                                          |
| <b>Context</b>     | config>filter>redirect-policy>dest>ping-test                                                                                                                                                                     |
| <b>Description</b> | This command configures the source address to use in the IP packet of the ping test for this destination.                                                                                                        |
| <b>Default</b>     | no source-address                                                                                                                                                                                                |
| <b>Parameters</b>  | <i>ip-address</i> — The source address of the IP packet. This can be IPv4 only for an IPv4 destination and IPv6 only for an IPv6 destination.                                                                    |
| <b>Values</b>      | <div> <div>ipv4-address:</div> <div>a.b.c.d.</div> </div> <div> <div>ipv6-address:</div> <div> x:x:x:x:x:x:x (eight 16-bit pieces)<br/> x:x:x:x:x:d.d.d.d<br/> x: [0 to FFFF]H<br/> d: [0 to 255]D </div> </div> |

## timeout

|                    |                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>timeout</b> [ <i>seconds</i> ]<br><b>no timeout</b>                                                                                                                                             |
| <b>Context</b>     | config>filter>redirect-policy>dest>ping-test                                                                                                                                                       |
| <b>Description</b> | Specifies the amount of time, in seconds, that is allowed for receiving a response from the far-end host. If a reply is not received within this time the far-end host is considered unresponsive. |
| <b>Default</b>     | timeout 1                                                                                                                                                                                          |

---

|                   |                                                                                                                            |
|-------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>Parameters</b> | <i>seconds</i> — Specifies the amount of time, in seconds, that is allowed for receiving a response from the far end host. |
| <b>Values</b>     | 1 to 60                                                                                                                    |

## priority

|                    |                                                                                                                                                                                 |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>priority</b> [ <i>priority</i> ]<br><b>no priority</b>                                                                                                                       |
| <b>Context</b>     | config>filter>redirect-policy>dest                                                                                                                                              |
| <b>Description</b> | Redirect policies can contain multiple destinations. Each destination is assigned an initial or base <b>priority</b> which describes its relative importance within the policy. |
| <b>Default</b>     | priority 100                                                                                                                                                                    |
| <b>Parameters</b>  | <i>priority</i> — Specifies the priority, expressed as a decimal integer, used to weigh the destination's relative importance within the policy.                                |
| <b>Values</b>      | 1 to 255                                                                                                                                                                        |

## shutdown

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] shutdown</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>filter>redirect-policy<br>config>filter>redirect-policy>destination<br>config>filter>log>summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | <p>Administratively enables/disabled (AdminUp/AdminDown) an entity. Downing an entity does not change, reset or remove any configuration settings or statistics. Many objects must be shutdown before they may be deleted.</p> <p>The <b>shutdown</b> command administratively downs an entity. Administratively downing an entity changes the operational state of the entity to down.</p> <p>Unlike other commands and parameters where the default state will not be indicated in the configuration file, <b>shutdown</b> and <b>no shutdown</b> are always indicated in system generated configuration files.</p> <p>The <b>no</b> form of the command puts an entity into the administratively enabled state.</p> |
| <b>Default</b>     | no shutdown                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## unicast-rt-test

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] unicast-rt-test</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Context</b>     | config>filter>redirect-policy>dest                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b> | <p>This command configures a unicast route test for this destination. A destination is eligible for redirect if a valid unicast route to that destination exists in the routing instance specified by <b>config&gt;filter&gt;redirect-policy&gt;router</b>. The unicast route test is mutually exclusive with other redirect-policy test types.</p> <p>The test cannot be configured if <b>no router</b> is configured for this redirect policy.</p> <p>The <b>no</b> form of the command disables the test.</p> |
| <b>Default</b>     | no unicast-rt-test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## notify-dest-change

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] notify-dest-change</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>filter>redirect-policy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command instructs the system to send notifications (Log, SNMP, ...) when the active destination of a redirect policy changes. No notification is sent when there are no more active destinations (as this is covered by a specific other notification). Notifications can be controlled (using the <b>config&gt;log&gt;event-control</b> command) using application ID 2017 and event-name <i>tFilterRPActiveDstChangeEvent</i>.</p> <p>The <b>no</b> form of the command disables notification generation.</p> |
| <b>Default</b>     | no notify-dest-change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## router

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>router router-instance</b><br><b>router service-name service-name</b><br><b>no router</b>                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter>redirect-policy                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b> | <p>This command enhances VRF support in redirect policies. When a router instance is specified, the configured destination tests are run in the specified router instance, and the PBR action is executed in the specified router instance. If no destination is active or if the hardware does not support PBR action "next-hop router", action forward will be executed (i.e. routing will be performed in the context of the incoming interface routing instance).</p> |

The **no** form of the command preserves backward-compatibility. Tests always run in the “Base” routing instance context, and the PBR action executes in the routing context of the ingress interface that the filter using this redirect policy is deployed on.

|                   |                                                                                                                                                                                       |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | no router                                                                                                                                                                             |
| <b>Parameters</b> | <i>router-instance</i> — Specifies a router instance in the form of <b>router-name</b> or <b>service-id</b> .                                                                         |
| <b>Values</b>     | <b>router-name</b> — Base<br><b>service-id</b> — Specifies an existing Layer 3 service [1 to 2147483647]<br><i>service-name</i> — Specifies the name of a configured Layer 3 service. |

## redirect-policy-binding

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>redirect-policy-binding</b> <i>name</i> [ <b>create</b> ]<br><b>no redirect-policy-binding</b> <i>name</i>                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>This command creates a redirect-policy binding (specified by its name) in case it does not exist and, enters the context associated with it. When a redirect-policy binding is created, no destination is associated to this binding by default and the binding operator is set to AND.</p> <p>The <b>no</b> form of this command deletes the redirect-policy binding and all the associated configuration information.</p>       |
| <b>Parameters</b>  | <i>name</i> — Specifies the name of the binding. Possible values are any string up to 32 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, etc.), the entire string must be enclosed within double quotations.<br><b>create</b> — This keyword is required to create the binding if it does not exist. This has no effect when used with an existing binding. |

## binding-operator

|                    |                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>binding-operator</b> { <b>and</b>   <b>or</b> }<br><b>no binding-operator</b>                                                                                                                                                                                                                                                            |
| <b>Context</b>     | config>filter>redirect-policy-binding                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command configures the logical operator to use with the destinations test results to obtain the master test result (the redirect-policy binding test result). A change in this configuration results in the re-evaluation of the master test result.</p> <p>The <b>no</b> version of this command sets the value to its default</p> |



---

|                   |                                                                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | binding-operator and                                                                                                                                                   |
| <b>Parameters</b> | <b>and   or</b> — Keyword to specify the type of logical or boolean operation to perform between the individual destinations test results to obtain the master result. |

## redirect-policy

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>redirect-policy</b> <i>redirect-policy-name</i> <b>destination</b> <i>ip-address</i><br><b>no redirect-policy</b> <i>redirect-policy-name</i> [ <b>destination</b> <i>ip-address</i> ]                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>filter>redirect-policy-binding                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b> | <p>This command adds the destination (specified by its IP address) of a redirect-policy (specified by its name) to the binding. An error is thrown if either the destination does not exist for the specified redirect-policy or if the redirect-policy does not exist.</p> <p>The <b>no</b> form of the command removes from the binding from all the destinations of the specified redirect-policy, or only the specified destination.</p> |
| <b>Parameters</b>  | <p><i>redirect-policy-name</i> — Specifies the name of the redirect-policy (up to 32 characters) as the destination that is to be added to the binding.</p> <p><i>ip-address</i> — The IP address of the destination. This can be an IPv4 or IPv6 address.</p>                                                                                                                                                                               |

### Values

|               |                                                                                               |
|---------------|-----------------------------------------------------------------------------------------------|
| ipv4-address: | a.b.c.d.                                                                                      |
| ipv6-address: | x:x:x:x:x:x:x (eight 16-bit pieces)<br>x:x:x:x:x:d.d.d.d<br>x: [0 to FFFF]H<br>d: [0 to 255]D |

## 4.4.2.8 Match Filter List Commands

### match-list

|                    |                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>match-list</b>                                                                                              |
| <b>Context</b>     | config>filter                                                                                                  |
| <b>Description</b> | This command enables the configuration context for match lists to be used in filter policies (IOM/FP and CPM). |

---

## ip-prefix-list

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ip-prefix-list</b> <i>ip-prefix-list-name</i> [ <b>create</b> ]<br><b>no ip-prefix-list</b> <i>ip-prefix-list-name</i>                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>filter>match-list                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | <p>This command creates a list of IPv4 prefixes for match criteria in IPv4 ACL and CPM filter policies.</p> <p>The <b>no</b> form of this command deletes the specified list.</p> <p><b>Operational Notes:</b></p> <p>An <b>ip-prefix-list</b> must contain only IPv4 address prefixes.</p> <p>An IPv4 prefix match list cannot be deleted if it is referenced by a filter policy.</p> <p>See general description related to match-list usage in filter policies.</p> |
| <b>Parameters</b>  | <i>ip-prefix-list-name</i> — Specifies a string of up to 32 printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.                                                                                                                                                                                                                                                                                             |

## apply-path

|                    |                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] apply-path</b>                                                                                                                                                                                                                                                                                                                                                    |
| <b>Context</b>     | config>filter>match-list>ip-prefix-list<br>config>filter>match-list>ipv6-prefix-list                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | <p>This command enables the context to configure auto-generation of address prefixes for IPv4 or IPv6 address prefix match lists. The context in which the command is executed governs whether IPv4 or IPv6 prefixes will be auto-generated.</p> <p>The <b>no</b> form of this command removes all auto-generation configuration under the <b>apply-path</b> context.</p> |
| <b>Default</b>     | no apply path                                                                                                                                                                                                                                                                                                                                                             |

## bgp-peers

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>bgp-peers</b> <i>criterion-index</i> <b>group</b> <i>reg-exp</i> <b>neighbor</b> <i>reg-exp</i><br><b>bgp-peers</b> <i>criterion-index</i> <b>router</b> <i>router-instance</i> <b>group</b> <i>reg-exp</i> <b>neighbor</b> <i>reg-exp</i><br><b>bgp-peers</b> <i>criterion-index</i> <b>router</b> <i>service-name</i> <i>service-name</i> <b>group</b> <i>reg-exp</i> <b>neighbor</b> <i>reg-exp</i><br><b>no bgp-peers</b> <i>criterion-index</i> |
| <b>Context</b> | config>filter>match-list>ip-prefix-list>apply-path                                                                                                                                                                                                                                                                                                                                                                                                      |

```
config>filter>match-list>ipv6-prefix-list>apply-path
```

**Description** This command configures auto-generation of IPv4 or IPv6 address prefixes (as required by the context that the command is executed within) based on the base router BGP instance configuration.

The **no** form of this command removes the bgp-peers configuration for auto-generation of address prefixes for the specified index value.

**Default** No embedded filter policies are included in a filter policy.

**Parameters** *service-name* — Specifies the service name, up to 64 characters in length.

**group** — Configures a match against the base router BGP instance group configuration.  
 Regex wildcard match (.) can be used to match against any group.

**neighbor** — Configures a match against the base router BGP instance neighbor configuration.  
 Regex wildcard match (.) can be used to match against any neighbor.

*criterion-index* — Specifies an integer from 1 to 255 enumerating BGP peers auto-generation configuration within this list.

*router-instance* — Specifies the router name or service ID.

**Values** router-instance: *router-name* or *vprn-svc-id*  
 router-name: "Base"  
 vprn-svc-id: 1 to 2147483647  
*service-name*: Specifies the service name, up to 64 characters in length.

**router** — Configures a match against the base router BGP instance configuration.

*reg-exp* — Specifies a regular expression that defines a match string, up to 255 characters in length, to be used to auto-generate address prefixes. Matching is performed from the least-significant digit. For example, a string **10.0** matches all neighbors with addresses starting with **10**, such as **10.0.x.x** or **10.0xx.x.x**.

## prefix

**Syntax** [no] **prefix** *ip-prefix/prefix-length*

**Context** config>filter>match-list>ip-prefix-list

**Description** This command adds an IPv4 address prefix to an existing IPv4 address prefix match list.

The **no** form of this command deletes the specified prefix from the list.

### Operational Notes:

To add set of unique prefixes, execute the command with all unique prefixes. The prefixes are allowed to overlap IPv4 address space.

An IPv4 prefix addition will be blocked, if resource exhaustion is detected anywhere in the system because of filter policies that use this IPv4 address prefix list.

- Parameters** *ip-prefix* — Specifies a valid IPv4 address prefix in dotted decimal notation.
- Values** 0.0.0.0 to 255.255.255.255 (host bit must be 0)
- prefix-length* — Specifies the length of the entered IPv4 prefix.
- Values** 0 to 32

## prefix-exclude

- Syntax** **[no] prefix-exclude** *ip-prefix/prefix-length*
- Context** config>filter>match-list>ip-pfx-list
- Description** This command excludes IPv4 prefix(es) from an **ip-prefix-list**. The **prefix-exclude** command is mutually exclusive with **apply-path**.
- The **no** form of this command deletes the specified excluded prefixes from the **ip-prefix-list**.
- Parameters** *ip-prefix* — Specifies a valid IPv4 address prefix in dotted decimal notation.
- Values** 0.0.0.0 to 255.255.255.255 (host bit must be 0)
- prefix-length* — Specifies the length of the entered IPv4 prefix.
- Values** 0 to 32

## ipv6-prefix-list

- Syntax** **ipv6-prefix-list** *ipv6-prefix-list-name* **[create]**  
**no ipv6-prefix-list** *ipv6-prefix-list-name*
- Context** config>filter>match-list
- Description** This command creates a list of IPv6 prefixes for match criteria in ACL and CPM IPv6 filter policies.
- The **no** form of this command deletes the specified list.
- Operational Notes:**
- An **ipv6-prefix-list** must contain only IPv6 address prefixes.
- An *ipv6-prefix-list* cannot be deleted if it is referenced by a filter policy.
- See general description related to match-list usage in filter policies.
- Parameters** *ipv6-prefix-list-name* — Specifies a string of up to 32 printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.

## prefix

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] prefix</b> <i>ipv6-prefix/prefix-length</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Context</b>     | config>filter>match-list>ipv6-prefix-list                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b> | <p>This command adds an IPv6 address prefix to an existing IPv6 address prefix match list.</p> <p>The <b>no</b> form of this command deletes the specified prefix from the list.</p> <p><b>Operational Notes:</b></p> <p>To add set of different prefixes, execute the command with all unique prefixes. The prefixes are allowed to overlap IPv6 address space.</p> <p>An IPv6 prefix addition will be blocked, if resource exhaustion is detected anywhere in the system because of filter policies that use this IPv6 address prefix list.</p> |
| <b>Parameters</b>  | <p><i>ipv6-prefix/prefix-length</i> — Specifies an IPv6 address prefix written as hexadecimal numbers separated by colons with host bits set to 0. One string of zeros can be omitted, so 2001:db8::700:0:217A is equivalent to 2001:db8:0:0:0:700:0:217A.</p> <p><b>Values</b></p> <p>x:x:x:x:x:x:x (eight 16-bit pieces)</p> <p>x:x:x:x:x:x.d.d.d</p> <p>x: [0..FFFF]H</p> <p>d: [0..255]D</p> <p><i>prefix-length</i> — Specifies the length of the entered IPv6 prefix.</p> <p><b>Values</b> 1 to 128</p>                                     |

## prefix-exclude

|                    |                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] prefix</b> <i>ipv6-prefix/prefix-length</i>                                                                                                                                                                                                                                                                                                                          |
| <b>Context</b>     | config>filter>match-list>ipv6-pfx-list                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command excludes IPv6 prefix(es) from an <b>ipv6-prefix-list</b>. The <b>prefix-exclude</b> command is mutually exclusive with <b>apply-path</b>.</p> <p>The <b>no</b> form of this command deletes the specified excluded prefixes from the <b>ipv6-prefix-list</b>.</p>                                                                                            |
| <b>Parameters</b>  | <p><i>ipv6-prefix/prefix-length</i> — Specifies an IPv6 address prefix written as hexadecimal numbers separated by colons with host bits set to 0. One string of zeros can be omitted, so 2001:db8::700:0:217A is equivalent to 2001:db8:0:0:0:700:0:217A.</p> <p><b>Values</b></p> <p>x:x:x:x:x:x:x (eight 16-bit pieces)</p> <p>x:x:x:x:x:x.d.d.d</p> <p>x: [0..FFFF]H</p> |

d: [0..255]D

*prefix-length* — Specifies the length of the entered IPv6 prefix.

**Values** 1 to 128

## port-list

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>port-list</b> <i>port-list-name</i> [create]<br><b>no port-list</b> <i>port-list-name</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Context</b>     | config>filter>match-list                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Description</b> | <p>This command creates a list of TCP/UDP/SCTP port values or ranges for match criteria in IPv4 and IPv6 ACL and CPM filter policies.</p> <p>The <b>no</b> form of this command deletes the specified list.</p> <p><b>Operational notes:</b></p> <p>SCTP port match is supported in ACL filter policies only.</p> <p>A port-list must contain only TCP/UDP/SCTP port values or ranges.</p> <p>A TCP/UDP/SCTP port match list cannot be deleted if it is referenced by a filter policy.</p> <p>See general description related to match-list usage in filter policies.</p> |
| <b>Parameters</b>  | <i>port-list-name</i> — Specifies a string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes.                                                                                                                                                                                                                                                                                                                                                                                        |

## port

|                    |                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | [no] <b>port</b> <i>port-number</i><br>[no] <b>port range</b> <i>start end</i>                                                                                                                                                      |
| <b>Context</b>     | config>filter>match-list>port-list                                                                                                                                                                                                  |
| <b>Description</b> | This command adds a port or a range of ports to an existing port match list. The <b>no</b> form of this command deletes the specified port or range of ports from the list.                                                         |
| <b>Parameters</b>  | <i>port-number</i> — Specifies the port number to add to the list. The port number can be expressed as a decimal integer, as well as in hexadecimal or binary format. Below shows decimal integer only.<br><b>Values</b> 0 to 65535 |

*start end* — Specifies an inclusive port range between two port numbers values. The *start* of the range and *end* of the range can be expressed as decimal integers, as well as in hexadecimal or binary format. The following value shows decimal integer only.

**Values** 0 to 65535

## 4.4.2.9 Log Filter Commands

### log

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>        | <b>log</b> <i>log-id</i> [ <b>create</b> ]<br><b>no log</b> <i>log-id</i>                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>       | config>filter                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>   | <p>This command, creates a configuration context for the specified filter log if it does not exist, and enables the context to configure the specified filter log.</p> <p>The <b>no</b> form of the command deletes the filter log. The log cannot be deleted if there are filter entries configured to write to the log. All filter entry logging associations need to be removed before the log can be deleted.</p> |
| <b>Default</b>       | log 101                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Special Cases</b> | <b>Filter log 101</b> — Filter log 101 is the default log and is automatically created by the system. Filter log 101 is always a memory filter log and cannot be changed to a Syslog filter log. The log size defaults to 1000 entries, the filter log description is set to "Default filter log". The number of entries and <b>wrap-around</b> behavior can be modified.                                             |
| <b>Parameters</b>    | <p><i>log-id</i> — Specifies the filter log ID expressed as a decimal integer.</p> <p><b>Values</b> 101 to 199</p> <p><b>create</b> — This keyword is required to create the configuration context. After it is created, the context can be enabled with or without the <b>create</b> keyword.</p>                                                                                                                    |

### destination

|                    |                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>destination memory</b> <i>num-entries</i><br><b>destination syslog</b> <i>syslog-id</i><br><b>no destination</b> |
| <b>Context</b>     | config>filter>log                                                                                                   |
| <b>Description</b> | This command configures the destination for filter log entries for the filter log ID.                               |

Filter logs can be sent to either memory (**memory**) or to an existing Syslog server definition (**syslog**).

If the filter log destination is **memory**, the maximum number of entries in the log must be specified.

The **no** form of the command deletes the filter log association.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>    | destination memory 1000                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b> | <b>memory</b> <i>num-entries</i> — Specifies the destination of the filter log ID is a memory log. The <i>num-entries</i> value is the maximum number of entries in the filter log expressed as a decimal integer.<br><b>Values</b> 10 to 50000<br><b>syslog</b> <i>syslog-id</i> — Specifies the destination of the filter log ID is a Syslog server. The <i>syslog-id</i> parameter is the number of the Syslog server definition.<br><b>Values</b> 1 to 10 |

## summary

|                    |                                                                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>summary</b>                                                                                                                                      |
| <b>Context</b>     | config>filter>log                                                                                                                                   |
| <b>Description</b> | This command enables the context to configure log summarization. These settings will only be taken into account when syslog is the log destination. |

## summary-crit

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>summary-crit dst-addr</b><br><b>summary-crit src-addr</b><br><b>no summary-crit</b>                                                                                                                                                                                                                                                                                                                                   |
| <b>Context</b>     | config>filter>log>summary                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b> | This command defines the key of the index of the mini-table. If key information is changed while summary is administratively enabled (no shutdown), the filter summary mini-table is flushed and recreated with different key information. Log packets received during the reconfiguration time will be handled as if summary was not active.<br><br>The <b>no</b> form of the command reverts to the default parameter. |
| <b>Default</b>     | summary-crit src-addr                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Parameters</b>  | <b>dst-addr</b> — Specifies that received log packets are summarized based on the destination IPv4, IPv6, or MAC address.                                                                                                                                                                                                                                                                                                |



**src-addr** — Specifies that received log packets are summarized based on the source IPv4, IPv6 or MAC address.

## wrap-around

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>[no] wrap-around</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Context</b>     | config>filter>log                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b> | <p>This command configures a memory filter log to log until full or to store the most recent log entries (circular buffer).</p> <p>Specifying <b>wrap-around</b> configures the memory filter log to store the most recent filter log entries (circular buffer). When the log is full, the oldest filter log entries are overwritten with new entries.</p> <p>The <b>no</b> form of the command configures the memory filter log to accept filter log entries until full. When the memory filter log is full, filter logging for the log filter ID ceases.</p> |
| <b>Default</b>     | wrap-around                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

### 4.4.2.10 Copy Filter Commands

## copy

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>copy</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b> | <p>This command copies existing filter list entries for a specific filter ID to another filter ID. The <b>copy</b> command is a configuration level maintenance tool used to create new filters using existing filters. It also allows bulk modifications to an existing policy with the use of the <b>overwrite</b> keyword.</p> <p>If <b>overwrite</b> is not specified, an error will occur if the destination policy ID exists.</p> |

## ip-filter

|                |                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>  | <b>ip-filter</b> <i>src-filter-id</i> [ <b>src-entry</b> <i>src-entry-id</i> ] <b>to</b> <i>dst-filter-id</i> [ <b>dst-entry</b> <i>dst-entry-id</i> ] [ <b>overwrite</b> ] |
| <b>Context</b> | config>filter                                                                                                                                                               |

---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command copies existing filter list entries for a specific filter ID to another filter ID. The <b>copy</b> command is a configuration level maintenance tool used to create new filters using existing filters. It also allows bulk modifications to an existing policy with the use of the <b>overwrite</b> keyword.</p> <p>If <b>overwrite</b> is not specified, an error will occur if the destination policy ID exists.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Parameters</b>  | <p><b>ip-filter</b> — Indicates that the <i>src-filter-id</i> and the <i>dst-filter-id</i> are IPv4 filter IDs.</p> <p><i>src-filter-id</i> — Identifies the source filter policy from which the copy command will attempt to copy. The filter policy must exist within the context of the preceding keyword (<b>ip-filter</b>, <b>ipv6-filter</b> or <b>mac-filter</b>).</p> <p><i>dst-filter-id</i> — Identifies the destination filter policy to which the copy command will attempt to copy. If the <b>overwrite</b> keyword does not follow, the filter policy ID cannot already exist within the system for the filter type the copy command is issued for. If the <b>overwrite</b> keyword is present, the destination policy ID may or may not exist.</p> <p><b>overwrite</b> — Specifies that the destination filter ID may exist. If it does, everything in the existing destination filter ID will be completely overwritten with the contents of the source filter ID. If the destination filter ID exists, either <b>overwrite</b> must be specified or an error message will be returned. If <b>overwrite</b> is specified, the function of copying from source to destination occurs in a “break before make” manner and therefore should be handled with care.</p> |

## ipv6-filter

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>ipv6-filter</b> <i>src-filter-id</i> [ <b>src-entry</b> <i>src-entry-id</i> ] <b>to</b> <i>dst-filter-id</i> [ <b>dst-entry</b> <i>dst-entry-id</i> ] [ <b>overwrite</b> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b> | <p>This command copies existing filter list entries for a specific filter ID to another filter ID. The <b>copy</b> command is a configuration level maintenance tool used to create new filters using existing filters. It also allows bulk modifications to an existing policy with the use of the <b>overwrite</b> keyword.</p> <p>If <b>overwrite</b> is not specified, an error will occur if the destination policy ID exists.</p>                                                                                                                                                                                                                                                                                                                             |
| <b>Parameters</b>  | <p><b>ipv6-filter</b> — Indicates that the <i>src-filter-id</i> and the <i>dst-filter-id</i> are IPv6 filter IDs.</p> <p><i>src-filter-id</i> — Identifies the source filter policy from which the copy command will attempt to copy. The filter policy must exist within the context of the preceding keyword (<b>ip-filter</b>, <b>ipv6-filter</b> or <b>mac-filter</b>).</p> <p><i>dst-filter-id</i> — Identifies the destination filter policy to which the copy command will attempt to copy. If the <b>overwrite</b> keyword does not follow, the filter policy ID cannot already exist within the system for the filter type the copy command is issued for. If the <b>overwrite</b> keyword is present, the destination policy ID may or may not exist.</p> |

**overwrite** — Specifies that the destination filter ID may exist. If it does, everything in the existing destination filter ID will be completely overwritten with the contents of the source filter ID. If the destination filter ID exists, either **overwrite** must be specified or an error message will be returned. If **overwrite** is specified, the function of copying from source to destination occurs in a “break before make” manner and therefore should be handled with care.

## mac-filter

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>mac-filter</b> <i>src-filter-id</i> [ <b>src-entry</b> <i>src-entry-id</i> ] <b>to</b> <i>dst-filter-id</i> [ <b>dst-entry</b> <i>dst-entry-id</i> ] [ <b>overwrite</b> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Context</b>     | config>filter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Description</b> | This command copies existing filter list entries for a specific filter ID to another filter ID. The <b>copy</b> command is a configuration level maintenance tool used to create new filters using existing filters. It also allows bulk modifications to an existing policy with the use of the <b>overwrite</b> keyword.<br>If <b>overwrite</b> is not specified, an error will occur if the destination policy ID exists.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Parameters</b>  | <p><b>mac-filter</b> — Indicates that the <i>src-filter-id</i> and the <i>dst-filter-id</i> are MAC filter IDs.</p> <p><i>src-filter-id</i> — Identifies the source filter policy from which the copy command will attempt to copy. The filter policy must exist within the context of the preceding keyword (<b>ip-filter</b>, <b>ipv6-filter</b> or <b>mac-filter</b>).</p> <p><i>dst-filter-id</i> — Identifies the destination filter policy to which the copy command will attempt to copy. If the <b>overwrite</b> keyword does not follow, the filter policy ID cannot already exist within the system for the filter type the copy command is issued for. If the <b>overwrite</b> keyword is present, the destination policy ID may or may not exist.</p> <p><b>overwrite</b> — Specifies that the destination filter ID may exist. If it does, everything in the existing destination filter ID will be completely overwritten with the contents of the source filter ID. If the destination filter ID exists, either <b>overwrite</b> must be specified or an error message will be returned. If <b>overwrite</b> is specified, the function of copying from source to destination occurs in a “break before make” manner and therefore should be handled with care.</p> |

### 4.4.2.11 Model-Driven Automatic ID Commands

## md-auto-id

|                |                   |
|----------------|-------------------|
| <b>Syntax</b>  | <b>md-auto-id</b> |
| <b>Context</b> | config>filter     |

---

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p>This command automatically assigns numerical ID values for model-driven management interfaces.</p> <p>Classic management interfaces use a numerical filter ID as the primary key for IP filters, IPv6 filters, and MAC filters. In model-driven interfaces, IP, IPv6, and MAC filters use string names as keys. The filters can optionally be created without having to explicitly select and specify a numerical filter ID. In this case, SR OS assigns an ID using the configured ID range.</p> |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

filter-id-range

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>      | <b>filter-id-range start <i>filter-id</i> end <i>filter-id</i></b><br><b>no filter-id-range</b>                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Context</b>     | config>filter>md-auto-id                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b> | <p>This command specifies the range of IDs used by SR OS to automatically assign an ID to filters that are created in model-driven interfaces without an ID explicitly specified by the user or client.</p> <p>A filter created with an explicitly-specified ID cannot use an ID in this range. The ID range cannot be changed while filters exist inside the previous or new range.</p> <p>The <b>no</b> form of this command removes the range values.</p> <p>See the <a href="#">md-auto-id</a> command for further details.</p> |
| <b>Default</b>     | no filter-id-range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Parameters</b>  | <p><b>start <i>filter-id</i></b> — Specifies the lower value of the ID range. The value must be less than or equal to the <b>end</b> value.</p> <p><b>Values</b> 1 to 2147483647</p> <p><b>end <i>filter-id</i></b> — Specifies the upper value of the ID range. The value must be greater than or equal to the <b>start</b> value.</p> <p><b>Values</b> 1 to 2147483647</p>                                                                                                                                                        |

## 4.5 Show, Clear, Monitor, and Debug Command Reference

- [Command Hierarchies](#)
- [Command Descriptions](#)

### 4.5.1 Command Hierarchies

- [Show Commands](#)
- [Clear Commands](#)
- [Monitor Commands](#)
- [Debug Commands](#)
- [Tools Commands](#)

#### 4.5.1.1 Show Commands

```
show
 — filter
 — dhcp [filter-id]
 — dhcp6 [filter-id]
 — ip [filter-type filter-type]
 — ip embedded [inactive]
 — ip ip-filter-id embedded [inactive]
 — ip ip-filter-id [detail]
 — ip ip-filter-id associations
 — ip ip-filter-id type entry-type
 — ip ip-filter-id counters [type entry-type] [detail]
 — ip ip-filter-id entry entry-id [counters] [detail]
 — ip ip-filter-id [entry entry-id] effective-action [{ingress | egress}]
 — ip ip-filter-id [entry entry-id] effective-action router [{ingress | egress}]
 — ip ip-filter-id [entry entry-id] effective-action service service-id [{ingress | egress}]
 — ipv6 [filter-type filter-type]
 — ipv6 embedded [inactive]
 — ipv6 ipv6-filter-id embedded [inactive]
 — ipv6 ipv6-filter-id [detail]
 — ipv6 ipv6-filter-id associations
 — ipv6 ipv6-filter-id type entry-type
 — ipv6 ipv6-filter-id counters [type entry-type] [detail]
 — ipv6 ipv6-filter-id entry entry-id [counters] [detail]
 — ipv6 ipv6-filter-id [entry entry-id] effective-action [{ingress | egress}]
 — ipv6 ipv6-filter-id [entry entry-id] effective-action router [{ingress | egress}]
```

- **ipv6** *ipv6-filter-id* [**entry** *entry-id*] **effective-action** **service** *service-id* [{**ingress** | **egress**}]
- **log** [**bindings**]
- **log** *log-id* [**match** *string*]
- **mac** *mac-filter-id*
- **mac** *mac-filter-id* **associations**
- **mac** *mac-filter-id* [**type** *entry-type*] **counters** [**detail**]
- **mac** *mac-filter-id* [**entry** *entry-id*] **effective-action** [{**ingress** | **egress**}]
- **mac** *mac-filter-id* [**entry** *entry-id*] **effective-action** **router** [{**ingress** | **egress**}]
- **mac** *mac-filter-id* [**entry** *entry-id*] **effective-action** **service** *service-id* [{**ingress** | **egress**}]
- **mac** [*mac-filter-id*] **embedded** [**inactive**]
- **mac** *mac-filter-id* **entry** *entry-id* [**counters**] [**detail**]
- **mac** [**filter-type** *filter-type*]
- **mac** *mac-filter-id* **type** *entry-type*
- **match-list**
  - **ip-prefix-list** [*prefix-list-name*]
  - **ip-prefix-list** *prefix-list-name* **references**
  - **ipv6-prefix-list** [*prefix-list-name*]
  - **ipv6-prefix-list** *prefix-list-name* **references**
  - **port-list** [*port-list-name*]
  - **port-list** *port-list-name* **references**
- **md-auto-id**
- **redirect-policy** [*redirect-policy-name* {**dest** *ip-address* | **associations**}]
- **redirect-policy-binding** [*name*]
- **system-filter** [**chained-to**]

#### 4.5.1.2 Clear Commands

- ```
clear
  — filter
    — ip ip-filter-id [entry entry-id] [{ingress | egress}]
```
- ```
 — ipv6 ipv6-filter-id [entry entry-id] [{ingress | egress}]
```
- ```
    — log log-id
```
- ```
 — mac mac-filter-id [entry entry-id] [{ingress | egress}]
```

#### 4.5.1.3 Monitor Commands

- ```
monitor
  — filter
    — ip ip-filter-id entry entry-id [interval seconds] [repeat repeat] [{absolute | rate}]
```
- ```
 — ipv6 ipv6-filter-id entry entry-id [interval seconds] [repeat repeat] [{absolute | rate}]
```
- ```
    — mac mac-filter-id entry entry-id [interval seconds] [repeat repeat] [{absolute | rate}]
```

4.5.1.4 Debug Commands

```
tools
  — dump
  — filter
    — overload
    — overload card slot-number fp fp-number
    — overload card slot-number fp fp-number cpm-ip
    — overload card slot-number fp fp-number cpm-ipv6
    — overload card slot-number fp fp-number cpm-mac
    — overload card slot-number fp fp-number ip ip-filter-id direction direction
    — overload card slot-number fp fp-number ipv6 ipv6-filter-id direction direction
    — overload card slot-number fp fp-number mac mac-filter-id direction direction
    — resources
      — cpm
      — dest-tracking ip [detail]
      — dest-tracking ipv6 [detail]
      — dest-tracking sap [detail]
      — dest-tracking sdp [detail]
      — egress-pbr [detail]
      — http-redirect [detail]
      — iom [slot-number]
      — ip ip-filter-id
      — ipv6 ipv6-filter-id
      — mac mac-filter-id
      — sticky-dest
```

4.5.1.5 Tools Commands

```
tools
  — perform
  — filter
    — ip-filter
      — entry
        — activate-primary-action
    — ipv6-filter
      — entry
        — activate-primary-action
    — mac-filter
      — entry
        — activate-primary-action
    — redirect-policy
      — activate-best-dest
```

4.5.2 Command Descriptions

- [Show Commands](#)

- [Clear Commands](#)
- [Monitor Commands](#)
- [Debug Commands](#)
- [Tools Commands](#)

4.5.2.1 Show Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

dhcp

Syntax	dhcp [<i>filter-id</i>]
Context	show>filter
Description	This command displays DHCP filter information.
Parameters	<i>filter-id</i> — Displays detailed information for the specified filter ID and its filter entries. Values 1 to 65535
Output	The following is a sample command output for the command when no filter ID is specified.

Sample Output

```
*B:TechPubs>config# show filter dhcp
=====
DHCP Filters
=====
Filter-Id   Applied Description
-----
10          No      test-dhcp-filter
-----
Num filter entries: 1
=====
*B:TechPubs>config#

*B:TechPubs>config# show filter dhcp 10
=====
DHCP Filter
=====
Filter-Id   : 10                      Applied      : No
Entries     : 0
Description : test-dhcp-filter
-----
Filter Match Criteria
-----
```



```
No Match Criteria Found
=====
*B:TechPubs>config#
```

dhcp6

Syntax	dhcp6 <i>[filter-id]</i>
Context	show>filter
Description	This command displays DHCP6 filter information.
Parameters	<i>filter-id</i> — Displays detailed information for the specified filter ID and its filter entries. Values 1 to 65535

ip

Syntax	ip [filter-type <i>filter-type</i>] ip embedded [inactive] ip <i>ip-filter-id embedded</i> [inactive] ip <i>ip-filter-id</i> [detail] ip <i>ip-filter-id associations</i> ip <i>ip-filter-id type entry-type</i> ip <i>ip-filter-id counters</i> [type entry-type] [detail] ip <i>ip-filter-id entry entry-id</i> [counters] [detail] ip <i>ip-filter-id</i> [entry entry-id] effective-action [{ ingress egress }] ip <i>ip-filter-id</i> [entry entry-id] effective-action router [{ ingress egress }] ip <i>ip-filter-id</i> [entry entry-id] effective-action service <i>service-id</i> [{ ingress egress }]
Context	show>filter
Description	This command displays IPv4 filter information. When effective-action is specified, this command displays what effectively happens to a packet that matches the criteria associated with the IPv4 filter policy.
Parameters	<i>filter-type</i> — Specifies the type of filter to display. Values config, flowspec, host-common, openflow, vsd inactive — Displays all, or optionally inactive embeddings. If <i>ip-filter-id</i> is specified, displays embeddings for the IP filter ID. <i>ip-filter-id</i> — Specifies the IPv4 filter policy for which to display information. Values can be expressed in different formats; the following shows decimal integer format. Values 1 to 65535 detail — Displays detailed information.

associations — Appends, to the detailed filter policy output, information about where the specified filter policy is applied.

entry-type — Specifies the type of filter entry to display.

Values fixed, radius-insert, credit-control-insert, flow-spec, embedded, radius-shared, pcc-rule (applies only to the 7750 SR)

counters — Displays counter information for the specified filter ID. Egress counters count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.

entry-id — Specifies the filter policy entry (of the specified filter policy) for which to display information.

Values 1 to 2097151

effective-action — Displays the action that the system will effectively apply to the packet.

ingress — Filters the output and only displays the information for filter policies applied on ingress.

egress — Filters the output and only displays the information for filter policies applied on egress.

router — Filters the output and only displays the information for that specific service ("Base" instance).

service-id — Filters the output and only displays the information for the specified service. The specified value must correspond to an existing service in which the filter has been applied.

Output **Show Filter (no policy specified)** — The following is a sample output of IPv4 filter information when no policy is specified. [Table 59](#) describes the command output fields.

Sample Output

```
A:ALA-49# show filter ip
=====
Configured IP Filters                                     Total:      2
=====
Filter-Id  Scope      Applied Description
-----
5          Template  Yes
6          Template  Yes

=====
Host Common IP Filters                                   Total:      2
=====
Filter-Id      Description
-----
5:P4           Auto-created PCC-Rule Ingress Filter
6:P5           Auto-created PCC-Rule Egress Filter
=====
Num IP filters: 4
=====
```

Table 59 Show IP Filter Output Fields - no policy specified

Label	Description
Filter Id	The IP filter ID.
Scope	Template The filter policy is of type template.
	Exclusive The filter policy is of type exclusive.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Description	The IP filter policy description.

Show Filter (no filter-id specified, embedded keyword specified) — The following is a sample output of IPv4 filter information when no filter ID is specified but the embedded keyword is specified. [Table 60](#) describes the command output fields.

Sample Output

```
*A:Dut-C>config>filter# show filter ip embedded
=====
IP Filter embedding
=====
In      From      Priority      Inserted      Status
-----
10      2           50           1/1           OK
        1           100          1/2           OK- 1 entry overwritten
20      2           100          0/5           Failed - out of resources
=====
```

Table 60 Filter IP Output Fields (No Filter ID Specified, Embedded Keyword Specified)

Label	Description
In	Shows embedding filter index.
From	Shows embedded filters included.
Priority	Shows priority of embedded filter.

Table 60 Filter IP Output Fields (No Filter ID Specified, Embedded Keyword Specified) (Continued)

Label	Description
Inserted	Shows embedded/total number of entries from embedded filter. Status: OK —Embedding operation successful, if any entries are overwritten this will also be indicated. Failed —Embedding failed, the reason is displayed (out of resources).

Show Filter (with filter-id specified) — The following is a sample output of IPv4 filter information with the filter ID specified. [Table 61](#) describes the command output fields.

Sample Output

```
*A:Dut-B>config>filter>ip-filter# show filter ip 10
=====
IP Filter
=====
Filter Id       : 10
Scope          : Embedded
Type           : Normal
Entries        : 4
Description    : (Not Specified)
Filter Name    : 10
```

Table 61 Show IP Filter Policy Output Fields

Label	Description
Filter Id	The IPv4 filter policy ID.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Scope	Template The filter policy is of type template.
	Exclusive The filter policy is of type exclusive.

Table 61 Show IP Filter Policy Output Fields (Continued)

Label	Description
Type	Normal The filter policy is of type normal.
	src-mac The filter policy is of type src-mac.
	Packet-length The filter policy is of type packet-length.
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
System filter	Indicates if the filter has been chained to a system filter.
Radius Ins Pt	Indicates the RADIUS insertion point, if any.
CrCtl. Ins Pt	Indicates the Credit Control insertion point, if any.
RadSh. Ins Pt	Indicates the RADIUS shared insertion point, if any.
PccRI. Ins Pt	Indicates the PCC rule insertion point, if any.
Entries	The number of entries configured in this filter ID.
Description	The IPv4 filter policy entry description string.
Filter Match Criteria	IP Indicates the filter is an IPv4 filter policy.
Entry	The filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Description	The IPv4 filter policy entry description string.
Log Id	The filter log ID.
Src. IP	The source IPv4 address and prefix length match criterion. "0.0.0.0/0" indicates no criterion specified for the filter entry.
Src. Port	The source TCP, UDP, or SCTP port number, port range, or port match list.
Dest. IP	The destination IPv4 address and prefix length match criterion. "0.0.0.0/0" indicates no criterion specified for the filter entry.

Table 61 Show IP Filter Policy Output Fields (Continued)

Label	Description
Dest. Port	The destination TCP, UDP, or SCTP port number, port range, or port match list.
Protocol	The protocol for the match criteria. Undefined indicates no protocol specified.
Dscp	The DiffServ Code Point (DSCP) name.
ICMP Type	The ICMP type match criterion. Undefined indicates no ICMP type specified.
ICMP Code	The ICMP code field in the ICMP header of an IPv4 packet.
Fragment	False Configures a match on all non-fragmented IPv4 packets.
	True Configures a match on all fragmented IPv4 packets.
	Off Fragments are not a matching criteria. All fragments and non-fragments implicitly match.
Src Route Opt	Indicates if the source route option has been set.
Sampling	Off Specifies that traffic sampling is disabled.
	On Specifies that traffic matching the associated IPv4 filter entry is sampled.
Int. Sampling	Off Interface traffic sampling is disabled.
	On Interface traffic sampling is enabled.
IP-Option	Specifies matching packets with a specific IPv4 option or a range of IPv4 options in the IPv4 header for IPv4 filter match criteria.
Multiple Option	Off The option fields are not checked.
	On Packets containing one or more option fields in the IPv4 header will be used as IPv4 filter match criteria.

Table 61 Show IP Filter Policy Output Fields (Continued)

Label	Description
Tcp-flag	Specifies the list of TCP flags selected. Match true is represented with the TCP Flag value. Match false is represented with an exclamation mark before the flag value. TCP flags not selected as match criteria are not displayed. Example: Matching “tcp-ack true” and “tcp-rst false” is represented in the show command as Tcp-flag : Ack !Rst.
Option-present	Off Specifies not to search for packets that contain the option field or have an option field of zero.
	On Matches packets that contain the option field or have an option field of zero be used as IPv4 filter match criteria.
Egress PBR	Indicates if the egress-pbr flag is set for this entry.
Primary Action	Indicates the configured action, if any. Indented sub-labels in the show output provide configured parameters for this action
Secondary Action	Indicates the configured secondary action, if any. Indented sub-labels in the show output provide configured parameters for this action.
PBR Target Status	The status of the target of the primary or secondary action based on simple checks.
Extended Action	Indicates the configured extended action, if any.
PBR Down Action	Indicates the action to take when the target is down. Packets that match the entry criteria will be subject to the PBR Down Action in case the target of the main action is down.
Downloaded Action	The action downloaded by CPM to IOM.
Dest. Stickiness	Indicates whether stickiness is configured.
Hold Remain	The stickiness timer.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Show Filter Associations — The following is a sample output of IPv4 filter information when the **associations** keyword is specified. [Table 62](#) describes the command output fields.

Sample Output

```

A:ALA-49# show filter ip 1 associations
=====
IP Filter
=====
Filter Id      : 4                      Applied      : Yes
Scope         : Template               Def. Action  : Drop
System filter  : Unchained
Radius Ins Pt  : n/a
CrCtl. Ins Pt  : n/a
RadSh. Ins Pt  : n/a
PccRl. Ins Pt  : n/a
Entries       : 1
Description    : (Not Specified)
-----
Filter Association : IP
-----
Service Id     : 2                      Type         : VPLS
  - SAP      1/2/2  (Ingress)
-----
Filter associated with IOM: 1
=====

```

Table 62 Filter IP Associations Output Fields

Label	Description
Filter Id	The IPv4 filter policy ID.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Scope	Template The filter policy is of type Template.
	Exclusive The filter policy is of type Exclusive.
Type	Normal The filter policy is of type normal.
	src-mac The filter policy is of type src-mac.
	Packet-length The filter policy is of type packet-length.

Table 62 Filter IP Associations Output Fields (Continued)

Label	Description
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
System filter	Indicates if the filter has been chained to a system filter.
Radius Ins Pt	Indicates the RADIUS insertion point, if any.
CrCtl. Ins Pt	Indicates the Credit Control insertion point, if any.
RadSh. Ins Pt	Indicates the RADIUS shared insertion point, if any.
PccRI. Ins Pt	Indicates the PCC rule insertion point, if any.
Entries	The number of entries configured in this filter ID.
Description	The IPv4 filter policy description.
Filter Association	Indicates the filter is an IPv4 filter policy.
Service Id	The service ID on which the filter policy ID is applied. The output also provides a list of service points where the filter has been applied.
Type	The type of service of the service ID.
(Ingress)	The filter policy ID is applied as an ingress filter policy on the interface.
(Egress)	The filter policy ID is applied as an egress filter policy on the interface.

Show Filter Counters — The following is a sample output of IPv4 filter information when the **counters** keyword is specified. [Table 63](#) describes the command output fields.

Egress counters count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.

Sample Output

```
*A:ALA-48# show filter ip 100 counters
=====
IP Filter
=====
Filter Id           : 4                      Applied           : Yes
```

```

Scope           : Template           Def. Action      : Drop
System filter   : Unchained
Radius Ins Pt   : n/a
CrCtl. Ins Pt   : n/a
RadSh. Ins Pt   : n/a
PccRl. Ins Pt   : n/a
Entries         : 1
Description     : (Not Specified)

```

```

-----
Filter Match Criteria : IP
-----

```

```

Entry           : 4001
Ing. Matches     : 9788619 pkts (978861900 bytes)
Egr. Matches     : 9788619 pkts (978861900 bytes)
=====

```

Table 63 Filter IP Counters Output Field Descriptions

Label	Description
Filter Id	The IPv4 filter policy ID.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Scope	Template The filter policy is of type Template.
	Exclusive The filter policy is of type Exclusive.
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
System filter	Indicates if the filter has been chained to a system filter.
Radius Ins Pt	Indicates the RADIUS insertion point, if any.
CrCtl. Ins Pt	Indicates the Credit Control insertion point, if any.
RadSh. Ins Pt	Indicates the RADIUS shared insertion point, if any.
PccRl. Ins Pt	Indicates the PCC rule insertion point, if any.
Entries	The number of entries configured in this filter ID.

Table 63 Filter IP Counters Output Field Descriptions (Continued)

Label	Description
Description	The IPv4 filter policy description.
Filter Match Criteria	IP Indicates the filter is an IPv4 filter policy.
Entry	The filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Show Filter IP Output (with effective-action specified) — The following is a sample output of IPv4 filter information when the **effective-action** keyword is specified. [Table 64](#) describes the command output fields.

If the main action (either primary or secondary) cannot be performed, a reason will be given. This will be displayed on the same line as the Effective Action. The reason codes as currently defined are:

- action not supported in L2 service
- action not supported in L3 service
- action not supported on egress
- destination not reachable
- egress-pbr is off
- egress-pbr is on
- entry-default
- filter-default-action
- not POS unnumbered interface
- pbr-down-action-override
- target does not exist

Sample Output

```
show filter ip 1 effective-action
=====
IP Filter
=====
Filter Id      : 1                      Applied      : Yes
Scope         : Template              Def. Action  : Drop
Entries       : 1
Description    : (Not Specified)
-----
Entry         : 1
-----
Stickiness    : No
```

```

PBR Dwn Act Override: None
PBR Down Action      : Drop (entry-default)

Configuration
Primary Action       : Forward (SAP)
  Next Hop           : 1/1/2
  Service Id         : 10
Secondary Action     : None

Status
Target status based on extended checks
  Primary Action     : Down
  Secondary Action   : None
Downloaded Action    : Primary
Stickiness Timer     : Not Running

Effective Action based on application context
Service Id           : 10                               Type           : VPLS
Ingress
  Effective Action: Drop (entry-default)
=====

```

Table 64 Show Filter IP effective-action Output Field Descriptions

Label	Description
Filter Id	The IPv4 filter policy ID.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Scope	Template The filter policy is of type Template.
	Exclusive The filter policy is of type Exclusive.
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
Entries	The number of entries configured in this filter ID.
Description	The IPv4 filter policy description.

Table 64 Show Filter IP effective-action Output Field Descriptions

Label	Description
Entry	The filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Stickiness	No Stickiness is not configured.
	Yes Stickiness is configured.
PBR Dwn Act Override	Indicates whether or not the action to take when the PBR target is down has been overridden.
PBR Down Action	Indicates the action to take when the target is down. Packets that match the entry criteria will be subject to the PBR Down Action in case the target of the main action is down.
Configuration	Section of the output providing information on the configured parameters.
Primary Action	The configured action, if any. Indented sub-labels in the show output provide configured parameters for this action.
Secondary Action	The configured secondary action, if any. Indented sub-labels in the show output provide configured parameters for this action.
Status/Target status based on extended checks	Section of the output providing information on the operational status of certain parameters.
Primary Action	The status of the target of the primary action, if any configured, based on extended checks.
Secondary Action	The status of the target of the secondary action, if any configured, based on extended checks.
Downloaded Action	The action downloaded by the CPM to the IOM.
Stickiness Timer	The status of the stickiness timer, if any.
Effective Action based on application context	Section of the output providing the effective action, in the context of services, that a packet matching the criteria will be subject to.
Service Id	The service ID on which the filter policy ID is applied. The output also provides a list of service points where the filter has been applied.
Type	The service type in which the service has been applied.
Ingress/Egress	The direction in which the service has been applied.

Table 64 Show Filter IP effective-action Output Field Descriptions

Label	Description
Effective Action	The effective action that the packet will be subject to.
Extended Action	Indicates the configured extended action, if any.

ipv6

Syntax **ipv6** [**filter-type** *filter-type*]
ipv6 embedded [**inactive**]
ipv6 *ipv6-filter-id embedded* [**inactive**]
ipv6 *ipv6-filter-id* [**detail**]
ipv6 *ipv6-filter-id associations*
ipv6 *ipv6-filter-id type entry-type*
ipv6 *ipv6-filter-id counters* [**type entry-type**] [**detail**]
ipv6 *ipv6-filter-id entry entry-id* [**counters**] [**detail**]
ipv6 *ipv6-filter-id* [**entry entry-id**] **effective-action** [{**ingress** | **egress**}]
ipv6 *ipv6-filter-id* [**entry entry-id**] **effective-action router** [{**ingress** | **egress**}]
ipv6 *ipv6-filter-id* [**entry entry-id**] **effective-action service service-id** [{**ingress** | **egress**}]

Context show>filter

Description This command shows IPv6 filter information.

When **effective-action** is specified, this command displays what effectively happens to a packet that matches the criteria associated with the IPv6 filter policy.

Parameters *filter-type* — Specifies the type of filter to display.

Values config, flowspec, host-common, openflow, vsd

inactive — Shows all embeddings, optionally shows inactive embedding only, if *ipv6-filter-id* is not specified shows all embedded filters.

ipv6-filter-id — Specifies the IPv6 filter policy for which to display information. Values can be expressed in different formats. The following only shows decimal integer format.

Values 1 to 65535

detail — Displays detailed information.

associations — Appends, to the detailed filter policy output, information as to where the specified filter policy ID is applied.

entry-type — Specifies type of filter entry to display.

Values fixed, radius-insert, credit-control-insert, embedded, radius-shared

counters — Displays counter information. Egress counters count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.

entry-id — Specifies the filter policy entry (of the specified filter policy) to display information.

Values 1 to 2097151

effective-action — Displays the action that the system will effectively apply to the packet.

ingress — Filters the output and only displays the information for filter policies applied on ingress.

egress — Filters the output and only displays the information for filter policies applied on egress.

router — Filters the output and only displays the information for that specific service ("Base" instance).

service-id — Filters the output and only displays the information for the specified service. The specified value should correspond to an existing service in which the filter has been applied.

Output **Show Filter (no filter-id specified)** — The following output is an example of IPv6 filter information when no filter ID is specified, and [Table 65](#) describes the fields.

Sample Output

```
A:ALA-48# show filter ipv6
=====
IP Filters
=====
Filter-Id Scope      Applied Description
-----
100      Template    Yes    test
200      Exclusive    Yes
-----
Num IPv6 filters: 2
=====
A:ALA-48# show filter ipv6 embedded
=====
IP Filter embedding
=====
In      From      Priority    Inserted    Status
-----
10      2           50         1/1        OK
        1           100        1/2        OK- 1 entry overwritten
20      2           100        0/5        Failed - out of resources
=====
A:ALA-48#
=====
Configured IP Filters                                Total:      4
=====
Filter-Id  Scope      Applied Description
```

```

-----
1          Template  No
5          Exclusive No
10         Template  Yes
100        Embedded  N/A
=====
System IP Filters                               Total:      1
=====
Filter-Id          Description
-----
_tmnx_ofs_test      of-switch 'test' embedded filter
-----
Num IP filters: 5
=====

```

Table 65 IPv6 Filter Output Fields - no policy specified

Label	Description
Filter Id	The IPv6 filter ID.
Scope	Template The filter policy is of type template.
	Exclusive The filter policy is of type exclusive.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Description	The IPv6 filter policy description.
In	Shows embedding filter index.
From	Shows embedded filters included.
Priority	Shows priority of embedded filter.
Inserted	Shows embedded/total number of entries from embedded filter. Status: OK —Embedding operation successful, if any entries are overwritten this will also be indicated. Failed —Embedding failed, the reason is displayed (out of resources).

Show Filter (with filter-id specified) — The following output is an example of IPv6 filter information when filter-id is specified, and [Table 66](#) describes the fields.

Sample Output

```
A:ALA-48# show filter ipv6 100
=====
IPv6 Filter
=====
Filter Id      : 100                      Applied       : Yes
Scope         : Template                 Def. Action   : Forward
Entries       : 1
Description    : test
-----
Filter Match Criteria : IPv6
-----
Entry         : 10
Log Id        : 101
Src. IP       : ::/0                     Src. Port     : None
Dest. IP      : ::/0                     Dest. Port    : None
Next Header   : Undefined                Dscp          : Undefined
ICMP Type     : Undefined                ICMP Code     : Undefined
Tcp-flag      : (Not Specified)
Match action  : Drop
Ing. Matches  : 0                        Egr. Matches  : 0
=====
A:ALA-48#
```

Table 66 IPv6 Filter Policy Output Fields

Label	Description
Filter Id	The IPv6 filter policy ID.
Scope	Template The filter policy is of type template.
	Exclusive The filter policy is of type exclusive.
Entries	The number of entries configured in this filter ID.
Description	The IPv6 filter policy description.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.

Table 66 IPv6 Filter Policy Output Fields (Continued)

Label	Description
Filter Match Criteria	IP Indicates the filter is an IPv6 filter policy.
Entry	The filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Log Id	The filter log ID.
Src. IP	The source IPv6 address and mask match criterion. “::/0” indicates no criterion specified for the filter entry.
Dest. IP	The destination IPv6 address and mask match criterion. “::/0” indicates no criterion specified for the filter entry.
Protocol	The protocol ID for the match criteria. Undefined indicates no protocol specified.
ICMP Type	The ICMP type match criterion. Undefined indicates no ICMP type specified.
Fragment	False Configures a match on all non-fragmented IPv6 packets.
	True Configures a match on all fragmented IPv6 packets.
	Off Fragments are not a matching criteria. All fragments and nonfragments implicitly match.
Sampling	Off Specifies that traffic sampling is disabled.
	On Specifies that traffic matching the associated IPv6 filter entry is sampled.
IP-Option	Specifies matching packets with a specific IPv6 option or a range of IPv6 options in the IPv6 header for IPv6 filter match criteria.

Table 66 IPv6 Filter Policy Output Fields (Continued)

Label	Description
Match action	Default The filter does not have an explicit forward or drop match action specified. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
	Drop Drop packets matching the filter entry.
	Forward The explicit action to perform is forwarding of the packet. If the action is Forward, then if configured, the next hop information should be displayed, including nexthop: <i>IPv6 address</i> , Indirect: <i>IPv6 address</i> or Interface: <i>IPv6 interface name</i> .
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Src. Port	The source TCP, UDP, or SCTP port number, port range, or port match list.
Dest. Port	The destination TCP, UDP, or SCTP port number, port range, or port match list.
Dscp	The DiffServ Code Point (DSCP) name.
ICMP Code	The ICMP code field in the ICMP header of an IPv6 packet.
Tcp-flag	Specifies the list of TCP flags selected. Match true is represented with the TCP Flag value. Match false is represented with an exclamation mark before the flag value. TCP flags not selected as match criteria are not displayed. Example: Matching “tcp-ack true” and “tcp-rst false” is represented in the show command as Tcp-flag : Ack !Rst.
Option-present	Off Specifies not to search for packets that contain the option field or have an option field of zero.
	On Matches packets that contain the option field or have an option field of zero be used as IPv6 filter match criteria.
Int. Sampling	Off Interface traffic sampling is disabled.
	On Interface traffic sampling is enabled.

Table 66 IPv6 Filter Policy Output Fields (Continued)

Label	Description
Multiple Option	Off The option fields are not checked.
	On Packets containing one or more option fields in the IPv6 header will be used as IPv6 filter match criteria.
Egr. Matches	The number of egress filter matches/hits for the filter entry.
Ing. Rate-limiter	The number of offered, forwarded, and dropped packet matches for the filter entry.

Show Filter Associations — The following output is an example of IPv6 filter information when the **associations** keyword is specified, and [Table 67](#) describes the fields.

Sample Output

```
A:ALA-48# show filter ipv6 1 associations
=====
IPv6 Filter
=====
Filter Id       : 1                               Applied       : Yes
Scope          : Template                         Def. Action   : Drop
Entries        : 1
-----
Filter Association : IPv6
-----
Service Id     : 2000                               Type          : IES
- SAP         : 1/1/1:2000   (Ingress)
=====
Filter Match Criteria : IPv6
-----
Entry          : 10
Log Id         : 101
Src. IP        : ::/0                               Src. Port     : None
Dest. IP       : ::/0                               Dest. Port    : None
Next Header    : Undefined                         Dscp         : Undefined
ICMP Type      : Undefined                         ICMP Code     : Undefined
TCP-flag       : (Not Specified)
Match action   : Drop
Ing. Matches   : 0                               Egr. Matches  : 0
=====
A:ALA-48#
```

Table 67 Filter IPv6 Associations Output Fields

Label	Description
Filter Id	The IPv6 filter policy ID.

Table 67 Filter IPv6 Associations Output Fields (Continued)

Label	Description
Scope	Template The filter policy is of type Template.
	Exclusive The filter policy is of type Exclusive.
Entries	The number of entries configured in this filter ID.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
Service Id	The service ID on which the filter policy ID is applied. The output also provides a list of service points where the filter has been applied.
SAP	The Service Access Point on which the filter policy ID is applied.
(Ingress)	The filter policy ID is applied as an ingress filter policy on the interface.
(Egress)	The filter policy ID is applied as an egress filter policy on the interface.
Type	The type of service of the service ID.
Entry	The filter entry ID. If the filter entry ID indicates the entry is Inactive, the filter entry is incomplete, no action was specified.
Log Id	The filter log ID.
Src. IP	The source IPv6 address and mask match criterion. "0.0.0.0/0" indicates no criterion specified for the filter entry.
Dest. IP	The destination IPv6 address and mask match criterion. "0.0.0.0/0" indicates no criterion specified for the filter entry.
Protocol	The protocol ID for the match criteria. Undefined indicates no protocol specified.

Table 67 Filter IPv6 Associations Output Fields (Continued)

Label	Description
ICMP Type	The ICMP type match criterion. Undefined indicates no ICMP type specified.
Fragment	False Configures a match on all non-fragmented IPv6 packets.
	True Configures a match on all fragmented IPv6 packets.
	Off Fragments are not a matching criteria. All fragments and nonfragments implicitly match.
Sampling	Off Specifies that traffic sampling is disabled.
	On Specifies that traffic matching the associated IPv6 filter entry is sampled.
IP-Option	Specifies matching packets with a specific IPv6 option or a range of IPv6 options in the IPv6 header for IPv6 filter match criteria.
TCP-syn	False Configures a match on packets with the SYN flag set to false.
	True Configures a match on packets with the SYN flag set to true.
	Off The state of the TCP SYN flag is not considered as part of the match criteria.
Match action	Default The filter does not have an explicit forward or drop match action specified. If the filter entry ID indicates the entry is Inactive, the filter entry is incomplete, no action was specified.
	Drop Drop packets matching the filter entry.
	Forward The explicit action to perform is forwarding of the packet. If the action is Forward, then if configured the nexthop information should be displayed, including Nexthop: <IPv6 address>, Indirect: <IPv6 address> or Interface: <IPv6 interface name>.

Table 67 Filter IPv6 Associations Output Fields (Continued)

Label	Description
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Src. Port	The source TCP, UDP, or SCTP port number, port range, or port match list.
Dest. Port	The destination TCP, UDP, or SCTP port number, port range, or port match list.
Dscp	The DiffServ Code Point (DSCP) name.
ICMP Code	The ICMP code field in the ICMP header of an IPv6 packet.
Option-present	Off Specifies not to search for packets that contain the option field or have an option field of zero.
	On Matches packets that contain the option field or have an option field of zero be used as IPv6 filter match criteria.
Int. Sampling	Off Interface traffic sampling is disabled.
	On Interface traffic sampling is enabled.
Multiple Option	Off The option fields are not checked.
	On Packets containing one or more option fields in the IPv6 header will be used as IPv6 filter match criteria.
TCP-ack	False Configures a match on packets with the ACK flag set to false.
	True Configured a match on packets with the ACK flag set to true.
	Off The state of the TCP ACK flag is not considered as part of the match criteria.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Show Filter Counters — The following output is an example of IPv6 filter information when the **counters** keyword is specified, and [Table 68](#) describes the output fields.

Egress count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.

Sample Output

```
A:ALA-48# show filter ipv6 8 counters
=====
IPv6 Filter
=====
Filter Id      : 8                               Applied      : Yes
Scope         : Template                       Def. Action   : Forward
Entries       : 4
Description    : Description for Ipv6 Filter Policy id # 8
-----
Filter Match Criteria : IPv6
-----
Entry         : 5
Ing. Matches  : 0 pkts
Egr. Matches  : 0 pkts

Entry         : 6
Ing. Matches  : 0 pkts
Egr. Matches  : 0 pkts

Entry         : 8
Ing. Matches  : 160 pkts (14400 bytes)
Egr. Matches  : 80 pkts (6880 bytes)

Entry         : 10
Ing. Matches  : 80 pkts (7200 bytes)
Egr. Matches  : 80 pkts (6880 bytes)

=====
A:ALA-48#
```

Table 68 Filter IPv6 Counters Output Fields

Label	Description
IP Filter Filter Id	The IPv6 filter policy ID.
Scope	Template The filter policy is of type template.
	Exclusive The filter policy is of type exclusive.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.

Table 68 Filter IPv6 Counters Output Fields (Continued)

Label	Description
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
Filter Match Criteria	IP Indicates the filter is an IPv6 filter policy.
Entry	The filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Egress count the packets without Layer 2 encapsulation. Ingress counters count the packets with Layer 2 encapsulation.

Show Filter IPv6 Output (with effective-action specified) — The following is a sample output of IPv6 filter information when the **effective-action** keyword is specified. [Table 69](#) describes the command output fields.

If the main action (either primary or secondary) cannot be performed, a reason will be given. This will be displayed on the same line as the Effective Action. The reason codes as currently defined are:

- action not supported in L2 service
- action not supported in L3 service
- action not supported on egress
- destination not reachable
- egress-pbr is off
- egress-pbr is on
- entry-default
- filter-default-action
- pbr-down-action-override
- target does not exist

Sample Output

```
show filter ipv6 10 entry 10 effective-action
```

```

=====
IPv6 Filter
=====
Filter Id      : 10                               Applied      : Yes
Scope         : Template                         Def. Action   : Drop
Entries       : 8
Description    : (Not Specified)
-----
Entry         : 10
-----
Origin        : Fixed - overwrites embedded filter 30 entry 5
Egress PBR    : Disabled
Stickiness    : No
PBR Dwn Act Override: None
PBR Down Action : Drop (entry-default)

Configuration
Primary Action : Forward (Next Hop VRF)
  Next Hop     : 3ffe:0:a0a:a01:: (Indirect)
  Router       : Base
  Extended Action : Remark DSCP "cp51"
Secondary Action : Forward (Next Hop VRF)
  Next Hop     : 3ffe:0:1414:1401:: (Indirect)
  Router       : Base
  Extended Action : Remark DSCP "cp31"

Status
Target status based on extended checks
  Primary Action : Up
  Secondary Action : Up
Downloaded Action : Primary
Stickiness Timer : Not Running

Effective Action based on application context
Service Id      : 100                               Type          : IES
  Ingress
    Effective Action: Primary
    Extended Action : Performed
Service Id      : N/A                               Type          : Base Router
  Egress
    Effective Action: Primary
    Extended Action : Performed
=====

```

Table 69 Filter IPv6 effective-action Output Fields

Label	Description
Filter Id	The IPv6 filter policy ID.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.

Table 69 Filter IPv6 effective-action Output Fields (Continued)

Label	Description
Scope	Template The filter policy is of type Template.
	Exclusive The filter policy is of type Exclusive.
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
Entries	The number of entries configured in this filter ID.
Description	The IPv6 filter policy description.
Entry	The filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Origin	The type of filter entry.
Egress PBR	Indicates if the egress-pbr flag is set for this entry.
Stickiness	No Stickiness is not configured.
	Yes Stickiness is configured.
PBR Dwn Act Override	Indicates whether or not the action to take when the PBR target is down has been overridden.
PBR Down Action	Indicates the action to take when the target is down. Packets that match the entry criteria will be subject to the PBR Down Action in case the target of the main action is down.
Configuration	Section of the output providing information on the configured parameters.
Primary Action	The configured action, if any. Indented sub-labels in the show output provide configured parameters for this action.
Secondary Action	The configured secondary action, if any. Indented sub-labels in the show output provide configured parameters for this action.

Table 69 Filter IPv6 effective-action Output Fields (Continued)

Label	Description
Status/Target status based on extended checks	Section of the output providing information on the operational status of certain parameters.
Primary Action	The status of the target of the primary action, if configured, based on extended checks.
Secondary Action	The status of the target of the secondary action, if configured, based on extended checks.
Downloaded Action	The action downloaded by the CPM to the IOM.
Stickiness Timer	The status of the stickiness timer, if any.
Effective Action based on application context	Section of the output providing the effective action, in the context of services, that a packet matching the criteria will be subject to.
Service Id	The service ID on which the filter policy ID is applied. The output also provides a list of service points where the filter has been applied.
Type	The service type in which the service has been applied.
Ingress/Egress	The direction in which the service has been applied.
Effective Action	Indicates the effective action the packet will be subject to.
Extended Action	Indicates the configured extended action, if any.

log

Syntax **log** [bindings]
log *log-id* [**match** *string*]

Context show>filter

Description This command shows the contents of a memory-based or a file-based filter log.

If the optional keyword **match** and *string* parameter are given, the command displays the given filter log from the first occurrence of the given string.

Parameters **bindings** — Displays the number of filter logs currently instantiated.

log-id — Specifies the filter log ID destination expressed as a decimal integer.

Values 101 to 199

string — Specifies to start displaying the filter log entries from the first occurrence of *string*.

Output The following output is an example of filter log entry information, and [Table 70](#) describes the fields. If log summary is active, the filter log mini-tables contain the information described in [Table 71](#).

Sample Output

```
2007/04/13 16:23:09 Filter: 100:100 Desc: Entry-100
Interface: to-ser1 Action: Forward
Src MAC: 04-5b-01-01-00-02 Dst MAC: 04-5d-01-01-00-02 EtherType: 0800
Src IP: 10.10.0.1:646 Dst IP: 10.10.0.4:49509 Flags: TOS: c0
Protocol: TCP Flags: ACK
```

```
2007/04/13 16:23:10 Filter: 100:100 Desc: Entry-100
Interface: to-ser1 Action: Forward
Src MAC: 04-5b-01-01-00-02 Dst MAC: 04-5d-01-01-00-02 EtherType: 0800
Src IP: 10.10.0.1:646 Dst IP: 10.10.0.3:646 Flags: TOS: c0
Protocol: UDP
```

```
2007/04/13 16:23:12 Filter: 100:100 Desc: Entry-100
Interface: to-ser1 Action: Forward
Src MAC: 04-5b-01-01-00-02 Dst MAC: 01-00-5e-00-00-05 EtherType: 0800
Src IP: 10.10.13.1 Dst IP: 224.0.0.5 Flags: TOS: c0
Protocol: 89
Hex: 02 01 00 30 0a 0a 00 01 00 00 00 00 ba 90 00 00
      00 00 00 00 00 00 00 00 ff ff ff 00 00 03 02 01
```

```
A:ALA-A>config# show filter log bindings
```

```
=====
Filter Log Bindings
=====
```

```
Total Log Instances (Allowed)      : 2046
Total Log Instances (In Use)       : 0
Total Log Bindings                 : 0
```

```
-----
Type  FilterId EntryId  Log      Instantiated
-----
```

```
No Instances found
```

```
=====
A:ALA-A>config#
```

A summary log will be printed only in case TotCnt is different from 0. Only the address types with at least 1 entry in the mini-table will be printed.

```
A:ALA-A>config# show filter log 190
```

```
=====
Summary Log[190] Crit1: SrcAddr TotCnt:      723 ArpCnt:      83
Mac           8 06-06-06-06-06-06
Mac           8 06-06-06-06-06-05
Mac           8 06-06-06-06-06-04
Mac           8 06-06-06-06-06-03
Mac           8 06-06-06-06-06-02
Ip            16 10.6.6.1
Ip            16 10.6.6.2
Ip            16 10.6.6.3
Ip            16 10.6.6.4
Ip            8 10.6.6.5
```

```

Ipv6      8  3ffe:1616:1616:1616:1616:1616::
Ipv6      8  3ffe:1616:1616:1616:1616:1616:ffff:ffff
Ipv6      8  3ffe:1616:1616:1616:1616:1616:ffff:fffe
Ipv6      8  3ffe:1616:1616:1616:1616:1616:ffff:fffd
Ipv6      8  3ffe:1616:1616:1616:1616:1616:ffff:fffc

```

```

=====
A:ALA-A

```

Log Message Formatting — Each filter log entry contains the following information in case summary log feature is not active (as appropriate).

Table 70 Filter Log Output Fields

Label	Description
<i>yyyy/mm/dd hh:mm:ss</i>	The date and timestamp for the log filter entry where <i>yyyy</i> is the year, <i>mm</i> is the month, <i>dd</i> is the day, <i>hh</i> is the hour, <i>mm</i> is the minute and <i>ss</i> is the second.
Filter	The filter ID and the entry ID which generated the filter log entry in the form <i>Filter_ID:Entry_ID</i> .
Desc	The description of the filter entry ID which generated the filter log entry.
Interface	The IP interface on which the filter ID and entry ID was associated which generated the filter log entry.
Action	The action of the filter entry on the logged packet.
Src MAC	The source MAC address of the logged packet.
Dst MAC	The destination MAC of the logged packet.
EtherType	The Ethernet type of the logged Ethernet type II packet.
Src IP	The source IP address of the logged packet. The source port will be displayed after the IP address as appropriate separated with a colon.
Dst IP	The destination IP address of the logged packet. The source port will be displayed after the IP address as appropriate separated with a colon.
Flags (IP flags)	M — The more fragments IP flag is set in the logged packet. DF — The do not fragment IP flag is set in the logged packet.
TOS	The TOS byte value in the logged packet.
Protocol	The IP protocol of the logged packet (TCP, UDP, ICMP or a protocol number in hex).

Table 70 Filter Log Output Fields (Continued)

Label	Description
Flags (TCP flags)	URG — Urgent bit set. ACK — Acknowledgment bit set. RST — Reset bit set. SYN — Synchronize bit set. FIN — Finish bit set.
HEX	If an IP protocol does not have a supported decode, the first 32 bytes following the IP header are printed in a hex dump. Log entries for non-IP packets include the Ethernet frame information and a hex dump of the first 40 bytes of the frame after the Ethernet header.
Total Log Instances (Allowed)	Specifies the maximum allowed instances of filter logs allowed on the system.
Total Log Instances (In Use)	Specifies the instances of filter logs presently existing on the system.
Total Log Bindings	Specifies the count of the filter log bindings presently existing on the system.
Type	The type of service of the service ID.
Filter ID	Uniquely identifies an IP filter as configured on the system.
Entry ID	The identifier which uniquely identifies an entry in a filter table.
Log	Specifies an entry in the filter log table.
Instantiated	Specifies if the filter log for this filter entry has or has not been instantiated.

If the packet being logged does not have a source or destination MAC address (that is, POS) then the MAC information output line is omitted from the log entry.

If log summary is active, the filter log mini-tables contain the information described in [Table 71](#).

Table 71 Filter Log Summary Mini-Table Fields

Label	Description
<i>Summary Log LogID</i>	Displays the log ID.
Crit1	Summary criterion that is used as index into the mini-tables of the log.
TotCnt	The total count of logs.

Table 71 Filter Log Summary Mini-Table Fields (Continued)

Label	Description
ArpCnt	Displays the total number of ARP messages logged for this log ID.
Src... Dst...	The address type indication of the key in the mini-table.
count	The number of messages logged with the specified source/destination address.
address	The address for which count messages were received.

mac

Syntax **mac** *mac-filter-id*
mac *mac-filter-id* **associations**
mac *mac-filter-id* [**type** *entry-type*] **counters** [**detail**]
mac *mac-filter-id* [**entry** *entry-id*] **effective-action** [{**ingress** | **egress**}]
mac *mac-filter-id* [**entry** *entry-id*] **effective-action router** [{**ingress** | **egress**}]
mac *mac-filter-id* [**entry** *entry-id*] **effective-action service** *service-id* [{**ingress** | **egress**}]
mac [*mac-filter-id*] **embedded** [**inactive**]
mac *mac-filter-id* **entry** *entry-id* [**counters**] [**detail**]
mac [**filter-type** *filter-type*]
mac *mac-filter-id* **type** *entry-type*

Context show>filter

Description This command displays MAC filter information.

When **effective-action** is specified, this command displays what effectively happens to a packet that matches the criteria associated with the MAC filter policy.

Parameters *mac-filter-id* — Displays detailed information for the specified filter ID and its filter entries.

Values 1 to 65535

associations — Appends information as to where the filter policy ID is applied to the detailed filter policy ID output.

entry-type — Specifies the type of filter entries as “fixed” or “embedded”.

counters — Displays counter information for the specified filter ID.

detail — Displays detailed information.

entry-id — Displays information on the specified filter entry ID for the specified filter ID only.

Values 1 to 2097151

effective-action — Displays the action that the system will effectively apply to the packet.

ingress — Filters the output and only displays the information for filter policies applied on ingress.

egress — Filters the output and only displays the information for filter policies applied on egress.

router — Filters the output and only displays the information for that specific service (“Base” instance).

service-id — Filters the output and only displays the information for the specified service. The specified value must correspond to an existing service in which the filter has been applied.

filter-type — Specifies the type of filter entries as “config” or “vsd”.

Output **No Parameters Specified** — A brief listing of MAC filters is produced when no parameters are specified; [Table 72](#) describes the output fields.

Sample Output

```
*A:Dut-C# show filter mac
=====
Configured Mac Filters                               Total:      1
=====
Filter-Id  Scope      Applied Description                                     Type
-----
10         Template  No                                     normal
=====
Num Mac filters: 1
=====
*A:Dut-C#
```

Table 72 **Filter MAC Output Fields**

Label	Description
Filter Id	The MAC filter ID
Scope	Template The filter policy is of type Template.
	Exclusive The filter policy is of type Exclusive.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.

Table 72 Filter MAC Output Fields (Continued)

Label	Description
Description	The MAC filter policy description.

Filter ID Specified — The following output is an example of MAC filter information when the filter ID is specified, and [Table 73](#) describes the fields. Detailed filter information for the filter ID and its entries is produced when the filter ID is specified.

Sample Output

```

=====
Mac Filter : 200
=====
Filter Id       : 200                      Applied       : No
Scope          : Exclusive                 D. Action     : Drop
Description     : Forward SERVER sourced packets
-----
Filter Match Criteria : Mac
-----
Entry          : 200                      FrameType     : 802.2SNAP
Description    : Not Available
Src Mac        : 00:00:5a:00:00:00 ff:ff:ff:00:00:00
Dest Mac       : 00:00:00:00:00:00 00:00:00:00:00:00
Dot1p          : Undefined                 Ethertype     : 802.2SNAP
DSAP           : Undefined                 SSAP          : Undefined
Snap-pid       : Undefined                 ESnap-oui-zero : Undefined
Match action   : Forward
Ing. Matches   : 0                        Egr. Matches  : 0
Entry          : 300 (Inactive)           FrameType     : Ethernet
Description    : Not Available
Src Mac        : 00:00:00:00:00:00 00:00:00:00:00:00
Dest Mac       : 00:00:00:00:00:00 00:00:00:00:00:00
Dot1p          : Undefined                 Ethertype     : Ethernet
DSAP           : Undefined                 SSAP          : Undefined
Snap-pid       : Undefined                 ESnap-oui-zero : Undefined
Match action   : Default
Ing. Matches   : 0                        Egr. Matches  : 0
=====

```

Table 73 Filter MAC with Filter-ID Specified Output Fields

Label	Description
MAC Filter Filter Id	The MAC filter policy ID.

Table 73 Filter MAC with Filter-ID Specified Output Fields (Continued)

Label	Description
Scope	Template The filter policy is of type Template.
	Exclusive The filter policy is of type Exclusive.
Description	The MAC filter policy description.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
Filter Match Criteria	MAC Indicates the filter is an MAC filter policy.
Entry	The filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Description	The filter entry description.
FrameType	Ethernet The entry ID match frame type is Ethernet IEEE 802.3.
	Ethernet II The entry ID match frame type is Ethernet Type II.
Src MAC	The source MAC address and mask match criterion. When both the MAC address and mask are all zeros, no criterion specified for the filter entry.
Dest MAC	The destination MAC address and mask match criterion. When both the MAC address and mask are all zeros, no criterion specified for the filter entry.
Dot1p	The IEEE 802.1p value for the match criteria. Undefined indicates no value is specified.
Ethertype	The Ethertype value match criterion.

Table 73 Filter MAC with Filter-ID Specified Output Fields (Continued)

Label	Description
DSAP	The DSAP value match criterion. Undefined indicates no value specified.
SSAP	SSAP value match criterion. Undefined indicates no value specified.
Snap-pid	The Ethernet SNAP PID value match criterion. Undefined indicates no value specified.
Esnap-oui-zero	Non-Zero Filter entry matches a non-zero value for the Ethernet SNAP OUI.
	Zero Filter entry matches a zero value for the Ethernet SNAP OUI.
	Undefined No Ethernet SNAP OUI value specified.
Match action	Default The filter does not have an explicit forward or drop match action specified. If the filter entry ID indicates the entry is Inactive, the filter entry is incomplete, no action was specified.
	Drop Packets matching the filter entry criteria will be dropped.
	Forward Packets matching the filter entry criteria is forwarded.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Filter Associations — The associations for a filter ID will be displayed if the **associations** keyword is specified. The association information is appended to the filter information.

The following output is an example of MAC filter information when the associations keyword is specified, and [Table 74](#) describes the fields.

Sample Output

```
A:ALA-49# show filter mac 3 associations
=====
Mac Filter
=====
Filter ID      : 3                Applied           : Yes
Scope         : Template         Def. Action       : Drop
Entries       : 1
-----
```

```
Filter Association : Mac
-----
Service Id      : 1001                      Type           : VPLS
- SAP           1/1/1:1001                  (Egress)
=====
```

Table 74 Filter MAC Associations Output Fields

Label	Description
Filter Association	Mac The filter associations displayed are for a MAC filter policy ID.
Service Id	The service ID on which the filter policy ID is applied. The output also provides a list of service points where the filter has been applied.
SAP	The Service Access Point or spoke/mesh SDP on which the filter policy ID is applied.
Type	The type of service of the Service ID.
(Ingress)	The filter policy ID is applied as an ingress filter policy on the interface.
(Egress)	The filter policy ID is applied as an egress filter policy on the interface.

Filter Entry Counters Output — When the **counters** keyword is specified, the filter entry output displays the filter matches/hit information. The following table describes the command output for the command.

```
A:ALA-49# show filter mac 8 counters
=====
Mac Filter
=====
Filter Id      : 8                      Applied           : Yes
Scope         : Template                Def. Action       : Forward
Entries       : 2
Description    : Description for Mac Filter Policy id # 8
-----
Filter Match Criteria : Mac
-----
Entry         : 8                      FrameType         : Ethernet
Ing. Matches: 80 pkts (5440 bytes)
Egr. Matches: 62 pkts (3968 bytes)

Entry         : 10                     FrameType         : Ethernet
Ing. Matches: 80 pkts (5440 bytes)
Egr. Matches: 80 pkts (5120 bytes)
=====
```

Table 75 Filter MAC Counters Output Field Descriptions

Label	Description
Mac Filter Filter Id	The MAC filter policy ID.
Scope	Template The filter policy is of type Template.
	Exclusive The filter policy is of type Exclusive.
Description	The MAC filter policy description.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
Filter Match Criteria	Mac Indicates the filter is an MAC filter policy.
Entry	The filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
FrameType	Ethernet The entry ID match frame type is Ethernet IEEE 802.3.
	802.2LLC The entry ID match frame type is Ethernet IEEE 802.2 LLC.
	802.2SNAP The entry ID match frame type is Ethernet IEEE 802.2 SNAP.
	Ethernet II The entry ID match frame type is Ethernet Type II.
Ing. Matches	The number of ingress filter matches/hits for the filter entry.
Egr. Matches	The number of egress filter matches/hits for the filter entry.

Show Filter MAC Output (with effective-action specified) — The following is a sample output of MAC filter information when the **effective-action** keyword is specified. [Table 76](#) describes the command output fields.

If the main action (either primary or secondary) cannot be performed, a reason will be given. This will be displayed on the same line as the Effective Action. The reason codes as currently defined are:

- entry-default
- filter-default-action
- pbr-down-action-override
- action not supported on egress
- target does not exist

Sample Output

```
show filter mac 1 effective-action
=====
Mac Filter
=====
Filter Id           : 1                      Applied           : Yes
Scope              : Template                Def. Action       : Drop
Entries            : 1                      Type              : normal
Description         : (Not Specified)
-----
Entry              : 2
-----
Stickiness         : No
PBR Dwn Act Override: None
PBR Down Action    : Drop (entry-default)

Configuration
Primary Action     : Forward (SAP)
  Next Hop        : 1/1/3
  Service Id      : Not configured
Secondary Action   : None

Status
Target status based on extended checks
  Primary Action   : Target does not exist
  Secondary Action : None
Downloaded Action : Forward
Stickiness Timer  : Not Running

Effective Action based on application context
Service Id        : 10                      Type              : VPLS
Ingress
  Effective Action: Forward (target does not exist)
=====
```

Table 76 Filter MAC effective-action Output Fields

Label	Description
Filter Id	The MAC filter policy ID.
Applied	No The filter policy ID has not been applied.
	Yes The filter policy ID is applied.
Scope	Template The filter policy is of type Template.
	Exclusive The filter policy is of type Exclusive.
Def. Action	Forward The default action for the filter ID for packets that do not match the filter entries is to forward.
	Drop The default action for the filter ID for packets that do not match the filter entries is to drop.
Entries	The number of entries configured in this filter ID.
Type	The type of entries configured in this filter.
Description	The MAC filter policy description.
Entry	The filter entry ID. If the filter entry ID indicates the entry is (Inactive), then the filter entry is incomplete as no action has been specified.
Stickiness	No Stickiness is not configured.
	Yes Stickiness is configured.
PBR Dwn Act Override	Indicates whether or not the action to take when the PBR target is down has been overridden.
PBR Down Action	The action to take in case the target is down.
Configuration	Section of the output providing information on the configured parameters.
Primary Action	The configured action, if any. Indented sub-labels in the show output provide configured parameters for this action.

Table 76 Filter MAC effective-action Output Fields (Continued)

Label	Description
Secondary Action	The configured secondary action, if any. Indented sub-labels in the show output provide configured parameters for this action.
Status/Target status based on extended checks	Section of the output providing information on the operational status of certain parameters.
Primary Action	The status of the target of the primary action, if configured, based on extended checks.
Secondary Action	The status of the target of the secondary action, if configured, based on extended checks.
Downloaded Action	The action downloaded by the CPM to the IOM.
Stickiness Timer	The status of the stickiness timer, if any.
Effective Action based on application context	Section of the output providing the effective action, in the context of services, that a packet matching the criteria will be subject to.
Service Id	The service ID on which the filter policy ID is applied. The output also provides a list of service points where the filter has been applied.
Type	The service type in which the service has been applied.
Ingress/Egress	The direction in which the service has been applied.
Effective Action	Indicates the effective action the packet will be subject to.

match-list

Syntax	match-list
Context	show>filter
Description	This command enables the context to display information for match lists used in filter policies (IOM/FP and CPM).

ip-prefix-list

Syntax	ip-prefix-list [<i>prefix-list-name</i>] ip-prefix-list <i>prefix-list-name</i> references
Context	show>filter>match-list

Description	This command displays IPv4 prefixes information for match criteria in IPv4 ACL and CPM filter policies.
Parameters	<i>prefix-list-name</i> — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes. references — Displays the filter policies, policy entries and source/destination IPv4 match type per entry referring to this match list.

ipv6-prefix-list

Syntax	ipv6-prefix-list [<i>prefix-list-name</i>] ipv6-prefix-list <i>prefix-list-name</i> references
Context	show>filter>match-list
Description	This command displays IPv6 prefixes information for match criteria in IPv6 ACL and CPM filter policies.
Parameters	<i>prefix-list-name</i> — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes. references — Displays the filter policies, policy entries and source/destination IPv6 match type per entry referring to this match list.

port-list

Syntax	port-list [<i>port-list-name</i>] port-list <i>port-list-name</i> references
Context	show>filter>match-list
Description	This command displays TCP/UDP/SCTP port values or ranges for match criteria in IPv4 and IPv6 ACL and CPM filter policies.
Parameters	<i>port-list-name</i> — A string of up to 32 characters of printable ASCII characters. If special characters are used, the string must be enclosed within double quotes. references — Displays the filter policies, policy entries and source/destination/port match type per entry referring to this match list.

md-auto-id

Syntax	md-auto-id
Context	show>filter
Description	This command displays MD automatically-assigned ID information.

Output The following output is an example of MD automatically-assigned filter information and [Table 77](#) describes the MD automatic ID filter output fields.

Sample Output

```
*A:node-6# show filter md-auto-id
=====
MD Auto-Id Information
=====
Filter-id Range
Start           : 1073741822                End           : 2147483647
Ip-filter Count : 30
Ipv6-filter Count : 20
Mac-filter Count : 10
=====
```

Table 77 MD Auto-Id Filter Output Fields

Label	Description
Start	Specifies the start range for a filter policy ID.
End	Specifies the end range for a filter policy ID.
Ip-filter Count	Specifies the number of IP filter policies with automatically-assigned IDs.
Ipv6-filter Count	Specifies the number of IPv6 filter policies with automatically-assigned IDs.
Mac-filter Count	Specifies the number of MAC filter policies with automatically-assigned IDs.

redirect-policy

Syntax **redirect-policy** [*redirect-policy-name* {**dest** *ip-address* | **associations**}]

Context show>filter

Description This command shows redirect filter information.

Parameters *redirect-policy-name* — Displays information for the specified redirect policy, up to 32 characters.
dest *ip-address* — Directs the router to use a specified IP address for communication.

Values

ipv4-address:	a.b.c.d.
ipv6-address:	x:x:x:x:x:x:x (eight 16-bit pieces)
	x:x:x:x:x:d.d.d.d

x: [0 to FFFF]H

d: [0 to 255]D

associations — Appends association information.**Output** **Redirect Policy Output** — The following output is an example of redirect policy information, and [Table 78](#) describes the fields.**Sample Output**

```

A:ALA-A>config>filter# show filter redirect-policy
=====
Redirect Policies
=====
Redirect Policy          Applied Description
-----
wccp                    Yes
redirect1               Yes      New redirect info
redirect2               Yes      Test test test test
=====
ALA-A>config>filter#

ALA-A>config>filter# show filter redirect-policy redirect1
=====
Redirect Policy
=====
Redirect Policy: redirect1          Applied      : Yes
Description      : New redirect info
Active Dest     : 10.10.10.105
-----
Destination     : 10.10.10.105
-----
Description      : another test
Admin Priority   : 95                      Oper Priority: 105
Admin State     : Up                      Oper State  : Down

Ping Test
Source Address  : None
Interval       : 1                      Timeout      : 30
Drop Count     : 5
Hold Down      : 0                      Hold Remain  : 0
Last Action at : 03/19/2007 00:46:55    Action Taken : Disable
=====
A:ALA-A>config>filter#

```

Table 78 **Filter Redirect-Policy Output Fields**

Label	Description
Redirect Policy	Specifies a specific redirect policy.

Table 78 Filter Redirect-Policy Output Fields (Continued)

Label	Description
Applied	Specifies whether the redirect policy is applied to a filter policy entry.
Description	Displays the user-provided description for this redirect policy.
Active Destination	ip address Specifies the IP address of the active destination.
	none Indicates that there is currently no active destination.
Destination	Specifies the destination IP address.
Oper Priority	Specifies the operational value of the priority for this destination. The highest operational priority across multiple destinations is used as the preferred destination.
Admin Priority	Specifies the configured base priority for the destination.
Admin State	Specifies the configured state of the destination.
	Out of Service Tests for this destination will not be conducted.
Oper State	Specifies the operational state of the destination.
Ping Test	Specifies the name of the ping test.
Source Address	Specifies the source address of the ping test (if any).
Timeout	Specifies the amount of time in seconds that is allowed for receiving a response from the far-end host. If a reply is not received within this time the far-end host is considered unresponsive.
Interval	Specifies the amount of time in seconds between consecutive requests sent to the far end host.
Drop Count	Specifies the number of consecutive requests that must fail for the destination to declared unreachable.
Hold Down	Specifies the amount of time in seconds that the system should be held down if any of the test has marked it unreachable.
Hold Remain	Specifies the amount of time in seconds that the system will remain in a hold down state before being used again.
Last Action at	Displays a time stamp of when this test received a response for a probe that was sent out.

redirect-policy-binding

Syntax	redirect-policy-binding [<i>name</i>]
Context	show>filter
Description	This command shows configured redirect-policy bindings information.
Parameters	<i>name</i> — Displays information for the specified redirect policy binding, up to 32 characters.
Output	Redirect Policy Output — The following output is an example of redirect policy binding information, and Table 79 describes the fields.

Sample Output

```
A:ALA-A>config>filter# show filter redirect-policy-binding
=====
Redirect Policy Bindings
=====
Name                               Binding Operator Oper State
-----
TestBinding                        And                      Up
=====
ALA-A#
```

Table 79 Filter Redirect Policy Bindings Output Fields

Label	Description
Test Binding	Specifies a specific test binding field.

system-filter

Syntax	system-filter [chained-to]
Context	show>filter
Description	This command shows system filter information.
Parameters	chained-to — Displays filters that chain to a given system filter.
Output	No Parameters Specified — When no parameters are specified, the output is grouped for IPv4 and IPv6, and displays information about the active system filter and all filters with scope system .

The following output is an example of system filter information when no parameters are specified.

Sample Output

```
*A:Dut-C>show>filter# system-filter

=====
IP system filters
=====
Filter-Id                Active
-----
100                      Yes
65535                   No
-----
No. of IP system filters (total / active): 2 / 1
=====

=====
IPv6 system filters
=====
Filter-Id                Active
-----
No Matching Entries
-----
No. of IPv6 system filters (total / active): 0 / 0
=====
```

With chained-to Option Specified — The following output is an example of system filter information when the **chained-to** option is specified.

```
*A:Dut-C>show>filter# system-filter chained-to

=====
IP filters that chain to the active IP system filter
=====
3                4                5                6
5:23            6:24
-----
No. of IP filters that chain to the active IP system filter: 6
=====

=====
IPv6 filters that chain to the active IPv6 system filter
=====
No Matching Entries
-----
No. of IPv6 filters that chain to the active IPv6 system filter: 0
=====
```

4.5.2.2 Clear Commands

ip

Syntax **ip** *ip-filter-id* [**entry** *entry-id*] [{**ingress** | **egress**}]

Context clear>filter

Description	Clears the counters associated with the entries of the specified IPv4 filter policy. By default, the counters associated with each entry of the specified filter policy are all cleared. The scope of which counters are cleared can be narrowed using the command line parameters.
Default	Clears all counters associated with each entry of the specified IPv4 filter policy.
Parameters	<i>ip-filter-id</i> — The IPv4 filter policy ID for which to clear the entry counters. Values can be expressed in different formats. The following shows decimal integer format. Values 1 to 65535 <i>entry-id</i> — Specifies that only the counters associated with the specified filter policy entry will be cleared. Values 1 to 2097151 ingress — Specifies to only clear the ingress counters. egress — Specifies to only clear the egress counters.

ipv6

Syntax	ipv6 <i>ipv6-filter-id</i> [entry <i>entry-id</i>] [{ ingress egress }]
Context	clear>filter
Description	Clears the counters associated with the entries of the specified IPv6 filter policy. By default, the counters associated with each entry of the specified filter policy are all cleared. The scope of which counters are cleared can be narrowed using the command line parameters.
Default	Clears all counters associated with each entry of the specified IPv6 filter policy.
Parameters	<i>ipv6-filter-id</i> — The IPv6 filter policy ID for which to clear the entry counters. Values can be expressed in different formats. The following only shows decimal integer format. Values 1 to 65535 <i>entry-id</i> — Specifies that only the counters associated with the specified filter policy entry will be cleared. Values 1 to 2097151 ingress — Specifies to only clear the ingress counters. egress — Specifies to only clear the egress counters.

log

Syntax	log <i>log-id</i>

Context	clear>filter
Description	Clears the contents of a memory or file based filter log. This command has no effect on a syslog based filter log.
Parameters	<i>log-id</i> — Specifies the filter log ID as a decimal integer. Values 101 to 199

mac

Syntax	mac <i>mac-filter-id</i> [entry <i>entry-id</i>] [{ ingress egress }]
Context	clear>filter
Description	Clears the counters associated with the entries of the specified MAC filter policy. By default, the counters associated with each entry of the specified filter policy are all cleared. The scope of which counters are cleared can be narrowed using the command line parameters.
Default	Clears all counters associated with each entry of the specified MAC filter policy.
Parameters	<i>mac-filter-id</i> — The MAC filter policy ID for which to clear the entry counters. Values can either be expressed as a decimal integer or as an ASCII string of up to 64 characters. The following values only shows decimal integer. Values 1 to 65535 <i>entry-id</i> — Specifies that only the counters associated with the specified filter policy entry will be cleared. The values are expressed as a decimal integer. Values 1 to 2097151 ingress — Specifies to only clear the ingress counters. egress — Specifies to only clear the egress counters.

4.5.2.3 Monitor Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

ip

Syntax	ip <i>ip-filter-id</i> entry <i>entry-id</i> [interval <i>seconds</i>] [repeat <i>repeat</i>] [{ absolute rate }]

Context	monitor>filter
Description	This command monitors the counters associated with the specified entry of the specified IP filter policy.
Parameters	<i>ip-filter-id</i> — The IPv4 filter policy ID. Values can be expressed in different formats. The following only shows decimal integer format values. Values 1 to 65535 <i>entry-id</i> — Specifies the filter policy entry to monitor, as a decimal integer. Values 1 to 2097151 <i>seconds</i> — Configures the interval for each display in seconds. Default 10 seconds Values 3 to 60 <i>repeat</i> — Configures how many times the command is repeated. Default 10 Values 1 to 999 absolute — Displays the raw statistics without processing. No calculations are performed on the delta or rate statistics. rate — Displays the rate-per-second for each statistic instead of the delta. Default absolute

ipv6

Syntax	ipv6 <i>ipv6-filter-id</i> entry <i>entry-id</i> [interval <i>seconds</i>] [repeat <i>repeat</i>] [{ absolute rate }]
Context	monitor>filter
Description	This command monitors the counters associated with the IPv6 filter policy.
Parameters	<i>ipv6-filter-id</i> — The IPv6 filter policy ID. Values can be expressed in different formats. The following only shows decimal integer format values. Values 1 to 65535 <i>entry-id</i> — Specifies the filter policy entry to monitor, as a decimal integer. Values 1 to 2097151 <i>seconds</i> — Configures the interval for each display in seconds. Default 10 seconds Values 3 to 60

repeat — Configures how many times the command is repeated.

Default 10

Values 1 to 999

absolute — Displays the raw statistics without processing. No calculations are performed on the delta or rate statistics.

rate — Displays the rate-per-second for each statistic instead of the delta.

Default **absolute**

mac

Syntax	mac <i>mac-filter-id</i> entry <i>entry-id</i> [interval <i>seconds</i>] [repeat <i>repeat</i>] [{ absolute rate }]
Context	monitor>filter
Description	This command monitors the counters associated with the specified entry of the specified MAC filter policy.
Parameters	<i>mac-filter-id</i> — The MAC filter policy ID. Values can be expressed in different formats. The following only shows decimal integer format values. Values 1 to 65535 <i>entry-id</i> — Specifies the filter policy entry to monitor, as a decimal integer. Values 1 to 2097151 <i>seconds</i> — Configures the interval for each display in seconds. Default 10 seconds Values 3 to 60 <i>repeat</i> — Configures how many times the command is repeated. Default 10 Values 1 to 999 absolute — Displays the raw statistics without processing. No calculations are performed on the delta or rate statistics. rate — Displays the rate-per-second for each statistic instead of the delta. Default absolute

4.5.2.4 Debug Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

overload

Syntax	overload overload card slot-number fp fp-number overload card slot-number fp fp-number cpm-ip overload card slot-number fp fp-number cpm-ipv6 overload card slot-number fp fp-number cpm-mac overload card slot-number fp fp-number ip ip-filter-id direction direction overload card slot-number fp fp-number ipv6 ipv6-filter-id direction direction overload card slot-number fp fp-number mac mac-filter-id direction direction
Context	tools>dump>filter
Description	This command, when used without parameters, allows the operator to identify filter memory banks with one or more policies in overload in the system by slot number, FP number, direction (ingress or egress), and type (IP-MAC or IPv6). The command, when used with only the card and fp parameters, lists the filter policy ID as well as the number of entries in overload on a specified FP when the optional parameters <i>slot-number</i> and <i>fp-number</i> are specified. This command, when used with the ip, ipv6, or mac parameters in conjunction with the direction parameter, displays the entries not programmed for a specified filter policy due to an overload condition. This command, when used with the cpm-ip, cpm-ipv6, or cpm-mac parameters, displays the entries not programmed for a specified CPM filter policy. This command is available on applicable platforms only. Refer to the <i>7450 ESS, 7750 SR, 7950 XRS, and VSR System Management Guide, CPM Filters and Traffic Management</i> section for more details.
Parameters	<i>slot-number</i> — Specifies the IOM slot number or CPM for the overload command. Values 1 to 10 Values A (when used with cpm-ip, cpm-ipv6, or cpm-mac parameters) <i>fp-number</i> — Specifies the FP number. Values 1 to 8 <i>ip-filter-id</i> — Specifies the IP filter policy ID or name for which to display information. Values 1 to 65535 (Specifies the policy ID) <i>name</i> (Specifies a string of up to 64 characters uniquely identifying this filter policy name) <i>direction</i> — Specifies the direction. Values ingress or egress <i>ipv6-filter-id</i> — Specifies the IPv6 filter policy ID or name for which to display information. Values 1 to 65535 (Specifies the policy ID)

name (Specifies a string of up to 64 characters uniquely identifying this filter policy name)

mac-filter-id — Specifies the MAC filter ID policy for which to display information. Values can be expressed in different formats and refer to static or dynamic filters. The following values only shows decimal integer format.

Values 1 to 65535

filter-name (Specifies a string of up to 64 characters uniquely identifying this filter policy name)

Output The following output is an example of filter overload status.

Sample Output

```
*A:Dut# tools dump filter overload
=====
Filter Overload Status
=====
Slot FP Dir Type
-----
1 1 Ing ip-mac
1 1 Egr ipv6
=====
```

Sample overload output with **card** and **fp** parameters only:

```
A:Dut# tools dump filter overload card 1 fp 1
=====
Filter Overload Status
=====
Slot FP Dir Type Filter #Entries
-----
1 1 Ing ip 5 1
1 1 Egr ipv6 40008 10
=====
```

Sample overload output with **card**, **fp**, **{cpm-ip, cpm-ipv6, or cpm-mac}** parameters only

```
*A:Dut# tools dump filter overload card "a" fp 1 cpm-ipv6
=====
Filter Overload Status
=====
Slot FP Dir Type Filter Entry
-----
A 1 cpm-ipv6 168
=====
```

Sample overload output with **card**, **fp**, **{ip, ipv6, or mac}** and **direction** parameters only:

```
*A:Dut# tools dump filter overload card 1 fp 1 ip 9 direction ingress
=====
Filter Overload Status
=====
Slot FP Dir Type Filter Entry
-----
1 1 Ing ip 9 100
=====
```

cpm

- Syntax** `cpm`
- Context** `tools>dump>filter>resources`
- Description** This command displays information about filter resource utilization on the CPM, consumption by filter-using services such as OpenFlow, and the filters that use the most resources.
- Output** The following output is an example of filter resource utilization information.

Sample Output

```
*A:Dut-C>tools>dump>filter>resources># cpm
```

```
=====
Number of ACL filters defined on CPM
=====
```

Owner	MAC	IP	IPv6	Total
Configuration	0	7	0	7
Host Common	0	2	0	2
Openflow	0	2	1	3
Total	0	14	4	18

```
=====
Available filters (except openflow): 16369
Available openflow filters:          16381
=====
```

```
=====
Number of ACL filter entries / subentries defined on CPM
=====
```

Inserted by	MAC	IP	IPv6	Total
User configuration	0	21	1	22
Radius	0	21	1	22
Radius	0	0	0	0
Credit Control	0	0	0	0
Embedded	0	0	0	0
Radius shared host	0	2	0	2
Openflow	0	2	0	2
PCC-Rule	0	0	0	0
Other	0	0	0	0
Total	0	23	1	24
	0	23	1	24

```

=====
Available subentries (except openflow): 262120
Available openflow subentries:          262144

=====
Filters utilizing most resources (ordered by CPM entries)
=====
Type Id                               Entries    Subentries    TCAM entries
                                      (per FlexPath)
-----
No Mac filters found

-----
Ip    100                             5          5             5
Ip    65535                           5          5             5
Ip    1                               4          4             4
Ip    5:23                            2          2             2
Ip    6:24                            2          2             2
-----
Ipv6 fSpec-0                          0          0             0
Ipv6 fSpec-2345                       0          0             0
Ipv6 _tmnx_ofs_system:1                0          0             0
No more Ipv6 filters
=====

=====
Filters utilizing most resources (ordered by CPM subentries)
=====
Type Id                               Entries    Subentries    TCAM entries
                                      (per FlexPath)
-----
No Mac filters found

-----
Ip    100                             5          5             5
Ip    65535                           5          5             5
Ip    1                               4          4             4
Ip    5:23                            2          2             2
Ip    6:24                            2          2             2
-----
Ipv6 fSpec-0                          0          0             0
Ipv6 fSpec-2345                       0          0             0
Ipv6 _tmnx_ofs_system:1                0          0             0
No more Ipv6 filters
=====

```

dest-tracking

Syntax **dest-tracking ip [detail]**
dest-tracking ipv6 [detail]
dest-tracking sap [detail]
dest-tracking sdp [detail]

Context tools>dump>filter>resources

Description This command displays information about resources pertaining to tracked targets.

- Parameters**
- ip** — Displays information about IPv4 targets.
 - ipv6** — Displays information about IPv6 targets.
 - sap** — Displays information about SAP targets.
 - sdp** — Displays information about SDP targets.
 - detail** — Displays detailed information.

Output The following output is an example of filter resource SAP destination tracking information.

Sample Output

```
dest-tracking sap
=====
Unique SAPs with tracked forwarding states =====
Used   : 1
Free   : 4095
Total  : 4096
=====
```

The following output is an example of filter resource SAP destination tracking detailed information.

```
dest-tracking# sap detail
=====
Unique SAPs with tracked forwarding states =====
Num  Destination                                     Ref. count
-----
    1 sap 1/2/2                                         1
=====
Unique SAPs with tracked forwarding states =====
Used   : 1
Free   : 4095
Total  : 4096
=====
```

egress-pbr

- Syntax** **egress-pbr [detail]**
- Context** tools>dump>filter>resources
- Description** This command displays the number of allocated unique egress PBR destinations.
- Parameters** **detail** — Displays number of allocated unique egress PBR destinations together with a list of destinations and their ref counts.
- Output** The following output is an example of filter resource egress PBR destination information.

Sample Output


```
*A:Dut-C>tools dump filter resources egress-pbr

=====
Egress PBR destinations
=====
Name                               Count
-----
All destinations                    8
Unique destinations                 4
=====

*A:Dut-C# tools dump filter resources egress-pbr detail

=====
Unique egress PBR destinations
=====
Num Action      Ref. count Parameters
-----
  1 Esi L3       1          esi 00:00:00:00:00:00:00:00:01
                        ip  5.5.1.5
                        if  VasToFromAccess
                        rtr 123
-----
  2 Esi L3       2          esi 00:00:00:00:00:00:00:00:02
                        ip  5.5.0.5
                        if  VasToFromNetwork
                        rtr 123
-----
  3 Red-pol      3          name egress-pbr
-----
  4 Red-pol      2          name ingress-pbr
=====
```

http-redirect

Syntax	http-redirect [detail]
Context	tools>dump>filter>resources
Description	This command displays the number of unique and total installed HTTP redirect destinations per system.
Parameters	detail — Displays the number of unique and total installed HTTP redirect destinations per system, together with a list of unique HTTP redirect destinations.
Output	The following output is an example of filter resource HTTP redirect information.

Sample Output

```
A:SROS# /tools dump filter resources http-redirect detail
=====
Unique http-redirects
=====
Num   Not emb.      Emb. Override URL
```

```

-----
1          1          0 no ovr.  http://portal_1.com
-----
2          10         1 no ovr.  http://portal_2.com
-----
3          1          0 no ovr.  http://portal_3.com
-----
4          1          0 no ovr.  http://portal_4.com
-----
5          1          0 no ovr.  http://portal_5.com
=====
=====
Http-redirects
=====
Name                               Count
-----
Unique redirects                    5
Not embedded redirects              14
Embedded redirects                  1
All redirects                        15
=====

```

iom

Syntax	iom [<i>slot-number</i>]
Context	tools>dump>filter>resources
Description	This command shows information about filter resource utilization on all IOMs or a specified IOM. Resource utilization per filter type is available, as well as filters using most resources on a given line card.
Parameters	<i>slot-number</i> — Specifies that only the filter resource utilization associated with the IOM card in this slot will be displayed. Values 1 to 10
Output	The following output is an example of filter resource utilization information for all IOMs.

Sample Output

```

*A:Dut-C>tools>dump>filter>resources># iom

=====
Number of ACL filter entries used / available on IOMs
=====
Slot                               Used           Available
-----
1                                   11            65524
2                                   5             65530
3                                   5             65530
=====

=====
Number of ACL filters and filter entries used / available on FlexPaths

```

```

=====
Slot FlexPath   Dir  Filters  Filters  MAC/IP  MAC/IP  IPv6  IPv6
              used   avail  entries entries  entries entries
              used   avail  used   avail  used   avail
-----
1      1        Ingr    2    2045    10    65526    2    28670
              Egr     2    2045     5    32763    2    16382
2      1        Ingr    4    2043     7    65529    2    28670
              Egr     0    2047     2    32766    2    16382
3      1        Ingr    0    2047     7    65529    2    28670
              Egr     0    2047     2    32766    2    16382
=====

Filters utilizing most resources (ordered by TCAM entries per FlexPath)
Only filters present on any IOM are displayed
=====
Type Id                      Entries      Subentries  TCAM entries
                              (per FlexPath)
-----
No Mac filters found
-----
Ip   100                      5           5           5
Ip   5:23                     2           2           2
Ip   6:24                     2           2           2
Ip   3                        1           1           1
Ip   4                        1           1           1
-----
Ipv6 fSpec-0                  0           0           0
Ipv6 fSpec-2345              0           0           0
No more Ipv6 filters
=====

```

ip

Syntax	ip <i>ip-filter-id</i>
Context	tools>dump>filter>resources
Description	This command displays information about the specified IP filter including resource utilization on CPM and IOM, the IOMs on which the filter is used, and the entries using the most resources.
Parameters	<i>ip-filter-id</i> — Specifies that only the filter resource utilization associated with this IP filter will be displayed.
Values	1 to 65535
Output	The following output is an example of IP filter resource utilization information.

Sample Output

```
*A:Dut-C>tools>dump>filter>resources># ip 100
```

```

=====
Resource utilization details for Ip filter 100
=====
CPM entries used           : 5
CPM subentries used        : 5
TCAM entries used (per FlexPath) : 5
Associated with IOMs       : 1,2,3,4,5,6,7,8,9,10

-----
Largest 5 entries
-----
Entry ID                  Active          TCAM entries
                           (per FlexPath)
-----
3                          Yes              1
4                          Yes              1
5                          Yes              1
6                          Yes              1
100                        Yes              1
-----
=====

```

ipv6

- Syntax** `ipv6 ipv6-filter-id`
- Context** `tools>dump>filter>resources`
- Description** This command displays information about the specified IPv6 filter including resource utilization on CPM and IOM, the IOMs on which the filter is used, and the entries using the most resources.
- Parameters** *ipv6-filter-id* — Specifies that only the filter resource utilization associated with this IPv6 filter will be displayed.
- Values** 1 to 65535
- Output** The following output is an example of IPv6 filter resource utilization information.

Sample Output

```

*A:Dut-C>tools>dump>filter>resources># ipv6 "fSpec-0"

=====
Resource utilization details for Ipv6 filter fSpec-0
=====
CPM entries used           : 0
CPM subentries used        : 0
TCAM entries used (per FlexPath) : 0
Associated with IOMs       : 2

-----
Largest 5 entries
-----

```

Entry ID	Active	TCAM entries (per FlexPath)

No Matching Entries		

mac

Syntax	mac <i>mac-filter-id</i>
Context	tools>dump>filter>resources
Description	This command displays information about the specified MAC filter including resource utilization on CPM and IOM, the IOMs on which the filter is used, and the entries using the most resources.
Parameters	<i>mac-filter-id</i> — Specifies that only the filter resource utilization associated with this IPv6 filter will be displayed. Values 1 to 65535
Output	The following output is an example of MAC filter resource utilization information.

Sample Output

```
*A:Dut-C>tools>dump>filter>resources># mac 1

=====
Resource utilization details for Mac filter 1
=====
CPM entries used : 1
CPM subentries used : 1
TCAM entries used (per FlexPath) : 1
Associated with IOMs : 1

-----
Largest 5 entries
-----

```

Entry ID	Active	TCAM entries (per FlexPath)
1	Yes	1

```
No more entries defined
-----
```

sticky-dest

Syntax sticky-dest

Context	tools>dump>filter>resources
Description	This command displays information about resources pertaining to sticky destinations timers.
Output	The following output is an example of sticky destination filter action information.

Sample Output

```
=====
Filter action - Sticky-dest resources
=====
Used   : 1
Free   : 2047
Total  : 2048
=====
```

4.5.2.5 Tools Commands

activate-primary-action

Syntax	activate-primary-action
Context	tools>perform>filter>ip-filter>entry tools>perform>filter>ipv6-filter>entry tools>perform>filter>mac-filter>entry
Description	This command allows an operator to activate the primary action for the given filter policy entry. If the primary action is already active, the command has no effect. If a secondary action is active, the primary action will be activated unless the primary target is down. If the sticky destination timer is running for the primary action entry, it will expire.

activate-best-dest

Syntax	activate-best-dest
Context	tools>perform>filter>redirect-policy
Description	This command allows the operator to force a PBR switch to the best destination selected by the redirect policy when that destination is not currently active as result of sticky destination functionality being enabled for the specified redirect policy. If hold-time-up is running, the timer is also expired.

5 Hybrid OpenFlow Switch

5.1 In This Chapter

Nokia supports Hybrid OpenFlow Switch (H-OFS) functionality. The hybrid model allows operators to deploy Software Defined Networking (SDN) traffic steering using OpenFlow (OF) atop of the existing routing/switching infrastructure.

5.2 Hybrid OpenFlow Switching

The hybrid OpenFlow model allows operators to deploy SDN traffic steering using OpenFlow on top of the existing routing and switching infrastructure. Some of the main benefits of the hybrid model include:

- Increased flexibility and speed for new service deployment—H-OFS implements flexible, policy-driven, standard-based H-OFS traffic steering that allows deployment of new services and on-demand services through policy updates rather than service and infrastructure programming.
- Evolutionary CAPEX/OPEX-optimized SDN deployment—The H-OFS functionality can be deployed on the existing hardware through software upgrade to realize the benefits of FlexPath programmability. The OpenFlow traffic placement is focused access only (that is, flexible, fast, on-demand service deployment) while network infrastructure provides robustness, resiliency, scale, and security.

In a basic mode of operation, a single OpenFlow Switch instance is configured on the router and controlled by a single OpenFlow controller.

The OF controllers and router exchange OF messages using the OF protocol (version 1.3.1) over the TCP/IPv4 control channel. Both out-of-band (default) and in-band management are supported for connectivity to the controller. Transport Layer Security (TLS) is also supported on the control channel. An OF message is processed by the OF switch instance on the router that installs all supported H-OFS traffic steering rules in a flow table for the H-OFS instance. A single table per H-OFS instance is supported.

The H-OFS allows operators to:

- Steer IPv4/IPv6 unicast traffic arriving on a Layer 3 interface by programming the 7450 ESS, 7750 SR, and 7950 XRS L3 PBR ACL actions.
- Steer IPv4/IPv6 unicast traffic arriving on a Layer 2 interface by programming the 7450 ESS, 7750 SR, and 7950 XRS L2 PBF ACL actions.
- Drop traffic by programming ACL action drop.
- Forward traffic using regular processing by programming ACL action forward.

Steering actions programmed using OpenFlow are functionally equivalent to ACL actions.

The router allows operators to control traffic using OF, as follows:

- An operator can select a subset of interfaces on the router to have OF rules enabled, by embedding a specific instance of H-OFS in filter policies used only by those interfaces.
- For the interfaces with an H-OFS instance enabled, an operator can:
 - Steer all traffic arriving on an interface by programming the flow table with a “match all” entry.
 - Steer a subset of traffic arriving on an interface with this H-OFS instance enabled by programming the flow table with match rules that select a subset of traffic (OpenFlow match criteria are translated to ACL filter match criteria). Unless explicitly listed as a limitation, the SR OS H-OFS supports any OpenFlow match criteria that can be translated to ACL IPv4/IPv6 filter policy match criteria. A default rule can be assigned for packets that do not match specific rules. These packets can be dropped, forwarded, or sent to the OpenFlow controller.

To enable rules in an H-OFS on an existing service router interface, an operator must:

1. Create one or more ingress line card policies.
2. Assign those line card ingress filter policies to the 7450 ESS, 7750 SR, and 7950 XRS service router interfaces.
3. Embed an H-OFS instance into those line card policies.
4. Program OF rules as required.

OpenFlow can be embedded in IPv4/IPv6 ACL filter policies deployed on:

- L3 IES service interfaces
- L3 network interfaces in base router context
- L3 VPRN service interfaces, including those with NAT
- L2 VPLS service interfaces
- IES/VPRN r-VPLS service interfaces, including those with NAT
- System ACL filters

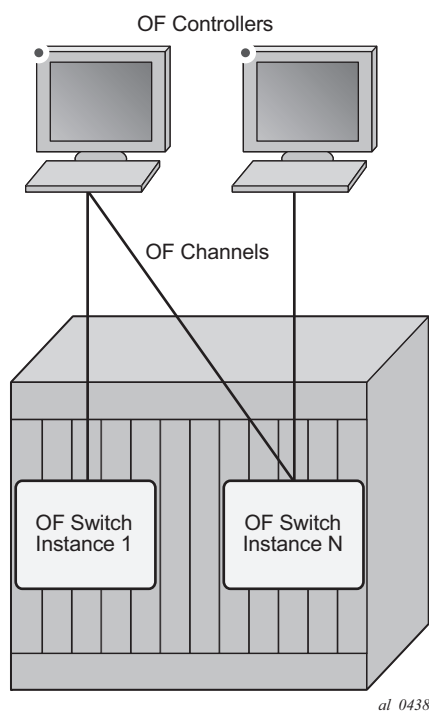
OpenFlow functionality can be enabled with no effect on forwarding performance. Operators can move from CLI/SNMP programmed steering rules to OpenFlow operational model in service without service disruption.

The control channel is routed via the GRT, meaning that the controller must be reachable via GRT, or it may be routed via a VPRN. VPRN support requires that a loopback interface corresponding to each OpenFlow switch, reachable via the VPRN, is configured in the VPRN. Then, the VPRN service ID or name and the corresponding OpenFlow control channel loopback address are specified in the OpenFlow switch control channel configuration.

5.2.1 Redundant Controllers and Multiple Switch Instances

The operator can configure one or more instances of an H-OFS (using SNMP or CLI interfaces) with each instance controlled by an OF controller over a unique OF channel using OpenFlow protocol. One OF controller can control multiple H-OFS instances using dedicated channels, or a dedicated OF controller can be deployed per switch. For each switch, up to two OF controllers can be deployed for redundancy. If two controllers are programmed, they can operate in either OFPCR_ROLE_EQUAL roles or in OFPCR_ROLE_MASTER and OFPCR_ROLE_SLAVE roles. [Figure 35](#) shows this architecture.

Figure 35 SR OS/Switch OF Controller/Switch Architecture Overview



5.2.2 GRT-only and Multi-Service H-OFS Modes of Operations

SR OS supports two modes of operation for an H-OFS instance: GRT-only and multi-service. The modes of operation are operator-controlled per H-OFS instance by enabling or disabling the **switch-defined-cookie** option (**configure>open-flow>of-switch>flowtable 0**). For backward compatibility, GRT-only mode of operation is default but, because multi-service mode is a functional superset, Nokia recommends operating in multi-service mode whenever possible. The operator can change the mode in which an H-OFS instance operates but a shutdown is required first. This will purge all the rules forcing the OF controller to reprogram the switch instance after it is re-enabled in a new mode. SR OS supports both H-OFS modes of operation concurrently for different switch instances.

Multi-service modes of operation uses part of the FlowTable cookie field (higher-order 32 bits) to provide the enhanced functionality; the lower-order FlowTable cookie bits are fully controlled by the OF controller. [Table 80](#) depicts higher-order bit Flow Table cookie encoding used when operating in the multi-service mode of operation.

Table 80 Multi-Service Mode — Higher-Order Bit Flow Table Cookie Encoding

sros-cookie Name	sros-cookie Type (Bits 63...60)	sros-cookie Value (Bits 59...32)	FlowTable Entry Interpretation Based on the sros-cookie
grt	0000	0	FlowTable rule is applicable to GRT instance (IES and router interfaces)
system	1000	0	FlowTable rule is applicable to system filters
service	1100	service-id for existing VPLS or VPRN service	FlowTable rule is applicable to an existing VPRN or VPLS service specified by the sros-cookie value

To enable multi-service mode of operation, an operator must embed the OF switch in an ACL filter policy, and, because multi-service H-OFS supports a mix of VPRN/VPLS/GRT/System rules, an additional scope of embedding must be selected (embed open-flow service, embed open-flow system - grt scope used by default). After embedding H-OFS instance, an ACL policy contains rules specific to a VPRN or VPLS service instance or to a GRT or to a System Filter Policy. Therefore, the ACL filter policy can only be used in the scope defined by H-OFS embedding.

Rules programmed by an OF controller with grt, system, and service cookies specified are accepted even if the H-OFS instance is not embedded by a filter activated in a specific context. Rules programmed by an OF controller with a service cookie specified, when the service ID is not one of the supported service types, or when the service with the specified ID does not exist, are rejected with an error returned back to the controller. If an H-OFS is embedded into a line card policy with a specific service context, the embedding must be removed before that service is deleted.

Table 81 summarizes the main differences between the two modes of operation.

Table 81 Differences Between GRT Mode and Multi-service Mode

Function	GRT Mode (no switch-defined-cookie)	Multi-service Mode (switch-defined-cookie)
Support OF on IES access interfaces	Yes	Yes
Support OF on router interfaces in GRT instance	Yes	Yes
Support OF on VPRN access and network interfaces	No (lack of native OF service virtualization)	Yes
Support OF on VPLS access and network interfaces	No (lack of native OF service virtualization)	Yes
Support port and VLAN in flowtable match (see the following section)	No	Yes
Support OF control of System ACL policies	No	Yes
Traffic steering actions	Forward, drop, redirect to LSP, Layer 3 PBR actions only	All
Scale	Up to ingress ACL filter policy entry scale	Up to OF system scale limit per H-OFS instance, and up to 64 534 entries per unique sros-cookie value

Restrictions:

- Refer to the SR OS 19.x.Rx Software Release Notes for a full list of GRT/IES/VPRN/VPLS interfaces that support OF control for multi-service mode.
- The 7450 ESS, 7750 SR, and 7950 XRS H-OFS always requires sros-cookie to be provided for FlowTable operations and will fail any operation without the cookie when the **switch-defined-cookie** command is enabled.

- OF no-match-action is not programmed in hardware for system filters, because system filters are chained to other filter policies and no-match-action would break the chaining.
- An H-OFS instance does not support overlapping of priorities (flow_priority value) within a single sros-cookie (type+value). The supported values for priority differ based on a value for **switch-define-cookie**:
 - H-OFS with the **switch-defined-cookie** command disabled
 - Valid flow_priority_range 1 to max-size – 1
 - flow_priority_value 0 is reserved (no match action)
 - H-OFS with the **switch-defined-cookie** command enabled
 - Valid flow_priority_range 1 to 65534
 - flow_priority_value 0 is reserved (no match action)
- flow_priority must map to a valid filter ID. The following items show how flow_priority is mapped to a filter policy entry ID:
 - H-OFS with **switch-define-cookie** disabled
 - filter entry ID = max-size – flow_priority + embedding offset
 - H-OFS with **switch-define-cookie** enabled
 - filter entry ID = 65535 – flow_priority + embedding offset
- When multiple H-OFS instances are embedded into a single ACL filter, no two H-OFS instances can program the same filter entry ID.

5.2.2.1 Port and VLAN ID Match in Flow Table Entries

When operating in multi-service mode, SR OS H-OFS supports matching on port and VLAN IDs as part of Flow Table match criteria. When an OF controller specifies incoming port and VLAN values other than "ANY", the H-OFS instance translates them to an SR OS VPLS SAP (sros-cookie must be set to a valid VPLS service ID). If the translation does not result in an existing VPLS SAP, the rule is rejected and an error is returned to the controller.

A flow table rule with a port/VLAN ID match is programmed only if the matching SAP has this H-OFS instance embedded in its ACL ingress filter policy using SAP scope of embedding (**embed open-flow sap**). See [SR OS H-OFS Port and VLAN Encoding](#) for required encoding of port and VLAN IDs.

The SR OS H-OFS supports a mix of rules with service scope and with SAP scope. For VPLS SAPs, an H-OFS instance must be embedded twice: once for the VPLS service and once for the SAP if both service-level and SAP-level rules are to be activated.

An example of activating both service-level and SAP-level rules inside a single ACL policy 1 used on VPLS SAP 1/1/1:100 is as follows:

```
configure filter ip-filter 1
  scope exclusive
  embed open-flow "ofs1" service vpls100 offset 100
  embed open-flow "ofs1" sap 1/1/1:100 offset 200
```

Restrictions:

- Because an H-OFS instance does not support overlapping priorities within a single sros-cookie (type+value), the priority for rules applicable to different SAPs within the same VPLS service must not overlap.
- Masking is not supported when adding a new flow table rule with a port and VLAN ID match.

5.2.3 Hybrid OpenFlow Switch Steering using Filter Policies

A router H-OFS instance is embedded into line card IPv4 and IPv6 filter policies to achieve OF-controlled Policy Based Routing (PBR). When H-OFS instance is created, embedded filters (IP and IPv6) required for that instance are automatically created. The filters are created with names, as follows:

“_tmnx_ofs_<ofs_name>”, with the same name for IPv4 and IPv6 filters used.

If embedded filters cannot be allocated due to the lack of filter policy instances, the creation of an H-OFS instance will fail. When the H-OFS instance is deleted, the corresponding embedded filters are freed.

The H-OFS can be embedded only in ingress filter policies on line cards/platforms supporting embedded filters and for services supporting H-OFS. Embedding of an H-OFS in filter policies on unsupported services is blocked. Embedding of an H-OFS in filter policies in unsupported direction or on unsupported hardware follows the general filter policy misconfiguration behavior and is not recommended. Unsupported match fields are ignored. Other match criteria may cause a packet to match an entry.

As soon as an H-OFS instance is created, the controller can program OF rules for that instance. For instance, the rules can be created prior to the H-OFS instance embedding into a filter policy or prior to a filter policy with H-OFS instance embedded being assigned to an interface. This allows the operator to either pre-program H-OFS steering rules, or to disable the rules without removing them from a flow table by removing the embedding. An error is returned to the controller if it attempts to program rules not supported by the system. The following lists examples of the errors returned:

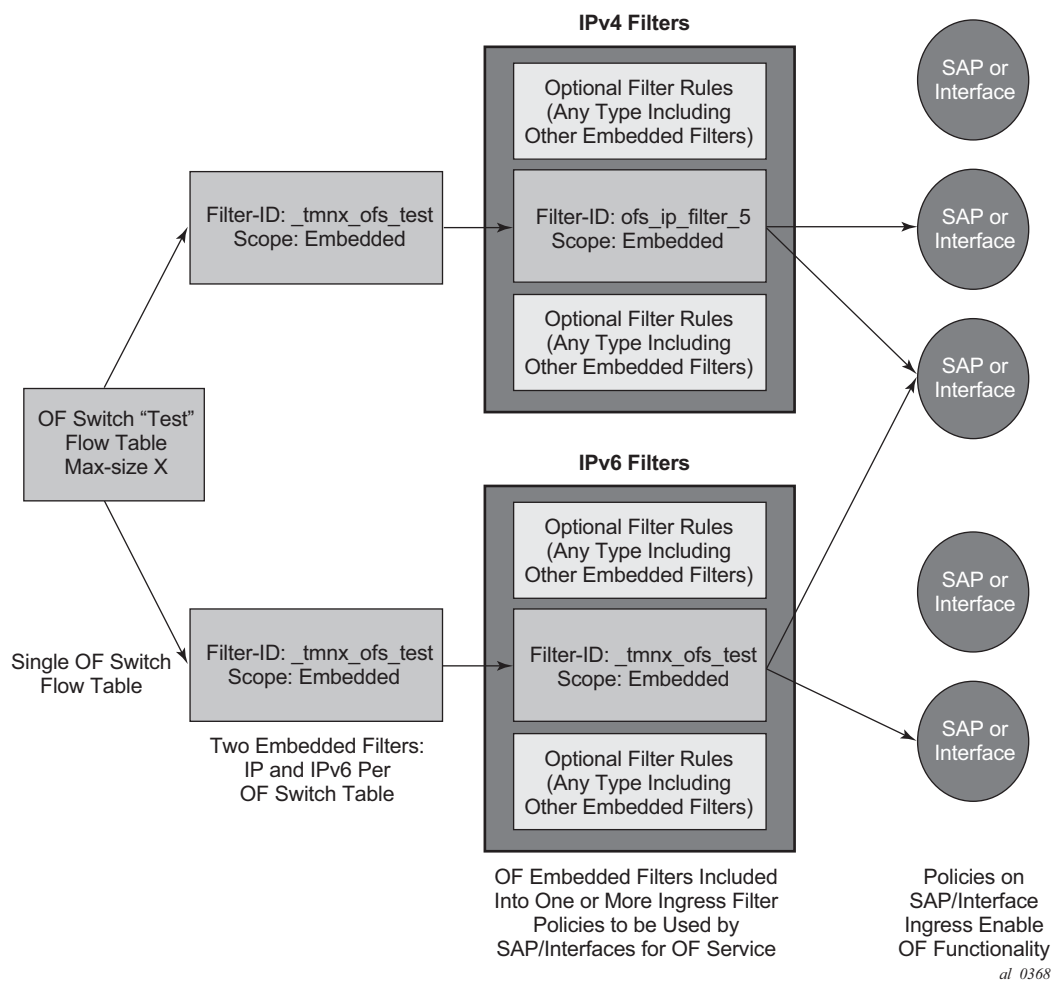
- unsupported instr: [OFPET_BAD_INSTRUCTION, OFPBIC_UNSUP_INST]
- unsupported action: [OFPET_BAD_ACTION, OFPBAC_BAD_TYPE]?
- unsupported output port: [OFPET_BAD_ACTION, OFPBAC_BAD_OUT_PORT]?
- unsupported match field: [OFPET_BAD_MATCH, OFPBMC_BAD_FIELD]?
- unsupported match value: [OFPET_BAD_MATCH, OFPBMC_BAD_VALUE]?
- output port invalid/deleted after flow_mod is sent to filter: OFPET_BAD_ACTION, OFPBAC_BAD_OUT_PORT]?

When the OF controller updates traffic steering rules, the Hybrid OpenFlow Switch updates the flow table rules. This automatically triggers programming of the embedded filter, which consequently causes instantiation of the rules for all services/interfaces that have a filter policy embedding this H-OFS instance. Embedded filter policy configuration/operational rules apply also to embedded filters auto-created for an H-OFS instance (see Embedded Filter Support for ACL Filter Policies section of this guide). MPLS cannot be deleted if OFS rules are created that redirect to an LSP.

The auto-created embedded filters can be viewed through CLI but cannot be modified and/or deleted through filter policy CLI/SNMP. The operator can see the above embedded filters under show filter context, including the details about the filters, entries programmed, interface association, statistics, and so on.

Figure 29 shows the H-OFS to service operator-configurable mapping example.

For an H-OFS with the **switch-defined-cookie** command enabled, embedded filters are created for each unique context in the H-OFS instead.

Figure 36 OF Flow Table Mapping to Router/Switch Service Infrastructure Example — switch-defined-cookie Disabled

The router allows mixing H-OFS rules from one or more H-OFS instances in a single filter policy. Co-existence of H-OFS rules in a single policy with CLI/SNMP programmed rules and/or BGP flowspec programmed rules in a single line card filter policy is also supported. When a management interface and an OF controller flow entry have the same filter policy entry, the management interface-created entry overrides the OF controller-created entry; see the embedded filter functional description. For mixing of the rules from multiple management entities, the controller should not program an entry in its Flow Table that would match all traffic, because this would stop evaluation of the filter policy.

The router supports HA for the OF Flow Table content and statistics. On an activity switch, the channel goes down and is reestablished by the newly active CPM. “Fail secure mode” operation takes place during channel reestablishment (OpenFlow rules continue to be applied to the arriving traffic). The OF controller is expected to resynchronize the OF table when the channel is reestablished. On a router reboot or H-OFS instance shutdown, H-OFS Flow Table rules and statistics are purged. An H-OFS instance cannot be deleted unless the H-OFS instance is first removed from all embedding filter policies.

5.2.4 Hybrid OpenFlow Switch Statistics

The SR OS Hybrid OpenFlow switch supports statistics retrieval using the OpenFlow protocol. There are two types of statistics that can be collected:

1. Statistics for SR OS H-OFS logical ports

Logical port statistics are available for RSVP-TE and MPLS-TP LSP logical ports. The non-zero statistics will be returned as long as an LSP has statistics enabled through an MPLS configuration.

Zero is always returned for logical port statistics for SR-TE LSPs when LSP statistics are not supported on SR-TE LSPs. The statistics can be retrieved regardless of whether an OF switch uses the specified LSP. The returned packet/bytes values are an aggregate of all packets/bytes forwarded over the LSP.

Statistics are not available for any other logical ports encodings.

2. Statistics for SR OS H-OFS flow table

Flow table statistics can be retrieved for one or more flow table entries of an H-OFS. The returned packet/bytes values are based on ACL statistics collected in the hardware. An OpenFlow controller can retrieve statistics either directly from hardware or from the ACL CPM-based bulk request cache. The ACL cache is used when processing an OpenFlow statistics multi-part aggregate request message (OFPMMP_AGGREGATE), or when an OpenFlow statistics multi-part flow message request (OFPM_FLOW) is translated to multiple flow table entries (a bulk request). When an OpenFlow multi-part flow statistics request message (OFPM_FLOW) is translated to a single flow table entries request (a single entry request), the counters are read from hardware in real time.

A mix of the two methods can be used to retrieve some flow table statistics from hardware in real time while retrieving other statistics from the cache. See [Filter Policy Statistics](#) for more information about ACL cache and ACL statistics.

When the auxiliary channel is enabled, the switch will set up a dedicated auxiliary channel for statistics. See [OpenFlow Switch Auxiliary Channels](#) for more information.

Operational Notes:

- Flow table statistics displayed through the CLI debugging tools (tools>dump>open-flow>of-switch) are read in real time from hardware. However, to protect the system, executing CLI debugging tool commands within 5 s will return the same statistics for any flow that had its statistics read from hardware within the last 5 s.
- When retrieving flow table statistics at scale, Nokia recommends to either use bulk requests, or to pace single entry requests in order to obtain the desired balance between stats real-time accuracy and CPM activity.

5.2.5 OpenFlow Switch Auxiliary Channels

The H-OFS supports auxiliary channels, as defined in OpenFlow version 1.3.1. The packet-in and statistics functions are supported on the auxiliary channels as well as on the main channel.

When the auxiliary channel is enabled on a switch (using the **aux-channel-enable** command), the switch will set up a dedicated auxiliary channel for statistics (Auxiliary ID 1) and a dedicated auxiliary channel for packet-in (Auxiliary ID 2) if a packet-in action is configured, to every controller for a given H-OFS switch instance. Auxiliary connections use the same transport as the main connection. The switch will handle any requests over any established channel and respond on the same channel even if a specific requested auxiliary channel is available.

The H-OFS instance uses the packet-in connection for packet-in functionality by default and expects (but does not require) the controller to use the statistics channel for statistics processing by default.

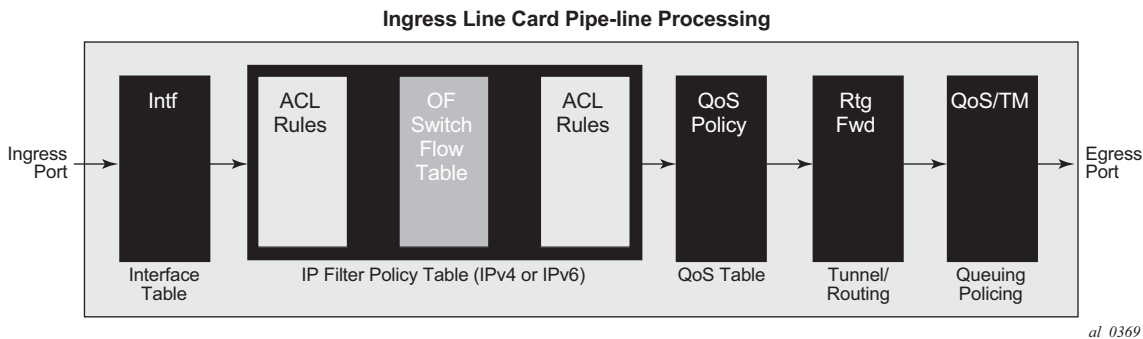
The switch uses the auxiliary channels (packet-in for packet-in-specific requests and statistics for statistics-specific requests) as long as they are available. If they are not available, the switch will use the next available auxiliary channel. If none of the auxiliary channels are available, the main channel will be used.

Auxiliary connections can be enabled or disabled without shutting down the switch.

5.2.6 Hybrid OpenFlow Switch Traffic Steering Details

As described in the previous section, an update to an OpenFlow Switch’s flow table results in the embedded filter updates, which triggers an update to all filter policies embedding those filters. The router automatically downloads the new set of rules to the line cards as defined through service configuration. The rules become part of an ingress line card pipeline, as shown in [Figure 37](#).

Figure 37 OpenFlow Switch Embedding in Ingress Pipeline Processing



5.2.6.1 SR OS H-OFS Logical Port

Logical ports are used in OpenFlow to encode switch-specific ports. SR OS H-OFS uses logical ports in steering actions by encoding PBR targets. [Table 82](#) lists logical port types supported by SR OS H-OFS:

Table 82 Encoding and Supported Logical Port Types

Bits 31..28	Bits 27..24	Bits 24..0
Logical port type (LPT)	Logical port type sub-type (LPT-S)	Logical port type value (LPT-V) — always padded with leading zeros

The following encoding sample shows logical port types supported by SR OS H-OFS:

```
RSVP LSP: LPT: 0100, LPT-S: 0000 (tunnel), LPT-V: RSVP TE Tunnel ID
MPLS-TP LSP: LPT: 0100, LPT-S: 0000 (tunnel), LPT-V: MPLS-TP Tunnel Number
SR-TE LSP: LPT: 0100, LPT-S: 0000 (tunnel), LPT-V: SR-TE LSP Index
GRT instance: LPT: 0100, LPT-S: 0001 (L3 routing instance), LPT-V: 0
VPRN Id: LPT: 0100, LPT-S: 0001 (L3 routing instance), LPT-V: VPRN Service ID for a
VPRN instance configured on the system, NAT: LPT 0100, LPT-S: 0020 (NAT), LPT-V: 0
```

OF is limited to a 24-bit service ID value range (a subset of VPRN IDs supported by the SR OS system).

Logical port values other than RSVP-TE LSP, SR-TE LSP, and MPLS-TP LSP require H-OFS with the **switch-defined-cookie** command enabled. Only tunnel-encoded ports are stored in the H-OFS logical port table. Therefore, functionality such as retrieving statistics per port is not available for logical ports that are not stored in the H-OFS logical port table.

5.2.6.2 SR OS H-OFS Port and VLAN Encoding

The OF controller can use port and VLAN values other than “ANY” for VPLS SAP match and for VPLS steering to SAP for H-OFS instances with the **switch-defined-cookie** command enabled.

To specify a port in an OF message, SR OS TmnxPortId encoding must be used. The allowed values are those for Ethernet physical ports and LAG.

To encode VLAN tags, OXM_OF_VLAN_ID and new experimenter OFL_OUT_VLAN_ID fields are used as shown in [Table 83](#).

Table 83 VLAN Tag Encoding

NULL tag, dot1Q tag, inner QinQ tag VlanId	Outer QinQ tag VlanId
OXM_OF_VLAN_VID	OFL_OUT_VLAN_ID (Experimenter field uses same encoding as OXM_OF_VLAN_VID)

[Table 84](#) shows how OF programmed values are translated to SR OS SAPs.

Table 84 Translation of OF Programmed Values to SR OS SAPs

OXM_OF_IN_PORT	OXM_OF_VLAN_VID	OFL_OUT_VLAN_ID	Matching SAP SR OS Encoding	Supported in flow_add	Supported in flow_mod flow_del mp_req	Comment
TmnxPortId for port or LAG	Value: 0x0000 Mask: Absent	Must be absent	port-id lag-id	Yes	Yes	Mask must be absent

Table 84 Translation of OF Programmed Values to SR OS SAPs (Continued)

OXM_OF_IN_PORT	OXM_OF_VLAN_VID	OFL_OUT_VLAN_ID	Matching SAP SR OS Encoding	Supported in flow_add	Supported in flow_mod flow_del mp_req	Comment
TmnxPortId for port or LAG	Value: 0x1yyy, yyy encodes qtag1 Mask: Absent	Must be absent	port-id:qtag1 lag-id:qtag1	Yes	Yes	Mask must be absent
TmnxPortId for port or LAG	Value: 0x1FFF Mask: Absent	Must be absent	port-id:* lag-id:*	Yes	Yes	Mask must be absent
TmnxPortId for port or LAG	Value: 0x1000 Mask: 0x1000	Must be absent	port-id: any lag-id: any where "any" is either * or a valid VLAN-ID (but not NULL)	No	Yes	Mask must be 0x1000
TmnxPortId for port or LAG	Value: 0x1yyy, yyy encodes qtag2 Mask: Absent	Value: 0x1zzz, zzz encodes qtag1 Mask: Absent	port-id:qtag1.qtag2 lag-id:qtag1.qtag2	Yes	Yes	Mask must be absent
TmnxPortId for port or LAG	Value: 0x1FFF Mask: Absent	Value: 0x1zzz, zzz encodes qtag1 Mask: Absent	port-id: qtag1.* lag-id: qtag1.*	Yes	Yes	Mask must be absent
TmnxPortId for port or LAG	Value: 0x1FFF Mask: Absent	Value: 0x1FFF Mask: Absent	port-id: *.* lag-id: *.*	Yes	Yes	Mask must be absent

Table 84 Translation of OF Programmed Values to SR OS SAPs (Continued)

OXM_OF_IN_PORT	OXM_OF_VLAN_VID	OFL_OUT_VLAN_ID	Matching SAP SR OS Encoding	Supported in flow_add	Supported in flow_mod flow_del mp_req	Comment
TmnxPortId for port or LAG	Value: 0x1000 Mask: 0x1000	Value: 0x1zzz, zzz encodes qtag1 Mask: Absent	port-id: qtag1.any lag-id: qtag1.any where any is either * or a valid VLAN-ID (but not NULL)	No	Yes	Mask must be absent for OFL_OUT_VLAN_VID
TmnxPortId for port or LAG	Value: 0x1000 Mask: 0x1000	Value: 0x1FFF Mask: Absent	port-id: *.any lag-id: *.any where "any" is either * or a valid VLAN-ID (but not NULL)	No	Yes	Mask must be absent for OFL_OUT_VLAN_VID
TmnxPortId for port or LAG	Value: 0x1000 Mask: 0x1000	Value: 0x1000 Mask: 0x1000	port-id: any.any lag-id: any.any where "any" is either * or a valid VLAN-ID (but not NULL)	No	Yes	Masks must be 0x1000
TmnxPortId for port or LAG	Value: 0x0000 Mask: Absent	Value: 0x1FFF Mask: Absent	port-id: *.null	Yes	Yes	Mask must be absent

5.2.6.3 Redirect to IP next-hop

A router supports redirection of IPv4 or IPv6 next-hop for traffic arriving on a Layer 3 interface. An OF controller can rely on this functionality and program PBR next-hop steering actions for H-OFS instances with the **switch-defined-cookie** command enabled using the following OF encoding:

```

ALU_IPD_EXPERIMENTER_ID: 0x000025BA
ALU_AXN_REDIRECT_TO_NEXTHOP: 2
flow_mod:
instruction= OFPAT_WRITE_ACTION/OFPAT_APPLY_ACTION,
action= OFPAT_EXPERIMENTER(ALU_AXN_REDIRECT_TO_NEXTHOP),
encoding:
struct alu_axn_redirect_to_nhopv4{
uint16_t type; /* OFPAT_EXPERIMENTER. */
uint16_t len; /* Total Length is a multiple of 8. */
uint32_t experimenter; /* Experimenter ID vendor unique*/
uint8_t redirect_type; /* Type = 1 for Nhop*/
uint8_t flags; /* flags is 0-7 bits:
    Bit 0 = Ipv4,
    Bit 1 = Ipv6,
    Bit 2 = indirect
*/
uint8_t pad[2];
uint32_t ipaddr; /* ipv4 addr */
uint8_t pad[0]; /* Not needed */
}; ASSERT(sizeof(alu_axn_redirect_to_nhopv4) == 16)
struct alu_axn_redirect_to_nhopv6{
uint16_t type; /* OFPAT_EXPERIMENTER. */
uint16_t len; /* Total Length is a multiple of 8. */
uint32_t experimenter; /* Experimenter ID vendor unique*/
uint8_t redirect_type; /* Type = 1 for Nhop*/
uint8_t flags; /* flags is 0-7 bits:
    Bit 0 = Ipv4,
    Bit 1 = Ipv6,
    Bit 2 = indirect
*/
uint8_t pad[2];
uint128_t ip6addr; /* ipv6 addr */
uint8_t pad[4]; /* Make total len multiple of 8 */
}; ASSERT(sizeof(alu_axn_redirect_to_nhopv6) == 32)

```

In case of erroneous programming, the following experimenter-specific errors are returned to the controller:

```

enum alu_err_exp_class{
ALU_ERR_CLASS_RD_TO_SDP = 0,
ALU_ERR_CLASS_RD_TO_NHOP = 1,
}
enum alu_err_subtype_redirect_to_nhop
{
ALU_ERR_RN_INVALID_FLAGS = 0
ALU_ERR_RN_INVALID_ARGS = 1
ALU_ERR_RN_INVALID_ADDR = 2
}

```

5.2.6.4 Redirect to GRT Instance or VRF Instance

A router supports redirection of IPv4 or IPv6 traffic arriving on a Layer 3 interface to a different routing instance (GRT or VRF). An OF controller can rely on this functionality and program PBR actions for GRT/VRF steering for H-OFS instances with the **switch-defined-cookie** command enabled using the following OF encoding:

```
flow_mod:
instruction type: OFPAT_WRITE_ACTIONS/OFPAT_APPLY_ACTION,
action type: OFPAT_OUTPUT,
```

port= SR OS LOGICAL port encoding GRT or VPRN Service ID as described in the [SR OS H-OFS Logical Port](#) section.

Because a 24-bit value is used to encode the VPRN service ID in the logical port, redirection to a VPRN service with a service ID above that range is not supported.

5.2.6.5 Redirect to Next-hop and VRF/GRT Instance

A router supports redirection of IPv4 or IPv6 traffic arriving on a Layer 3 interface to a different routing instance (GRT or VRF) and next-hop IP at the same time. An OF controller can rely on this functionality and program PBR steering action for H-OFS instances with the **switch-defined-cookie** command enabled using the following OF encoding:

```
ALU_IPD_EXPERIMENT_ID:0X000025BA
ALU_AXN_REDIRECT_TO_NEXTHOP:2
flow_mod:
Instruction 1:
instruction=OFPAT_WRITE_ACTION/OFPAT_APPLY_ACTION
action=OFPAT_EXPERIMENTER(ALU_AXN_REDIRECT_TO_NEXTHOP),
```

Encoding as described in the [Redirect to IP next-hop](#) section (indirect flag must be set).

```
Instruction 2:
instruction type: OFPAT_WRITE_ACTIONS/OFPAT_APPLY_ACTION,
action type: OFPAT_OUTPUT,
```

port= SR OS LOGICAL port encoding GRT or VPRN Service ID as described in the [SR OS H-OFS Logical Port](#) section.

5.2.6.6 Redirect to ESI (L2)

The router supports redirection of IPv4/IPv6 traffic arriving on a Layer 2 interface to an Ethernet Segment Identifier (ESI) with an EVPN control plane. An OF controller can program L2 ESI steering with the **switch-defined-cookie** command enabled using the following OF encoding:

```
flow_mod:
    instruction type: OFPIT_WRITE_ACTIONS/OFPIT_APPLY_ACTION,
    action type: OFPAT_EXPERIMENTER(ALU_AXN_REDIRECT_TO_ESI_L2)
    encoding:

struct alu_axn_redirect_to_ESI_L2{
    uint16_t type;                /* OFPAT_EXPERIMENTER. */
    uint16_t len;                /* Total Length is a multiple of 8. */
    uint32_t experimenter;       /* Experimenter ID vendor unique*/
    uint8_t redirect_type ;      /* Type = 3 for ESI*/
    uint8_t flags;               /* flags is 0-7 bits:
                                Value 0 = L2,
                                */
    uint8_t esi[10];             /* 10 byte ESI */
    uint32_t svcID;              /* Svc-Name Using the OF Encoding */
}; ASSERT(sizeof(alu_axn_redirect_to_ESI_L2) == 24)
```

5.2.6.7 Redirect to ESI (L3)

The router supports redirection of IPv4/IPv6 traffic arriving on a Layer 3 interface to an ESI with an EVPN control plane. An OF controller can program L3 ESI steering with the **switch-defined-cookie** command enabled using the following OF encoding:

```
flow_mod:
    instruction type: OFPIT_WRITE_ACTIONS/OFPIT_APPLY_ACTION,
    action type: OFPAT_EXPERIMENTER(ALU_AXN_REDIRECT_TO_ESI_L3)
    encoding:

struct alu_axn_redirect_to_ESI_L3_V4{
    uint16_t type;                /* OFPAT_EXPERIMENTER. */
    uint16_t len;                /* Total Length is a multiple of 8. */
    uint32_t experimenter;       /* Experimenter ID vendor unique*/
    uint8_t redirect_type ;      /* Type = 3 for ESI*/
    uint8_t flags;               /* flags is 0-7 bits:
                                Value 1 = L3 (ipv4)
                                */
    uint8_t esi[10];             /* 10 byte ESI */
    uint32_t svcID;              /* Svc-Name Using the OF Encoding */
    uint32_t sf-ip;              /* v4 address of sf-ip */
    uint32_t ifIndex;            /* interface id*/
}; ASSERT(sizeof(alu_axn_redirect_to_ESI_L3_V42) == 32)

struct alu_axn_redirect_to_ESI_L3_V6{
    uint16_t type;                /* OFPAT_EXPERIMENTER. */
```

```

uint16_t len; /* Total Length is a multiple of 8. */
uint32_t experimenter; /* Experimenter ID vendor unique*/
uint8_t redirect_type ; /* Type = 1 for Nhop*/
uint8_t flags; /* flags is 0-7 bits:
                Value = 2 = L3 (ipv6)
                */
uint8_t esi[10]; /* 10 byte ESI */
uint32_t svcId; /* Svc-Name Using the OF Encoding */
uint128_t sf-ip; /* v6 address of sf-ip */
uint32_t ifIndex; /* interface id*/
uint8_t pad[4];
}; ASSERT(sizeof(alu_axn_redirect_to_ESI_L3_V6) == 48)

```

5.2.6.8 Redirect to ESI IP VAS-Interface Router

The router supports redirection of IPv4/IPv6 traffic arriving on a Layer 3 interface to a VAS interface bound to an ESI with an EVPN control plane. In this encoding, the SF-IP address represents the VAS interface address, and the ifIndex is the VAS interface ID. An OF controller can program L3 steering with the **switch-defined-cookie** command enabled using the following OF encoding:

```

flow_mod:
  instruction type: OFPIT_WRITE_ACTIONS/OFPIT_APPLY_ACTION,
  action type: OFPAT_EXPERIMENTER(ALU_AXN_REDIRECT_TO_ESI_L3)
  encoding:

struct alu_axn_redirect_to_ESI_L3_V4{
  uint16_t type; /* OFPAT_EXPERIMENTER. */
  uint16_t len; /* Total Length is a multiple of 8. */
  uint32_t experimenter; /* Experimenter ID vendor unique*/
  uint8_t redirect_type ; /* Type = 2 for ESI*/
  uint8_t flags; /* flags is 0-7 bits:
                 Value 2 = L3 (ipv4)
                 */
  uint8_t esi[10];
  uint32_t svcId; /* Svc-Name Using the OF Encoding */
  uint32_t vas-ip; /* v4 address of sf-ip */
  uint32_t ifIndex; /* vas interface id*/
}; ASSERT(sizeof(alu_axn_redirect_to_ESI_L3_V4) == 24)

struct alu_axn_redirect_to_ESI_L3_V6{
  uint16_t type; /* OFPAT_EXPERIMENTER. */
  uint16_t len; /* Total Length is a multiple of 8. */
  uint32_t experimenter; /* Experimenter ID vendor unique*/
  uint8_t redirect_type ; /* Type = 2 for ESI*/
  uint8_t flags; /* flags is 0-7 bits:
                 Value 4 = L3 (ipv6)
                 */
  uint8_t esi[10]; /* 10 byte ESI */
  uint32_t svcId; /* Svc-Name Using the OF Encoding */
  uint128_t vas-ip; /* v6 address of sf-ip */
  uint32_t ifIndex; /* vas interface id*/
  uint8_t pad[4]
}; ASSERT(sizeof(alu_axn_redirect_to_ESI_L3_V6) == 40)

```

5.2.6.9 Redirect to LSP

The router supports traffic steering to an LSP. The following shows the OF encoding to be used by an OF controller:

```
flow_mod:
instruction type: OFFIT_WRITE_ACTIONS or OFFIT_APPLY_ACTION,
action type: OFFPAT_OUTPUT,
```

The port uses SR OS LOGICAL port encoding RSVP-TE, SR-TE, or MPLS-TP LSP as described in the [SR OS H-OFS Logical Port](#) section.

An LSP received in a flow rule is compared against those in the H-OFS logical port table. If the table does not contain the LSP, the rule programming fails. Otherwise, the rule is installed in an ACL filter. As long as any path within the LSP is UP, the redirect rule will forward unicast IPv4 or IPv6 traffic on the current best LSP path by adding an LSP transport label and, in the case of IPv6 traffic, also adding an explicit NULL label.

When an LSP in the H-OFS logical port table goes down, the OF switch removes the LSP from its logical port table and notifies the controller of that fact if the logical port status reporting is enabled. It is up to the OF controller to decide whether to remove rules using this LSP. If the rules are left in the flow table, the traffic that was to be redirected to this LSP will instead be subject to a forward action for this flow rule. If the controller does not remove the entries and the system reuses the LSP identified for another LSP, the rules left in the flow table will start redirecting traffic onto this new LSP.

In some deployments, an SDN controller may need to learn from the router H-OFS logical ports status. To support this function, the OF switch supports optional status reporting using asynchronous OF protocol messages for ports status change.

5.2.6.10 Redirect to NAT

The router supports redirection of IPv4 traffic arriving on a Layer 3 interface for ISA NAT processing. An OF controller can program NAT steering for H-OFS instances with the **switch-defined-cookie** command enabled using the following OF encoding:

```
flow_mod:
instruction type: OFFIT_WRITE_ACTIONS/OFFIT_APPLY_ACTION,
action type: OFFPAT_OUTPUT,
```

The port uses SR-OS LOGICAL port encoding as described in the [SR OS H-OFS Logical Port](#) section.

5.2.6.11 Redirect to SAP

For traffic arriving on a VPLS interface, a router supports PBF to steer traffic over another VPLS SAP in the same service. An OF controller can rely on this functionality and program PBF steering action for H-OFS instances with the **switch-defined-cookie** command enabled using the following OF encoding:

```
flow_mod:
instruction type: OFPIT_WRITE_ACTIONS or OFPIT_APPLY_ACTION,
Action 1:
action type: OFPAT_OUTPUT,
```

The port uses encoding as described in the [SR OS H-OFS Port and VLAN Encoding](#) section.

```
Action 2:
action type=OFPAT_SET_FIELD
```

OXM TLVs encode SAP VLANs as described in the [SR OS H-OFS Port and VLAN Encoding](#) section:

```
- OXM_OF_VLAN_VID
- OFL_OUT_VLAN_ID (optional)
```

5.2.6.12 Redirect to SDP

For traffic arriving on a VPLS interface, a router supports PBF to steer traffic over a VPLS SDP in the same service. An OF controller can rely on this functionality and program PBF steering action for H-OFS instances with **switched-defined-cookie** enabled using the following OF encoding:

```
ALU_IPD_EXPERIMENTER_ID: 0x000025BA
ALU_AXN_REDIRECT_TO_SDP: 1
flow_mod:
instruction= OFPIT_WRITE_ACTIONS/OFPIT_APPLY_ACTIONS,
action= OFPAT_EXPERIMENTER(ALU_AXN_REDIRECT_TO_SDP),
encoding:
struct alu_axn_redirect_to_sdp{
uint16_t type; /* OFPAT_EXPERIMENTER. */
uint16_t len; /* Total Length is a multiple of 8. */
uint32_t experimenter; /* Experimenter ID vendor unique*/
uint8_t redirect_type; /* Type = 0 for SDP*/
uint8_t flags; /*
* Flags that can be used to denote info(reserved)*/
uint16_t sdp-id; /* Sdp-id*/
uint32_t vcId; /* Vc-id*/
uint8_t pad[0]; /* Not needed */
}; ASSERT(sizeof(alu_axn_redirect_to_sdp) == 16)
```

In case of erroneous programming, the following experimenter-specific errors are returned to the controller:

```
enum alu_err_exp_class
{
    ALU_ERR_CLASS_RD_TO_SDP      = 0,
    ALU_ERR_CLASS_RD_TO_NHOP     = 1,
}
enum alu_err_redirect_to_sdp
{
    ALU_ERR_RS_INVALID_FLAGS     = 0
    ALU_ERR_RS_INVALID_ARGS      = 1
    ALU_ERR_RS_INVALID_SDP_ID    = 2
    ALU_ERR_RS_INVALID_VC_ID     = 3
}
```

5.2.6.13 Redirect to a Specific LSP Used by a VPRN Service

The router supports traffic steering within a VPRN, enabling the transport tunnels used by the SDP to be used for specific flows redirected from the system-selected default. This redirection enables large bandwidth flows to be moved to an alternative LSP.

For matching ingress traffic on a VPRN, the **switch-defined-cookie** command must be enabled, with the cookie encoded to match the ingress VPRN's service ID.

Traffic can be redirected to the following:

- the default PE and a different LSP
- a different PE and the default LSP
- the default PE and the default LSP (traffic that may otherwise egress a SAP will take a specified BGP next hop)
- the default PE and a different VRF
- a different PE, the default LSP, and a different prefix

Parameters must be matched in the OF encoding to steer traffic.

```
flow_mod:
instruction type: OFPAT_WRITE_ACTIONS/OFPAT_APPLY_ACTION,
```

```
Action 1:
action type: OFPAT_EXPERIMENTER
ALU_IPD_EXPERIMENTER_ID: 0x000025BA
ExpType= ALU_AXN_REDIRECT_TO_NEXTHOP,
```

```
Action 2:
action type: OFPAT_OUTPUT,
```

port= SR-OS LOGICAL port encoding RSVP-TE, MPLS-TP LSP, or segment routing, as described in [SR OS H-OFS Logical Port](#) section.

Action 3 (optional): to redirect to a different VPRN

```
Action 3:
action type: OFFPAT_EXPERIMENTER
ALU_IPD_EXPERIMENTER_ID: 0x000025BA
ExpType= ALU_AXN_REDIRECT_TO_VPRN,
```

Encoding:

```
struct alu_axn_redirect_to_vprn {
    uint16_t      type;                /* OFFPAT_EXPERIMENTER => ff ff */
    uint16_t      len;
    uint32_t      experimenter;        /
    * Vendor specific experimenter id => 00 00 25 ba */
    uint8_t       exp_axn_type;        /* type => 03 */
    uint8_t       exp_axn_flags;       /* flag => any value is accepted */
    uint8_t       pad[2];              /* pad => 00 00 */
    uint32_t      vprn;                /* vprn svc id */
};ASSERT(sizeof(alu_axn_redirect_to_vprn) == 16)
```

Action 4 (optional): to redirect to a different prefix

```
Action 4:
action type: OFFPAT_SET_FIELD
```

Field is an IP destination address. Subnet masks are not supported in the set_field instruction.

5.2.6.14 Forward Action

An OF controller can program forward action, when a specific flow is to be forwarded using regular router forwarding. This would be a default behavior if the filter-policy embedding this OF switch instance has a default-action forward and no filter policy rule matches the flow. To implement forward action, the following OF encoding is used:

```
flow_mod:
instruction type: OFFPAT_WRITE_ACTIONS or OFFPAT_APPLY_ACTION,
action type: OFFPAT_OUTPUT,
port= NORMAL
```

where NORMAL is an OF reserved value.

5.2.6.15 Drop Action

An OF controller can program a drop action, when packets of a specific flow are to be dropped. To implement a drop action, the OF encoding is a wildcard rule with empty action-set.

5.2.6.16 Default No-match Action

Packets that do not match any of the flow table entries programmed by the controller are subject to a default action. The default action is configurable in the CLI using the **no-match-action** command. Three possible no-match actions are supported: drop, fall-through (packets are forwarded with regular processing by the router), and packet-in.

The packet-in action causes packets that do not match entries in the flow table, as programmed by the OpenFlow controller, to be extracted and sent to the controller in a flow-controlled manner. Because EQUAL is supported, packet-in messages are sent to all controllers in the UP state. To protect the controller, only the first packet of a specific 5-tuple flow (source IP address, destination IP address, source port, destination port, protocol) to which the no-match action is applied is sent to the controller. This 5-tuple flow context ages out after 10 s. Each switch instance maintains contexts for up to 8192 outstanding packet-in messages to the controller. If the packet-in action is used, an auxiliary channel should be enabled for packet-in processing (using the **aux-channel-enable** command). A count of packets to which packet-in is applied is also available through the OpenFlow channel statistics.

5.2.6.17 Programming of DSCP Remark Action

The router supports DSCP remarking of IPv4/IPv6 packets arriving on VPLS, VPRN, GRT, and system interfaces for OFS instances with the **switch-defined-cookie** command enabled using the following OF encoding:

```
flow_mod:
    instruction type: OFPIT_METER
    action type: with the meterId.
```

The meters are configured using meter modification messages, and are configured before the flow messages are sent with meter instruction:

```
typedef struct tOfpMeterModMsg
{
    tOfpMsgHeader      msgHdr;
    uint16_t           mtrCommand;    /* One of OFP_MTR_CMD_*. */
}
```

```

        uint16_t          mtrConfig;      /* bitmap of OFP_MTR_CFG_*. */
        uint32_t          mtrId;          /* Meter instance. */
        tOfpMeterBandHeader bands[0];     /* The band list length is inferred from
                                           the length field in the msgHdr. */
    } tOfpMeterModMsg;

typedef struct tOfpMeterBandHeader
{
    uint16_t          bandType;      /* One of OFP_MTR_BAND_*. */
    uint16_t          length;        /* Length in bytes of this band. */
    uint32_t          rate;          /* Rate for this band. */
    uint32_t          burstSize;     /* Size of bursts. */
} tOfpMeterBandHeader;

typedef enum eOfpMeterBandType
{
    OFP_MTR_BAND_DROP          = 1,      /* Drop packet. */
    OFP_MTR_BAND_DSCP_REMARK   = 2,      /* Remark DSCP in the IP header. */
    OFP_MTR_BAND_EXPERIMENTER = 0xFFFF  /* Experimenter meter band. */
} eOfpMeterBandType;

typedef struct tOfpMeterBandDscpRemark
{
    tOfpMeterBandHeader bandHdr;      /* OFP_MTR_BAND_DSCP_REMARK */
    uint8_t              precLevel;    /* Number of drop precedence level to add */
    uint8_t              pad[3];
} tOfpMeterBandDscpRemark;

```

5.3 Configuration Notes

The following information describes OF implementation restrictions:

- SR OS Hybrid OpenFlow Switch requires a software upgrade only and can be enabled on any switch. For full functionality, performance, and future scale, IOM3-XP or newer line cards and CPM4 or newer control cards are recommended.
- Some platforms may not support all OF functionality based on the underlying hardware. For example, if the underlying hardware does not support IPv6, OF IPv6 functionality will not be supported. If the underlying hardware does not support redirect to LSP, redirect action will be ignored.
- Each flow in an OF flow table must have unique priority. Overlap is not supported.
- Timed expiry of the flow entries is not supported.
- The implementation is compliant by design with OpenFlow specification as applicable to supported router functionality only.

5.4 OpenFlow Command Reference

- [Command Hierarchies](#)
- [Command Descriptions](#)

5.4.1 Command Hierarchies

- [OpenFlow Commands](#)
- [Show Commands](#)
- [Tools Commands](#)

5.4.1.1 OpenFlow Commands

```
config
— open-flow
  — of-switch ofs-name [ofs-id ofs-id]
  — no of-switch ofs-name
    — [no] aux-channel-enable
    — description description-string
    — no description
    — echo-interval seconds
    — no echo-interval
    — echo-multiple value
    — no echo-multiple
    — [no] flowtable of-table-id
      — max-size size
      — no max-size
      — no-match-action action
      — no no-match-action
      — [no] switch-defined-cookie
    — logical-port-status {rsvp-te | mpls-tp | sr-te}
    — no logical-port-status [{rsvp-te | mpls-tp | sr-te}]
    — [no] of-controller ip-address:port
      — tls-client-profile profile-name
      — no tls-client-profile
      — vprn service-id ofc-loopback ip-address
      — no vprn
    — [no] shutdown
```

5.4.1.2 Show Commands

```
show
└─ open-flow
    └─ of-switch
        └─ of-switch of-name controller ip-address:port detail
            └─ of-switch of-name status controller [ip-address:port]
                └─ of-switch of-name controller
                    └─ of-switch of-name flowtable
                        └─ of-switch of-name status
                            └─ of-switch of-name port
```

5.4.1.3 Tools Commands

```
tools
├── dump
│   └── open-flow
│       ├── of-switch ofs-name [flowtable of-table-id] [controller ip-address:port] [{grt |
│           system | service-id service-id}] [cookie hex-string] [priority priority]
│       ├── of-switch ofs-name [flowtable of-table-id] [controller ip-address:port]
│           service-id service-id sap sap-id [cookie hex-string] [priority priority]
│       └── of-switch ofs-name [flowtable of-table-id] [controller ip-address:port]
│           summary
```

5.4.2 Command Descriptions

- OpenFlow Commands
- Show Commands
- Tools Commands

5.4.2.1 OpenFlow Commands

open-flow

Syntax	open-flow
Context	config
Description	This command enables configuration content for OpenFlow Hybrid Switch compatibility. The no form of the command removes the OpenFlow configuration from the context.

of-switch

Syntax	of-switch <i>ofs-name</i> [ofs-id <i>ofs-id</i>] no of-switch <i>ofs-name</i>
Context	config>open-flow
Description	This command creates an OpenFlow switch instance. The no form of the command deletes the OpenFlow switch instance from the context.
Default	no of-switch
Parameters	<i>ofs-name</i> — specifies the name of the OpenFlow switch instance, a string up to 32 characters. <i>ofs-id</i> — Specifies the ID of the switch. This is used together with the chassis MAC address to generate the Datapath ID of the OpenFlow switch instance. If it is not configured, an automatically generated Datapath ID is assigned to the switch according to the order in which the OFS instance came up relative to other OFS instances on the node. The configuration should be saved after configuring the OFS ID. If the user originally configures the OFS without an OFS ID, and subsequently adds an OFS ID without saving the new configuration, the OFS may not get the same Datapath ID (which is allocated on a first-come, first-served basis in the absence of an OFS ID).
Values	1 to 8

aux-channel-enable

Syntax	[no] aux-channel-enable
Context	config>open-flow>of-switch
Description	This command enables auxiliary connections for the given H-OFS instance. If enabled, the H-OFS switch sets up a statistics auxiliary channel (Auxiliary ID 1) and a packet-in auxiliary channel (Auxiliary ID 2) for the main connection to every configured OpenFlow controller. The no form of this command disables auxiliary connections.
Default	no aux-channel-enable

description

Syntax	description <i>description-string</i> no description
Context	config>open-flow>of-switch

Description	This command allows the user to configure a description string for the specified OpenFlow controller instance. The no form of this command deletes the description of the specified OpenFlow controller instance.
Default	no description
Parameters	<i>description-string</i> — Specifies a description of the OpenFlow switch instance, a string up to 256 characters.

echo-interval

Syntax	echo-interval <i>seconds</i> no echo-interval
Context	config>open-flow>of-switch
Description	This command configures the Echo Request interval for monitoring the OpenFlow control channels to the controllers for this OpenFlow switch instance. The no form of this command restores default value.
Default	echo-interval 10
Parameters	<i>seconds</i> — Specifies an interval, in seconds. Values 1 to 3600

echo-multiple

Syntax	echo-multiple <i>value</i> no echo-multiple
Context	config>open-flow>of-switch
Description	This command configures the number of consecutive Echo Reply messages that must be lost to declare OF control channel down. The no form of this command restores default value.
Default	echo-multiple 3
Parameters	<i>value</i> — Specifies the threshold value for the number of consecutive Echo Reply messages lost. Values 3 to 100

flowtable

Syntax	[no] flowtable <i>of-table-id</i>
Context	config>open-flow>of-switch
Description	This command configures the flow table parameters for this OpenFlow switch instance. The no form of this command restores flow table configuration default settings.
Default	no flowtable
Parameters	<i>of-table-id</i> — Specifies an identifier of the open flow table, a string up to 256 characters.

max-size

Syntax	max-size <i>size</i> no max-size				
Context	config>open-flow>of-switch>flowtable				
Description	This command configures the size for the specified flow table. The OpenFlow switch instance must be shutdown to modify this parameter. The no form of this command restores the default size.				
Default	max-size 1000				
Parameters	<i>size</i> — Specifies the maximum size limit for the flow table. The size limit is a total for both IPv4 and IPv6. <table> <tr> <td>Values</td><td>1 to 262144</td></tr> <tr> <td>Default</td><td>1000</td></tr> </table>	Values	1 to 262144	Default	1000
Values	1 to 262144				
Default	1000				

no-match-action

Syntax	no-match-action <i>action</i> no no-match-action
Context	config>open-flow>of-switch>flowtable
Description	This command configures the action for the flow table when a packet does not match any entry for the controller. The no form of this command restores the default action.
Default	no-match-action fall-through

Parameters	<i>action</i> — Specifies the action for the flow table.
Values	<i>drop</i> - Specifies that packets that do not match entries in the flow table as programmed by the OpenFlow switch will be dropped. <i>fall-through</i> - Specifies that packets that do not match entries in the flow table as programmed by the OpenFlow switch will be forwarded using regular processing by the router. Fall-through applies if an error occurs that prevents a flow table from being installed in a filter policy. <i>packet-in</i> - Specifies that packets that do not match entries in the flow table as programmed by the OpenFlow switch will be extracted and sent to the controller in a flow-controlled manner. If this action is used, an auxiliary channel should be enabled for packet-in processing using the aux-channel-enable command.

switch-defined-cookie

Syntax	[no] switch-defined-cookie
Context	config>open-flow>of-switch>flowtable
Description	This command enables OpenFlow switch-defined Flow Table cookie encoding for flowtable 0 that allows multi-service operation. The no form of the command disables the above function.
Default	no switch-defined-cookie

logical-port-status

Syntax	logical-port-status {rsvp-te mpls-tp sr-te} no logical-port-status [{rsvp-te mpls-tp sr-te}]
Context	config>open-flow>of-switch
Description	This command enables status change reporting to the OpenFlow controller for the specified logical port type. To report on multiple logical port types, the command needs to be executed multiple times with different logical port specified as required. The no form of this command disables status reporting for specified or all (no argument) logical ports.
Default	no logical-port-status
Parameters	rsvp-te — Enables reporting on RSVP-TE LSP logical ports. mpls-tp — Enables reporting on MPLS-TE logical ports. sr-te — Enables reporting on SR-TE logical ports.

of-controller

Syntax	[no] of-controller <i>ip-address:port</i>
Context	config>open-flow>of-switch
Description	This command configures the OpenFlow controller for this OpenFlow switch and creates a context for the configuration of additional OpenFlow control channel parameters. Up to two controllers can be configured per OpenFlow switch instance. The no form of this command deletes the controller for this OpenFlow switch instance.
Parameters	<i>ip-address:port</i> — Specifies the IP address and TCP port for the OpenFlow channel to the controller.

tls-client-profile

Syntax	tls-client-profile <i>profile-name</i> no tls-client-profile
Context	config>open-flow>of-switch>of-controller
Description	This command configures the use of Transport Layer Security (TLS) on the control channel to a given OpenFlow controller for this OpenFlow switch. The no form of this command deletes removed TLS from the control channel.
Parameters	<i>profile-name</i> — Specifies the use of TLS for the control channel. A named TLS profile must also be specified, referring to a TLS profile configured under config>system>security>tls .

vpn

Syntax	vpn <i>service-id ofc-loopback ip-address</i> no vpn
Context	config>open-flow>of-switch>of-controller
Description	This command specifies the <i>service-id</i> of the VPRN to use for the OpenFlow control channel. The loopback address for the OF control channel in the VPRN is specified using the ofc-loopback option. The no form of this command reverts the control channel to using base routing.
Parameters	<i>service-id</i> — Specifies the service ID for a VPRN instance. Values { <i>service-id</i> <i>service-name</i> } <i>service-id</i> : 1 to 2147483647

service-name: up to 64 characters (*service-name* is an alias for input only. The *service-name* gets replaced with an id automatically by SR OS in the configuration).

ip-address — Specifies the loopback IP address in the VPRN for the OpenFlow channel to the controller.

Values ip-address: a.b.c.d

shutdown

Syntax	[no] shutdown
Context	config>open-flow>of-switch
Description	This command administratively enables or disables the OpenFlow switch instance. Disabling the switch purges all flowtable entries.
Default	shutdown

5.4.2.2 Show Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

open-flow

Syntax	open-flow
Context	show
Description	Displays OpenFlow switch hybrid information.

of-switch

Syntax	of-switch
	of-switch <i>ofs-name</i> controller <i>ip-address:port</i> detail
	of-switch <i>ofs-name</i> status controller [<i>ip-address:port</i>]
	of-switch <i>ofs-name</i> controller
	of-switch <i>ofs-name</i> flowtable
	of-switch <i>ofs-name</i> status
	of-switch <i>ofs-name</i> port

Context show>open-flow

Description This command displays information related to H-OFS configuration and operations as per the parameters specified.

If no parameter is specified, this command displays a summary for H-OFS instances configured.

Parameters *ofs-name* — Specifies the name of the configured H-OFS instance, up to 32 characters.
ip-address:port — Displays information on the controller for the specified H-OFS instance.

Values ip-address: a.b.c.d
port: 1 to 65535

detail — Displays detailed information.

flowtable — Displays information about flowtables for the specified H-OFS instance.

status — Displays status information for the specified H-OFS switch or its controller.

port — Displays information about the logical OpenFlow ports registered with the specified H-OFS instance.

Output

Sample Output

```
*A:Dut-A# show open-flow of-switch "s1" status
=====
Open Flow Switch Information
=====
Switch Name      : s1
Data Path ID     : 0
Echo Interval    : 10 seconds
Logical Port Type : all
Buffer Size      : 256
Description      : test-sw1
Capabilities Supp. : flow-stats table-stats port-stats
=====

*A:Dut-A# show open-flow of-switch "s1" controller
=====
Open Flow Controller Summary
=====
IP Address      Port
-----
10.20.1.2       6633
10.20.1.3       6633
-----
Number of Controllers : 2
-----
=====

*A:Dut-A# show open-flow of-switch "s1" controller 10.20.1.2:6633 detail
=====
```

Open Flow Controller Information

```
=====
IP Address      : 10.20.1.2          Port      : 6633
Role           : equal              Generation ID : 0
=====
```

Open Flow Channel Information

```
-----
Channel ID      : 1                  Version     : 4
Connection Type : primary            Operational Status: Up
Operational Flags : socketStateEstablished helloReceived helloTransmitted
                    handshake
Async Fltr Packet In
  (Master or Equal) : tableMiss applyAction
  (Slave)           : (Not Specified)
Async Fltr Port Status
  (Master or Equal) : portAdd portDelete portModify
  (Slave)           : portAdd portDelete portModify
Async Fltr Flow Rem
  (Master or Equal) : idleTimeOut hardTimeOut flowModDelete groupDelete
  (Slave)           : (Not Specified)

Echo Time Expiry : 0d 00:00:10      Hold Time Expiry : 0d 00:00:30
Conn. Uptime     : 0d 00:00:00      Conn. Retry       : 0d 00:00:00
-----
```

Open Flow Channel Stats - Channel ID(1)

```
-----
Packet Type      Transmitted Packets  Received Packets  Error Packets
-----
Hello            1                  1                 0
Error            0                  0                 0
Echo Request     0                  70                0
Echo Reply       70                 0                 0
Experimenter     0                  0                 0
Feat. Request    0                  1                 0
Feat. Reply      1                  0                 0
Get Cfg Request  0                  1                 0
Get Cfg Reply    1                  0                 0
Set Config       0                  1                 0
Packet In        0                  0                 0
Flow Removed     0                  0                 0
Port Status      0                  0                 6
Packet Out       0                  0                 0
Flow Modify      0                  0                 0
Group Modify     0                  0                 0
Port Modify      0                  0                 0
Table Modify     0                  0                 0
Multipart Req    0                  0                 0
Multipart Reply  0                  0                 0
Barrier Request  0                  0                 0
Barrier Reply    0                  0                 0
Get Q Cfg Req    0                  0                 0
Get Q Cfg Reply  0                  0                 0
Role Request     0                  0                 0
Role Reply       0                  0                 0
Get Async Req    0                  0                 0
Get Async Reply  0                  0                 0
Set Async        0                  0                 0
-----
```

```

Meter Modify      0                      0                      0
-----
=====

*A:Dut-A# show open-flow of-switch "s1" flowtable
=====
Flow Table Information
=====
Flow Table ID      : 0                      Max-Size           : 1000
No-Match Action    : fall-through          Curr Num. of Entries : 1
                                           Max. Num. of Entries : 54
=====

*A:Dut-A# show open-flow of-switch "s1" port
=====
Open Flow Port Stats
=====
Port ID      Port Name          Transmitted Packets  Transmitted Bytes
-----
1073741825   to_B                        0                    0
1073741826   to_C                        0                    0
1073741827   to_D                        0                    0
1073741828   to_E                        0                    0
1073741829   to_F                        0                    0
1073742824   1                          0                    0
=====

*A:Dut-C# show open-flow of-switch "ofs" controller 1.3.8.8:6633 detail
=====
Open Flow Controller Information
=====
IP Address      : 1.3.8.8          Port           : 6633
Role            : equal
Generation ID   : 0
-----
Open Flow Channel Information - Channel ID(2)
-----
Channel ID      : 2              Version         : 4
Connection Type : primary        Operational Status: Up
Auxiliary ID    : 0
Source Address  : 10.20.1.3      Source Port     : 49722
Operational Flags : socket-state-established hello-received hello-transmitted
                    handshake
Async Fltr Packet In
(Master or Equal): table-miss apply-action
(Slave)          : (Not Specified)
Async Fltr Port Status
(Master or Equal): port-add port-delete port-modify
(Slave)          : port-add port-delete port-modify
Async Fltr Flow Rem
(Master or Equal): idle-time-out hard-time-out flow-mod-delete group-delete
(Slave)          : (Not Specified)
Echo Time Expiry : 0d 00:00:04      Hold Time Expiry : 0d 00:00:24
Conn. Uptime     : 0d 01:27:53   Conn. Retry      : 0d 00:00:00
-----
Open Flow Channel Stats - Channel ID(2)
-----
Packet Type      Transmitted Packets  Received Packets    Error Packets

```

```

-----
Hello          0          0          0
Error          0          0          0
Echo Request   348        174        0
Echo Reply     174        348        0
Experimenter   0          0          0
Feat. Request  0          0          0
Feat. Reply    0          0          0
Get Cfg Request 0          0          0
Get Cfg Reply  0          0          0
Set Config     0          0          0
Packet In      0          0          0
Flow Removed   0          0          0
Port Status    0          0          0
Packet Out     0          0          0
Flow Modify    0          0          0
Group Modify   0          0          0
Port Modify    0          0          0
Table Modify   0          0          0
Multipart Req  0          0          0
Multipart Reply 0          0          0
Barrier Request 0          0          0
Barrier Reply   0          0          0
Get Q Cfg Req  0          0          0
Get Q Cfg Reply 0          0          0
Role Request   0          0          0
Role Reply     0          0          0
Get Async Req  0          0          0
Get Async Reply 0          0          0
Set Async      0          0          0
Meter Modify   0          0          0
-----

```

```

-----
Open Flow Channel Information - Channel ID(3)
-----

```

```

Channel ID      : 3          Version      : 4
Connection Type : auxiliary   Operational Status: Up
Auxiliary ID    : 1
Source Address   : 10.20.1.3   Source Port    : 49748
Operational Flags : socket-state-established hello-received hello-transmitted
                    handshake
Async Fltr Packet In
  (Master or Equal): table-miss apply-action
  (Slave)           : (Not Specified)
Async Fltr Port Status
  (Master or Equal): port-add port-delete port-modify
  (Slave)           : port-add port-delete port-modify
Async Fltr Flow Rem
  (Master or Equal): idle-time-out hard-time-out flow-mod-delete group-delete
  (Slave)           : (Not Specified)
Echo Time Expiry : 0d 00:00:02   Hold Time Expiry : 0d 00:00:22
Conn. Uptime     : 0d 01:27:47   Conn. Retry       : 0d 00:00:00
-----

```

```

-----
Open Flow Channel Stats - Channel ID(3)
-----

```

```

-----
Packet Type      Transmitted Packets  Received Packets  Error Packets
-----
Hello            0          0          0
-----

```

Error	0	0	0
Echo Request	348	174	0
Echo Reply	174	348	0
Experimenter	0	0	0
Feat. Request	0	0	0
Feat. Reply	0	0	0
Get Cfg Request	0	0	0
Get Cfg Reply	0	0	0
Set Config	0	0	0
Packet In	0	0	0
Flow Removed	0	0	0
Port Status	0	0	0
Packet Out	0	0	0
Flow Modify	0	0	0
Group Modify	0	0	0
Port Modify	0	0	0
Table Modify	0	0	0
Multipart Req	0	0	0
Multipart Reply	0	0	0
Barrier Request	0	0	0
Barrier Reply	0	0	0
Get Q Cfg Req	0	0	0
Get Q Cfg Reply	0	0	0
Role Request	0	0	0
Role Reply	0	0	0
Get Async Req	0	0	0
Get Async Reply	0	0	0
Set Async	0	0	0
Meter Modify	0	0	0

Open Flow Channel Information - Channel ID(4)

Channel ID	: 4	Version	: 4
Connection Type	: auxiliary	Operational Status:	Up
Auxiliary ID	: 2		
Source Address	: 10.20.1.3	Source Port	: 49749
Operational Flags	: socket-state-established hello-received hello-transmitted handshake		

Async Fltr Packet In

(Master or Equal): table-miss apply-action

(Slave) : (Not Specified)

Async Fltr Port Status

(Master or Equal): port-add port-delete port-modify

(Slave) : port-add port-delete port-modify

Async Fltr Flow Rem

(Master or Equal): idle-time-out hard-time-out flow-mod-delete group-delete

(Slave) : (Not Specified)

Echo Time Expiry : 0d 00:00:01 Hold Time Expiry : 0d 00:00:21

Conn. Uptime : 0d 01:27:49 Conn. Retry : 0d 00:00:00

Open Flow Channel Stats - Channel ID(4)

Packet Type	Transmitted Packets	Received Packets	Error Packets
Hello	0	0	0
Error	0	0	0
Echo Request	348	174	0

Echo Reply	174	348	0
Experimenter	0	0	0
Feat. Request	0	0	0
Feat. Reply	0	0	0
Get Cfg Request	0	0	0
Get Cfg Reply	0	0	0
Set Config	0	0	0
Packet In	104420	0	0
Flow Removed	0	0	0
Port Status	0	0	0
Packet Out	0	0	0
Flow Modify	0	0	0
Group Modify	0	0	0
Port Modify	0	0	0
Table Modify	0	0	0
Multipart Req	0	0	0
Multipart Reply	0	0	0
Barrier Request	0	0	0
Barrier Reply	0	0	0
Get Q Cfg Req	0	0	0
Get Q Cfg Reply	0	0	0
Role Request	0	0	0
Role Reply	0	0	0
Get Async Req	0	0	0
Get Async Reply	0	0	0
Set Async	0	0	0
Meter Modify	0	0	0

=====			
*A:Dut-C#			

5.4.2.3 Tools Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

open-flow

Syntax	open-flow
Context	tools>dump
Description	This command enables dumping of the OpenFlow information.

of-switch

Syntax	of-switch ofs-name [flowtable of-table-id] [controller ip-address:port] [{grt system service-id service-id}] [cookie hex-string] [priority priority]

	of-switch <i>ofs-name</i> [flowtable <i>of-table-id</i>] [controller <i>ip-address:port</i>] service-id <i>service-id</i> sap <i>sap-id</i> [cookie <i>hex-string</i>] [priority <i>priority</i>] of-switch <i>ofs-name</i> [flowtable <i>of-table-id</i>] [controller <i>ip-address:port</i>] summary
Context	tools>dump>open-flow
Description	This command can be used to dump information for a given OpenFlow switch or its flowtable. Priority and cookie filters are provided no focus on part of a flow table. Usage examples: a. tools>dump>open-flow>of-switch ofs-test — This command displays detailed flow information for a given OpenFlow switch. If the switch has switch-defined-cookie enabled, the flows with all cookie-types are displayed. b. tools>dump>open-flow>of-switch ofs summary — This command displays a summary of each cookie context and the number of flows in it for the switch that has switch-defined-cookie enabled. If switch-defined-cookie is disabled, then the total number of entries is displayed (single context). c. Options like grt, system, service-id, sap-id, cookie, and priority can be used to limit display entries to the specified options.
Parameters	<i>ofs-name</i> — Specifies the name of the OFS instance, up to 32 characters. <i>of-table-id</i> — Specifies the identifier for the OpenFlow table. Values 0 <i>ip-address:port</i> — Specifies the IP address and TCP port for the OpenFlow channel to the controller. Values ip-address: a.b.c.d port: 1 to 65535 grt — Flowtable rules applicable to GRT instance (IES, Router). system — Flowtable rules applicable to system filters. <i>service-id</i> — Specifies the identifier for the service. Values 1 to 2148007978 <i>svc-name</i>: 64 characters max <i>hex-string</i> — Specifies the identifier for the OpenFlow cookies. Values 0x0 to 0xFFFFFFFFFFFFFFFF <i>priority</i> — Specifies the priority for the OpenFlow switch. Values 0 to 65535 <i>sap-id</i> — Specifies the identifier for the Ethernet SAP. Values <i>sap-id</i> null port-id bundle-id bpgrip-id lag-id aps-id>

dot1q	port-id bundle-id bpgrp-id lag-id aps-id pw-id>:qtag1	
qinq	port-id bundle-id bpgrp-id lag-id pw-id>:qtag1.qtag2	
atm	<port-id aps-id>[:vpi/vci vpi vpi1.vpi2 cp.conn-prof-id]	
	cp	keyword
	conn-prof-id	1..8000
frame	port-id aps-id:dlci	
cisco-hdlc	slot/mda/port.channel	
cem	slot/mda/port.channel	
ima-grp	bundle-id>[:vpi/vci vpi vpi1.vpi2 cp.conn-prof-id]	
	cp	keyword
	conn-prof-id	1..8000
port-id	slot/mda/port[.channel]	
bundle-id	bundle-<type>-slot/mda. <i>bundle-num</i>	
	bundle	keyword
	type	ima, fr, ppp
	bundle-num	1..336
bpgrp-id	bpgrp-<type>-<bpgrp-num>	
	bpgrp	keyword
	type	ima, ppp
	bpgrp-num	1..2000
aps-id	aps-<group-id>[.channel]	
	aps	keyword
	group-id	1..64
ccag-id	<i>ccag-id.path-id[cc-type]<cc-id</i>	
	ccag	keyword
	id	1..8
	path-id	a, b
	cc-type	.sap-net, .net-sap
	cc-id	0..4094
eth-tunnel	eth-tunnel- <i>id</i> [:eth-tun-sap-id]	
	id	1..1024
	eth-tun-sap-id	0..4094
lag-id	lag-id	
	lag	keyword

	id	1..800
pw-id	pw-id	
	pw	keyword
	id	1..10239
qtag1	*, 0..4094	
qtag2	* 0..4094	
vpi	0..4095 (NNI)	
	0..255 (UNI)	
vci	1, 2, 5..65535	
dlci	16..1022	
tunnel-id	tunnel-id.private public:tag	
	tunnel	keyword
	id	1..16
	tag	0..4094

summary — Keyword to summarize output.

Output

Sample Output

```
=====
Switch: ofs
=====
Table      : 0                      Flow Pri   : 0
Cookie     : 0x0000000000000000    CookieType: grt
Controller: :::0
Filter Hnd: 0xC30000010000FFFF
Filter     : _tmnx_ofs_ofs:1 entry 65535

In Port    : *
VID         : *                      Outer VID  : *
EthType    : *
Src IP     : *
Dst IP     : *
IP Proto   : *                      DSCP       : *
Src Port   : *                      Dst Port   : *
ICMP Type  : *                      ICMP Code  : *
Label      : *
IPv6ExtHdr: (Not Specified)

Action     : Fall-through

Flow Flags: IPv4/6 [!E] [RO] [DEF]
Up Time    : 0d 00:03:51             Add TS     : 680828
Mod TS     : 0                      Stats TS   : 703820
#Packets   : 0                      #Bytes     : 0
-----
Table      : 0                      Flow Pri   : 16
Cookie     : 0x0000000000000000    CookieType: grt
```

```
Controller: 1.3.8.8:6633
Filter Hnd: 0x830000010000FFEF
Filter      : _tmnx_ofs_ofs:1 entry 65519

In Port    : *
VID        : *                               Outer VID : *
EthType    : 0x0800
Src IP     : *
Dst IP     : 22.22.22.1/32
IP Proto   : *                               DSCP        : *
Src Port   : *                               Dst Port   : *
ICMP Type  : *                               ICMP Code   : *
Label      : *

Action      : Forward On Svc 99

Flow Flags: IPv4
Up Time    : 0d 00:01:15                     Add TS      : 696581
Mod TS     : 0                               Stats TS    : 703820
#Packets   : 0                               #Bytes      : 0
-----
Table      : 0                               Flow Pri    : 17
Cookie     : 0xC000006300000000             CookieType: service 99
Controller: 1.3.8.8:6633
Filter Hnd: 0x8300000D0000FFEE
Filter      : _tmnx_ofs_ofs:13 entry 65518

In Port    : *
VID        : *                               Outer VID : *
EthType    : 0x0800
Src IP     : *
Dst IP     : 22.22.22.2/32
IP Proto   : *                               DSCP        : *
Src Port   : *                               Dst Port   : *
ICMP Type  : *                               ICMP Code   : *
Label      : *

Action      : Forward On GRT

Flow Flags: IPv4
Up Time    : 0d 00:01:10                     Add TS      : 697095
Mod TS     : 0                               Stats TS    : 703820
#Packets   : 0                               #Bytes      : 0
-----
Table      : 0                               Flow Pri    : 4
Cookie     : 0xC000007E20000000             CookieType: service 2018
Controller: 1.3.8.8:6633
Filter Hnd: 0x830000050000FFFB
Filter      : _tmnx_ofs_ofs:5 entry 65531
SAP        : 1/1/3:0

In Port    : 0x2218000
VID        : 0x1000                           Outer VID : *
EthType    : 0x0800
Src IP     : *
Dst IP     : *
IP Proto   : *                               DSCP        : *
Src Port   : *                               Dst Port   : *
ICMP Type  : *                               ICMP Code   : *
```

```

Label      : *

Action     : Forward On Sap
             Sap 1/1/3:0

Flow Flags: IPv4
Up Time    : 0d 00:02:13      Add TS      : 690788
Mod TS     : 0                Stats TS    : 703820
#Packets   : 0                #Bytes     : 0
-----
Table      : 0                Flow Pri     : 3
Cookie     : 0xC00007E200000000 CookieType: service 2018
Controller: 1.3.8.8:6633
Filter Hnd: 0x830000040000FFFC
Filter     : _tmnx_ofs_ofs:4 entry 65532
SAP        : 1/1/3:4094

In Port    : 0x2218000
VID        : 0xlffe          Outer VID    : *
EthType    : 0x0800
Src IP     : *
Dst IP     : *
IP Proto   : *              DSCP        : *
Src Port   : *              Dst Port     : *
ICMP Type  : *              ICMP Code    : *
Label      : *

Action     : Forward On Sap
             Sap 1/1/3:4094

Flow Flags: IPv4
Up Time    : 0d 00:02:18      Add TS      : 690274
Mod TS     : 0                Stats TS    : 703820
#Packets   : 0                #Bytes     : 0
-----
Table      : 0                Flow Pri     : 5
Cookie     : 0xC00007E200000000 CookieType: service 2018
Controller: 1.3.8.8:6633
Filter Hnd: 0x830000060000FFFA
Filter     : _tmnx_ofs_ofs:6 entry 65530
SAP        : lag-800:4094

In Port    : 0x50000320
VID        : 0xlffe          Outer VID    : *
EthType    : 0x0800
Src IP     : *
Dst IP     : *
IP Proto   : *              DSCP        : *
Src Port   : *              Dst Port     : *
ICMP Type  : *              ICMP Code    : *
Label      : *

Action     : Forward On Sap
             Sap lag-800:4094

Flow Flags: IPv4
Up Time    : 0d 00:02:09      Add TS      : 691201
Mod TS     : 0                Stats TS    : 703821
#Packets   : 0                #Bytes     : 0

```

```

-----
Table      : 0                               Flow Pri   : 8
Cookie     : 0xC00007E300000000           CookieType: service 2019
Controller: 1.3.8.8:6633
Filter Hnd: 0x830000090000FFF7
Filter     : _tmnx_ofs_ofs:9 entry 65527
SAP        : 2/1/3:1.0

```

```

In Port    : 0x4218000
VID         : 0x1000                        Outer VID   : 0x1001
EthType    : 0x0800
Src IP     : *
Dst IP     : *
IP Proto   : *                            DSCP        : *
Src Port   : *                            Dst Port    : *
ICMP Type  : *                            ICMP Code   : *
Label      : *

```

```

Action     : Forward On Sap
              Sap 2/1/3:1.0

```

```

Flow Flags: IPv4
Up Time    : 0d 00:01:56                  Add TS      : 692448
Mod TS     : 0                            Stats TS    : 703821
#Packets   : 0                            #Bytes      : 0

```

```

-----
Table      : 0                               Flow Pri   : 7
Cookie     : 0xC00007E300000000           CookieType: service 2019
Controller: 1.3.8.8:6633
Filter Hnd: 0x830000080000FFF8
Filter     : _tmnx_ofs_ofs:8 entry 65528
SAP        : 2/1/3:4094.4094

```

```

In Port    : 0x4218000
VID         : 0x1ffe                        Outer VID   : 0x1ffe
EthType    : 0x0800
Src IP     : *
Dst IP     : *
IP Proto   : *                            DSCP        : *
Src Port   : *                            Dst Port    : *
ICMP Type  : *                            ICMP Code   : *
Label      : *

```

```

Action     : Forward On Sap
              Sap 2/1/3:4094.4094

```

```

Flow Flags: IPv4
Up Time    : 0d 00:02:01                  Add TS      : 692032
Mod TS     : 0                            Stats TS    : 703821
#Packets   : 0                            #Bytes      : 0

```

```

-----
Table      : 0                               Flow Pri   : 10
Cookie     : 0xC00007E300000000           CookieType: service 2019
Controller: 1.3.8.8:6633
Filter Hnd: 0x8300000B0000FFF5
Filter     : _tmnx_ofs_ofs:11 entry 65525
SAP        : lag-799:4094.4094

```

```

In Port    : 0x5000031f

```

```

VID      : 0xlffe                               Outer VID : 0xlffe
EthType  : 0x0800
Src IP   : *
Dst IP   : *
IP Proto : *                                     DSCP      : *
Src Port : *                                     Dst Port  : *
ICMP Type : *                                   ICMP Code : *
Label    : *

Action   : Forward On Sap
          Sap lag-799:4094.4094

Flow Flags: IPv4
Up Time  : 0d 00:01:46                         Add TS    : 693483
Mod TS   : 0                                    Stats TS  : 703821
#Packets : 0                                    #Bytes    : 0
-----
Table    : 0                                    Flow Pri  : 1
Cookie   : 0xC00007E400000000                 CookieType: service 2020
Controller: 1.3.8.8:6633
Filter Hnd: 0x830000020000FFFE
Filter   : _tmnx_ofs_ofs:2 entry 65534
SAP      : 2/1/4

In Port  : 0x4220000
VID      : 0x0                                Outer VID : *
EthType  : 0x0800
Src IP   : *
Dst IP   : *
IP Proto : *                                     DSCP      : *
Src Port : *                                     Dst Port  : *
ICMP Type : *                                   ICMP Code : *
Label    : *

Action   : Forward On Sap
          Sap 2/1/4

Flow Flags: IPv4
Up Time  : 0d 00:02:27                         Add TS    : 689443
Mod TS   : 0                                    Stats TS  : 703821
#Packets : 0                                    #Bytes    : 0
-----
Table    : 0                                    Flow Pri  : 12
Cookie   : 0xC00007E400000000                 CookieType: service 2020
Controller: 1.3.8.8:6633
Filter Hnd: 0x830000020000FFF3
Filter   : _tmnx_ofs_ofs:2 entry 65523
SAP      : 2/1/4

In Port  : 0x4220000
VID      : 0x0                                Outer VID : *
EthType  : 0x0800
Src IP   : *
Dst IP   : *
IP Proto : *                                     DSCP      : *
Src Port : *                                     Dst Port  : *
ICMP Type : *                                   ICMP Code : *
Label    : *

```

Action : Forward Sdp 12:4294967295

Flow Flags: IPv4

Up Time : 0d 00:01:36

Add TS : 694524

Mod TS : 0

Stats TS : 703821

#Packets : 0

#Bytes : 0

Table : 0

Flow Pri : 13

Cookie : 0xC00007E400000000

CookieType: service 2020

Controller: 1.3.8.8:6633

Filter Hnd: 0x830000020000FFF2

Filter : _tmnx_ofs_ofs:2 entry 65522

SAP : 2/1/4

In Port : 0x4220000

VID : 0x0

Outer VID : *

EthType : 0x0800

Src IP : *

Dst IP : *

IP Proto : *

DSCP : *

Src Port : *

Dst Port : *

ICMP Type : *

ICMP Code : *

Label : *

Action : Forward On Nhop(Indirect)

Nhop: 200.180.200.180

Flow Flags: IPv4

Up Time : 0d 00:01:31

Add TS : 695037

Mod TS : 0

Stats TS : 703821

#Packets : 0

#Bytes : 0

Table : 0

Flow Pri : 15

Cookie : 0xC00007E400000000

CookieType: service 2020

Controller: 1.3.8.8:6633

Filter Hnd: 0x830000020000FFF0

Filter : _tmnx_ofs_ofs:2 entry 65520

SAP : 2/1/4

In Port : 0x4220000

VID : 0x0

Outer VID : *

EthType : 0x0800

Src IP : *

Dst IP : *

IP Proto : *

DSCP : *

Src Port : *

Dst Port : *

ICMP Type : *

ICMP Code : *

Label : *

Action : Forward LspId 1

Lsp lsp1

Flow Flags: IPv4

Up Time : 0d 00:01:21

Add TS : 696067

Mod TS : 0

Stats TS : 703822

#Packets : 0

#Bytes : 0

Table : 0

Flow Pri : 14

Cookie : 0xC00007E400000000

CookieType: service 2020


```

Controller: 1.3.8.8:6633
Filter Hnd: 0x430000020000FFF1
Filter      : _tmnx_ofs_ofs:2 entry 65521
SAP         : 2/1/4

In Port     : 0x4220000
VID         : 0x0                                Outer VID : *
EthType     : 0x86dd
Src IP      : *
Dst IP      : *
IP Proto    : *                                DSCP       : *
Src Port    : *                                Dst Port    : *
ICMP Type   : *                                ICMP Code   : *
Label       : *
IPv6ExtHdr: (Not Specified)

Action      : Forward On Nhop(Indirect)
              Nhop: 3ffe:1111:1111:2222:2222:3333:3333:4444

Flow Flags: IPv6
Up Time     : 0d 00:01:26                        Add TS      : 695551
Mod TS      : 0                                  Stats TS    : 703822
#Packets    : 0                                  #Bytes      : 0
-----
Table       : 0                                  Flow Pri    : 2
Cookie      : 0xC00007E400000000                CookieType: service 2020
Controller: 1.3.8.8:6633
Filter Hnd: 0x830000030000FFFD
Filter      : _tmnx_ofs_ofs:3 entry 65533
SAP         : lag-798

In Port     : 0x5000031e
VID         : 0x0                                Outer VID : *
EthType     : 0x0800
Src IP      : *
Dst IP      : *
IP Proto    : *                                DSCP       : *
Src Port    : *                                Dst Port    : *
ICMP Type   : *                                ICMP Code   : *
Label       : *

Action      : Forward On Sap
              Sap lag-798

Flow Flags: IPv4
Up Time     : 0d 00:02:23                        Add TS      : 689857
Mod TS      : 0                                  Stats TS    : 703822
#Packets    : 0                                  #Bytes      : 0
-----
Table       : 0                                  Flow Pri    : 19
Cookie      : 0x8000000000000000                CookieType: system
Controller: 1.3.8.8:6633
Filter Hnd: 0x4300000E0000FFEC
Filter      : _tmnx_ofs_ofs:14 entry 65516

In Port     : *
VID         : *                                Outer VID : *
EthType     : 0x86dd
Src IP      : *

```

```

Dst IP      : 3ffe::1616:1601/128
IP Proto    : *
Src Port    : *
ICMP Type   : *
Label       : *
IPv6ExtHdr  : (Not Specified)

DSCP        : *
Dst Port    : *
ICMP Code   : *

Action      : Forward On Nhop(Indirect)
              Nhop: 3ffe:1111:1111:2222:2222:3333:3333:4444

Flow Flags: IPv6
Up Time     : 0d 00:01:01
Mod TS      : 0
#Packets    : 0
Add TS      : 698121
Stats TS    : 703822
#Bytes      : 0
-----
Table       : 0
Cookie      : 0x8000000000000000
Controller: 1.3.8.8:6633
Filter Hnd: 0x83000000E0000FFED
Filter      : _tmnx_ofs_ofs:14 entry 65517
Flow Pri    : 18
CookieType: system

In Port     : *
VID         : *
EthType     : 0x0800
Src IP      : *
Dst IP      : 22.22.22.1/32
IP Proto    : *
Src Port    : *
ICMP Type   : *
Label       : *
Outer VID   : *
DSCP        : *
Dst Port    : *
ICMP Code   : *

Action      : Forward On Nhop(Indirect)
              Nhop: 200.180.200.180

Flow Flags: IPv4
Up Time     : 0d 00:01:06
Mod TS      : 0
#Packets    : 0
Add TS      : 697608
Stats TS    : 703822
#Bytes      : 0
-----
Number of flows: 17
=====
*A:Dut-C#

```

6 Cflowd

6.1 Cflowd Overview

Cflowd is a tool used to sample IPv4, IPv6, MPLS, and Ethernet traffic data flows through a router. Cflowd enables traffic sampling and analysis by ISPs and network engineers to support capacity planning, trends analysis, and characterization of workloads in a network service provider environment.

Cflowd is also useful for traffic engineering, network planning and analysis, network monitoring, developing user profiles, data warehousing and mining, as well as security-related investigations. Collected information can be viewed several ways such as in port, AS, or network matrices, and pure flow structures. The amount of data stored depends on the cflowd configurations.

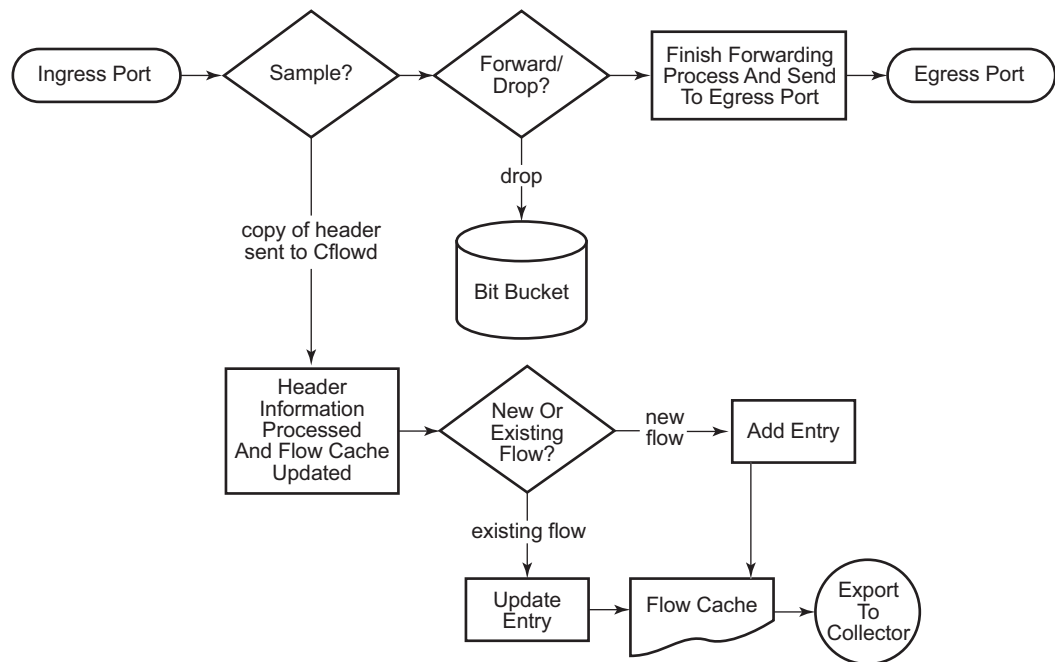
Cflowd maintains a list of data flows through a router. A flow is a unidirectional traffic stream defined by several characteristics such as source and destination IP addresses, source and destination ports, inbound interface, IP protocol and TOS bits.

When a router receives a packet for which it currently does not have a flow entry, a flow structure is initialized to maintain state information regarding that flow, such as the number of bytes exchanged, IP addresses, port numbers, AS numbers, and so on. Each subsequently sampled packet matching the same parameters of the flow contributes to the byte and packet count of the flow until the flow is terminated and exported to a collector for storage.

For the 7450 ESS-7 and 7450 ESS-12, cflowd is only supported if mixed mode is enabled.

6.1.1 Operation

[Figure 38](#) shows the basic operation of the cflowd feature. This sample flow is only used to describe the basic steps that are performed. It is not intended to specify implementation.

Figure 38 Basic Cflowd Steps

Router_Config_30

1. As a packet ingresses a port, a decision is made to forward or drop the packet.
2. If the packet is forwarded, it is then decided whether the packet should be sampled for cflowd.
3. If a new flow is found, a new entry is added to the cache. If the flow already exists in the cache, the flow statistics are updated.
4. If a new flow is detected and the maximum number of entries are already in the flow cache, the earliest expiry entry is removed. The earliest expiry entry/flow is the next flow that will expire due to the active or inactive timer expiration.
5. If a flow has been inactive for a period of time equal to or greater than the inactive timer (default 15 s), the entry is removed from the flow cache.
6. If a flow has been active for a period of time equal to or greater than the active timer (default 30 min), the entry is removed from the flow cache.

When a flow is exported from the cache, the collected data is sent to an external collector, which maintains an accumulation of historical data flows that network operators can use to analyze traffic patterns.

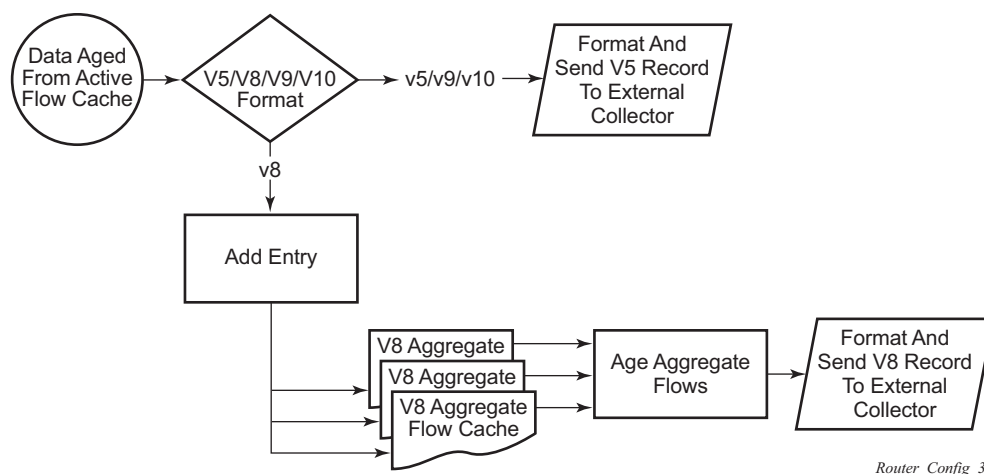
Data is exported in one of the following formats:

- Version 5 — Generates a fixed export record for each individual flow captured.
- Version 8 — Aggregates multiple individual flows into a fixed aggregate record.

- Version 9 — Generates a variable export record, depending on user configuration and sampled traffic type (IPv4, IPv6, or MPLS), for each individual flow captured.
- Version 10 (IPFIX) — Generates a variable export record, depending on user configuration and sampled traffic type (IPv4, IPv6, or MPLS), for each individual flow captured.

Figure 39 shows V5, V8, V9, and V10 flow processing.

Figure 39 V5, V8, V9, V10, and Flow Processing



1. As flows are expired from the active flow cache, the export format must be determined, either V5, V8, V9, and V10.
 - If the export format is V5 or V9 and V10, no further processing is performed and the flow data is accumulated to be sent to the external collector.
 - If the export format is V8, the flow entry is added to one or more of the configured aggregation matrices.
 - As the entries within the aggregate matrices are aged out, they are accumulated to be sent to the external flow collector in V8 format.

The sample rate and cache size are configurable values. The cache size default is 64K flow entries.

A flow terminates when one of the following conditions is met:

- When the inactive timeout period expires (default: 15 s). A flow is considered terminated when no packets are seen for the flow for n seconds.

- When an active timeout expires (default: 30 s). Default active timeout is 30 min. A flow terminates according to the time duration, regardless of whether there are packets coming in for the flow.
- When the user executes a **clear cflowd** command.
- When other measures are met that apply to aggressively age flows as the cache becomes too full (such as overflow percent).

6.1.1.1 Version 8

There are several different aggregate flow types including:

- AS matrix
- Destination prefix matrix
- Source prefix matrix
- Prefix matrix
- Protocol/port matrix.

Version 8 is an aggregated export format. As individual flows are aged out of the raw flow cache, the data is added to the aggregate flow cache for each configured aggregate type. Each of these aggregate flows are also aged in a manner similar to the method the active flow cache entries are aged. When an aggregate flow is aged out, it is sent to the external collector in the V8 record format.

6.1.1.2 Version 9

Version 9 format is a more flexible format and allows for different templates or sets of cflowd data to be sent based on the type of traffic being sampled and the template set configured.

Version 9 is interoperable with RFC 3954, *Cisco Systems NetFlow Services Export Version 9*.

6.1.1.3 Version 10

Version 10 is a new format and protocol that interoperates with the specifications from the IETF as the IP Flow Information Export (IPFIX) standard. Like V9, the V10 format uses templates to allow for different data elements regarding a flow that is to be exported and to handle different type of data flows, such as IPv4, IPv6, and MPLS.

Version 10 is interoperable with RFC 5150 and 5102.

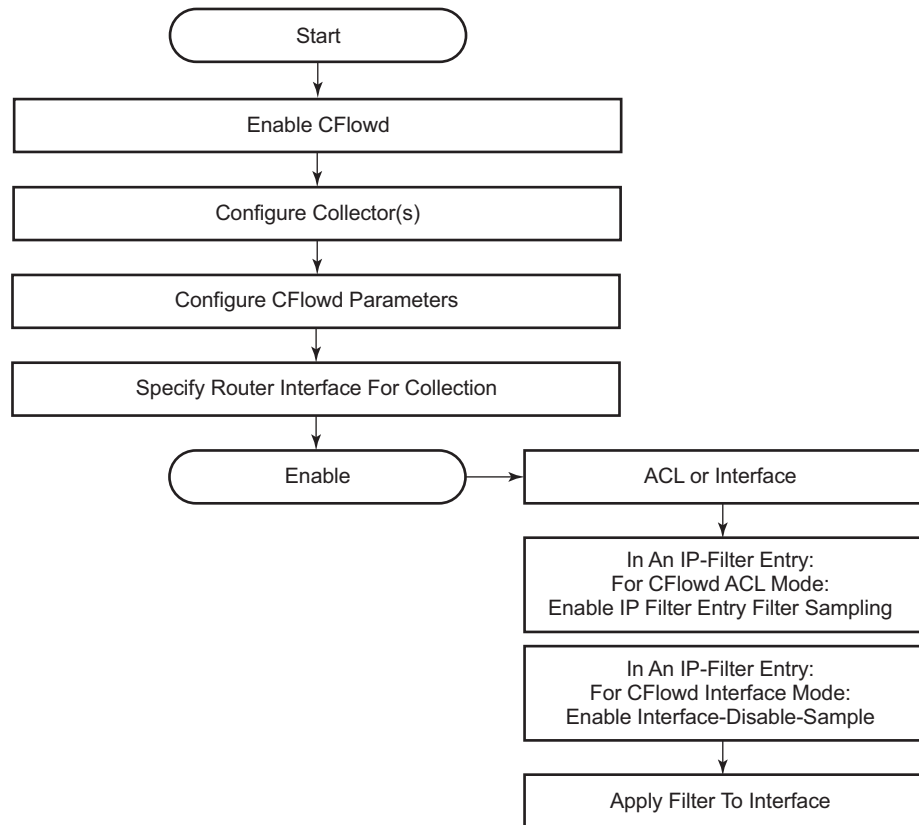
6.1.2 Cflowd Filter Matching

In the filter-matching process, usually every packet is matched against filter (access list) criteria to determine acceptability. With cflowd, only the first packet of a flow is checked. If the first packet is forwarded, an entry is added to the cflowd cache. Subsequent packets in the same flow are then forwarded without needing to be matched against the complete set of filters. Specific performance varies depending on the number and complexity of the filters.

6.2 Cflowd Configuration Process Overview

Figure 40 shows the process to configure cflowd parameters.

Figure 40 Cflowd Configuration and Implementation Flow



Router_Config_32

There are three modes in which cflowd can be enabled to sample traffic on an interface:

- Cflowd interface, where all traffic entering a specified port will be subjected to sampling at the configured sampling rate.
- Cflowd interface plus the definition of IP filters that specify an action of interface-disable-sample, where traffic that matches these filter entries will not be subject to cflowd sampling.
- Cflowd ACL, where IP filters must be created with entries containing the action filter-sampled. In this mode, only traffic matching these filter entries will be subject to the cflowd sampling process.

6.3 Configuration Notes

The following cflowd components must be configured for cflowd to be operational:

- Cflowd is enabled globally.
- At least one collector must be configured and enabled.
- A cflowd option must be specified and enabled on a router interface.
- Sampling must be enabled on either:
 - An IP filter that is applied to a port or service.
 - An interface on a port or service.

6.4 Configuring Cflowd with CLI

This section provides information to configure cflowd using the command line interface.

6.4.1 Cflowd Configuration Overview

SR OS implementation of cflowd supports the option to analyze traffic flow. The implementation also supports the use of traffic or access list (ACL) filters to limit the type of traffic that is analyzed.

6.4.1.1 Traffic Sampling

Traffic sampling does not examine all packets received by a router. Command parameters allow the rate at which traffic is sampled and sent for flow analysis to be modified. The default sampling rate is every 1000th packet. Excessive sampling over an extended period of time, for example, more than every 1000th packet, can burden router processing resources.

The following data is maintained for each individual flow in the raw flow cache:

- Source IP address
- Destinations IP address
- Source port
- Destination port
- Forwarding status
- Input interface
- Output interface
- IP protocol
- TCP flags
- First timestamp (of the first packet in the flow)
- Last timestamp (timestamp of last packet in the flow prior to expiry of the flow)
- Source AS number for peer and origin (taken from BGP)
- Destination AS number for peer and origin (taken from BGP)
- IP next hop
- BGP next hop

- ICMP type and code
- IP version
- Source prefix (from routing)
- Destination prefix (from routing)
- MPLS label stack from label 1 to 6

Within the raw flow cache, the following characteristics are used to identify an individual flow:

- Ingress interface
- Source IP address
- Destination IP address
- Source transport port number
- Destination transport port number
- IP protocol type
- IP TOS byte
- Virtual router ID
- ICMP type and code
- Direction
- MPLS labels

SR OS implementation allows you to enable cflowd either at the interface level or as an action to a filter. By enabling cflowd at the interface level, all IP packets forwarded by the interface are subject to cflowd analysis. By setting cflowd as an action in a filter, only packets matching the specified filter are subject to cflowd analysis. This provides the network operator greater flexibility in the types of flows that are captured.

6.4.1.2 Collectors

A collector defines how data flows should be exported from the flow cache. A maximum of five collectors can be configured. Each collector is identified by a unique IP address and UDP port value. Each collector can only export traffic in one version type: V5, V8, V9, or V10.

The parameters within a collector configuration can be modified or the defaults retained.

The **autonomous-system-type** command defines whether the autonomous system information to be included in the flow data is based on the originating AS or external peer AS of the flow.

6.4.1.2.1 Aggregation

V8 aggregation allows for flow data to be aggregated into larger, less granular flows. Use aggregation commands to specify the type of data to be collected. These aggregation types are only applicable to flows being exported to a V8 collector.

The following aggregation schemes are supported:

- AS matrix — Flows are aggregated based on source and destination AS and ingress and egress interface.
- Protocol-port — Flows are aggregated based on the IP protocol, source port number, and destination port number.
- Source prefix — Flows are aggregated based on source prefix and mask, source AS, and ingress interface.
- Destination prefix — Flows are aggregated based on destination prefix and mask, destination AS, and egress interface.
- Source-destination prefix — Flows are aggregated based on source prefix and mask, destination prefix and mask, source and destination AS, ingress interface and egress interface.
- Raw — Flows are not aggregated and are sent to the collector in a V5 record.

6.4.2 Basic Cflowd Configuration

This section provides information to configure cflowd and examples of common configuration tasks. To sample traffic, the following parameters must be configured, as a minimum.

- Cflowd must be enabled.
- At least one collector must be configured and enabled.
- Sampling must be enabled on either:
 - An IP filter entry (and applied to a service or a port).
 - An interface applied to a port.

The following example shows a cflowd configuration:

```
A:ALA-1>config>cflowd# info detail
```

```
-----
active-timeout 30
cache-size 65536
inactive-timeout 15
overflow 1
rate 1000
collector 10.10.10.103:2055 version 9
    no aggregation
    autonomous-system-type origin
    description "V9 collector"
    no shutdown
exit
template-retransmit 330
exit
no shutdown
-----
A:ALA-1>config>cflowd#
```

6.4.3 Common Configuration Tasks

This section provides a brief overview of the tasks that must be performed to configure cflowd and provides the CLI commands. To begin traffic flow sampling, cflowd must be enabled and at least one collector must be configured.

6.4.3.1 Global Cflowd Components

The following common (global) attributes apply to all instances of cflowd:

- Active timeout — Controls the maximum time a flow record can be active before it will be automatically exported to defined collectors.
- Inactive timeout — Controls the minimum time before a flow is declared inactive. If no traffic is sampled for a flow for the inactive timeout duration, the flow is declared inactive and marked to be exported to the defined collectors.
- Cache size — Defines the maximum size of the flow cache.
- Overflow — Defines the percentage of flow records that are exported to all collectors if the flow cache size is exceeded.
- Rate — Defines the system-wide sampling rate for cflowd.
- Template retransmit— Defines the interval (in seconds) at which the V9 and V10 templates are retransmitted to all configured V9 or V10 collectors.

6.4.3.2 Enabling Cflowd

Cflowd is disabled by default. Cflowd is not shut down but must be configured, including at least one collector, to be active. Executing the **cflowd** command enables cflowd.

Use the following CLI syntax to enable cflowd:

CLI Syntax: config# cflowd
 no shutdown

The following example shows the default values when cflowd is initially enabled. No collectors or collector options are configured.

```
A:ALA-1>config# info detail
...
#-----
echo "Cflowd Configuration"
#-----
    cflowd
        active-timeout 30
        cache-size 65536
        inactive-timeout 15
        overflow 1
        rate 1000
        template-retransmit 600
        no shutdown
    exit
#-----
A:ALA-1>config#
```

6.4.3.3 Configuring Global Cflowd Parameters

The following cflowd parameters apply to all instances where cflowd is enabled.

Use the following CLI commands to configure cflowd parameters:

CLI Syntax: config>cflowd#
 active-timeout *minutes*
 cache-size *num-entries*
 enhanced-distribution
 export-mode {automatic | manual}
 inactive-timeout *seconds*
 overflow *percent*
 rate *sample-rate*
 template-retransmit *seconds*
 no shutdown

The following example shows a sample cflowd configuration:

```
A:ALA-1>config>cflowd# info
#-----
    active-timeout 20
    inactive-timeout 10
    overflow 10
    rate 100
#-----
A:ALA-1>config>cflowd#
```

6.4.3.4 Configuring Cflowd Collectors

To configure cflowd collector parameters, enter the following commands:

CLI Syntax:

```
config>cflowd#
collector ip-address[:port] [version version]
    aggregation
        as-matrix
        destination-prefix
        protocol-port
        raw
        source-destination-prefix
        source-prefix
    autonomous-system-type [origin | peer]
    description description-string
    no shutdown
    template-set {basic | mpls-ip | l2-ip | mpls-
        transport}
```

The following example shows a basic cflowd configuration:

```
A:ALA-1>config>cflowd# info
-----
active-timeout 20
    inactive-timeout 10
    overflow 10
    rate 100
    collector 10.10.10.1:2000 version 8
        aggregation
            as-matrix
            raw
        exit
        description "AS info collector"
    exit
    collector 10.10.10.2:5000 version 8
        aggregation
            protocol-port
            source-destination-prefix
        exit
        autonomous-system-type peer
```



```

        description "Neighbor collector"
    exit
-----
A:ALA-1>config>cflowd#

```

Version 9 collector example:

```

collector 10.10.10.9:2000 version 9
    description "v9collector"
    template-set mpls-ip
    no shutdown
exit

```

6.4.3.4.1 Version 9 and Version 10 Templates

If the collector is configured to use either V9 or V10 (IPFIX) formats, the flow data is sent to the designated collector using one of the predefined templates. The template used is based on the type of flow for which the data was collected (IPv4, IPv6, MPLS, or Ethernet (Layer 2)), and the configuration of the **template-set** parameter.

[Table 85](#) lists these values and the corresponding template used to export the flow data.

Table 85 **Template Sets**

Traffic Flow	Basic	MPLS-IP
IPv4	Basic IPv4	MPLS-IPv4
IPv6	Basic IPv6	MPLS-IPv6
MPLS	Basic MPLS	MPLS-IP
Ethernet	L2-IP	L2-IP

Each flow exported to a collector configured for either V9 or V10 formats will be sent using one of the flow template sets listed in [Table 85](#).

[Table 86](#) to [Table 93](#) list the fields in each template listed in [Table 85](#).

Table 86 **Basic IPv4 Template**

Field Name	Field ID
IPv4 Src Addr	8

Table 86 Basic IPv4 Template (Continued)

Field Name	Field ID
IPv4 Dest Addr	12
IPv4 Nexthop	15
BGP Nexthop	18
Ingress Interface	10
Egress Interface	14
Packet Count	2
Byte Count	1
Start Time	22
End Time	21
Flow Start Milliseconds ¹	152
Flow End Milliseconds ¹	153
Src Port	7
Dest Port	11
Forwarding Status	89
TCP control Bits (Flags)	6
IPv4 Protocol	4
IPv4 TOS	5
IP version	60
ICMP Type & Code	32
Direction	61
BGP Source ASN	16
BGP Dest ASN	17
Source IPv4 Prefix Length	9
Dest IPv4 Prefix Length	13
Minimum IP Total Length	25
Maximum IP Total Length	26
Minimum TTL	52

Table 86 Basic IPv4 Template (Continued)

Field Name	Field ID
Maximum TTL	53
Multicast Replication Factor	99
IsMulticast ¹	206
Ingress VRFID ¹	234
Egress VRFID ¹	235

Note:

1. Only sent to collectors configured for V10 format.

Table 87 MPLS-IPv4 Template

Field Name	Field ID
IPv4 Src Addr	8
IPv4 Dest Addr	12
IPv4 Nexthop	15
BGP Nexthop	18
Ingress Interface	10
Egress Interface	14
Packet Count	2
Byte Count	1
Start Time	22
End Time	21
Flow Start Milliseconds ¹	152
Flow End Milliseconds ¹	153
Src Port	7
Dest Port	11
Forwarding Status	89
TCP control Bits (Flags)	6
IPv4 Protocol	4

Table 87 **MPLS-IPv4 Template (Continued)**

Field Name	Field ID
IPv4 TOS	5
IP version	60
ICMP Type & Code	32
Direction	61
BGP Source ASN	16
BGP Dest ASN	17
Source IPv4 Prefix Length	9
Dest IPv4 Prefix Length	13
MPLS Top Label Type	46
MPLS Top Label IPv4 Addr	47
MPLS Label 1	70
MPLS Label 2	71
MPLS Label 3	72
MPLS Label 4	73
MPLS Label 5	74
MPLS Label 6	75
MPLS Label 7	76
MPLS Label 8	77
MPLS Label 9	78
MPLS Label 10	79
Minimum IP Total Length	25
Maximum IP Total Length	26
Minimum TTL	52
Maximum TTL	53
Multicast Replication Factor	99
IsMulticast ¹	206
Ingress VRFID ¹	234

Table 87 MPLS-IPv4 Template (Continued)

Field Name	Field ID
Egress VRFID ¹	235

Note:

1. Only sent to collectors configured for V10 format.

Table 88 Basic IPv6 Template

Field Name	Field ID
IPv6 Src Addr	27
IPv6 Dest Addr	28
IPv6 Nexthop	62
IPv6 BGP Nexthop	63
IPv4 Nexthop	15
IPv4 BGP Nexthop	18
Ingress Interface	10
Egress Interface	14
Packet Count	2
Byte Count	1
Start Time	22
End Time	21
Flow Start Milliseconds ¹	152
Flow End Milliseconds ¹	153
Src Port	7
Dest Port	11
Forwarding Status	89
TCP control Bits (Flags)	6
Protocol	4
IPv6 Extension Hdr	64
IPv6 Next Header	193

Table 88 Basic IPv6 Template (Continued)

Field Name	Field ID
IPv6 Flow Label	31
TOS	5
IP version	60
IPv6 ICMP Type & Code	139
Direction	61
BGP Source ASN	16
BGP Dest ASN	17
IPv6 Src Mask	29
IPv6 Dest Mask	30
Minimum IP Total Length	25
Maximum IP Total Length	26
Minimum TTL	52
Maximum TTL	53
Multicast Replication Factor	99
IsMulticast ¹	206
Ingress VRFID ¹	234
Egress VRFID ¹	235

Note:

1. Only sent to collectors configured for V10 format.

Table 89 MPLS-IPv6 Template

Field Name	Field ID
IPv6 Src Addr	27
IPv6 Dest Addr	28
IPv6 Nexthop	62
IPv6 BGP Nexthop	63
IPv4 Nexthop	15

Table 89 MPLS-IPv6 Template (Continued)

Field Name	Field ID
IPv4 BGP Nexthop	18
Ingress Interface	10
Egress Interface	14
Packet Count	2
Byte Count	1
Start Time	22
End Time	21
Flow Start Milliseconds ¹	152
Flow End Milliseconds ¹	153
Src Port	7
Dest Port	11
Forwarding Status	89
TCP control Bits (Flags)	6
Protocol	4
IPv6 Extension Hdr	64
IPv6 Next Header	193
IPv6 Flow Label	31
TOS	5
IP version	60
IPv6 ICMP Type & Code	139
Direction	61
BGP Source ASN	16
BGP Dest ASN	17
IPv6 Src Mask	29
IPv6 Dest Mask	30
MPLS Top Label Type	46
MPLS Top Label IPv6 Addr	47

Table 89 MPLS-IPv6 Template (Continued)

Field Name	Field ID
MPLS Label 1	70
MPLS Label 2	71
MPLS Label 3	72
MPLS Label 4	73
MPLS Label 5	74
MPLS Label 6	75
MPLS Label 7	76
MPLS Label 8	77
MPLS Label 9	78
MPLS Label 10	79
MPLS_TOP_LABEL_TYPE	46
MPLS_TOP_LABEL_ADDR	47
Minimum IP Total Length	25
Maximum IP Total Length	26
Minimum TTL	52
Maximum TTL	53
Multicast Replication Factor	99
IsMulticast ¹	206
Ingress VRFID ¹	234
Egress VRFID ¹	235

Note:

1. Only sent to collectors configured for V10 format.

Table 90 Basic MPLS Template

Field Name	Field ID
Start Time	22
End Time	21

Table 90 Basic MPLS Template (Continued)

Field Name	Field ID
Flow Start Milliseconds ¹	152
Flow End Milliseconds ¹	153
Ingress Interface	10
Egress Interface	14
Packet Count	2
Byte Count	1
Direction	61
MPLS Top Label Type	46
MPLS Top Label Address	47
MPLS Label 1	70
MPLS Label 2	71
MPLS Label 3	72
MPLS Label 4	73
MPLS Label 5	74
MPLS Label 6	75

Note:

1. Only sent to collectors configured for V10 format.

Table 91 MPLS-IP Template

Field Name	Field ID
IPv4 Src Addr	8
IPv4 Dest Addr	12
IPv4 Nexthop	15
IPv6 Src Addr	27
IPv6 Dest Addr	28
IPv6 Nexthop	62
Ingress Interface	10

Table 91 **MPLS-IP Template (Continued)**

Field Name	Field ID
Egress Interface	14
Packet Count	2
Byte Count	1
Start Time	22
End Time	21
Flow Start Milliseconds ¹	152
Flow End Milliseconds ¹	153
Src Port	7
Dest Port	11
TCP control Bits (Flags)	6
IPv4 Protocol	4
IPv4 TOS	5
IP version	60
ICMP Type & Code	32
Direction	61
MPLS Top Label Type	46
MPLS Top Label IPv4 Addr	47
MPLS Label 1	70
MPLS Label 2	71
MPLS Label 3	72
MPLS Label 4	73
MPLS Label 5	74
MPLS Label 6	75
MPLS Label 7	76
MPLS Label 8	77
MPLS Label 9	78
MPLS Label 10	79

Note:

1. Only sent to collectors configured for V10 format.

Table 92 L2-IP (Ethernet) Flow Template

Field Name ¹	Field ID
MAC Src Addr	56
MAC Dest Addr	80
Ingress Physical Interface	252
Egress Physical Interface	253
Dot1q VLAN ID	243
Dot1q Customer VLAN ID	245
Post Dot1q VLAN ID	254
Post Dot1q Customer VLAN Id	255
IPv4 Src Addr	8
IPv4 Dest Addr	12
IPv6 Src Addr	27
IPv6 Dest Addr	28
Packet Count	2
Byte Count	1
Flow Start Milliseconds	152
Flow End Milliseconds	153
Src Port	7
Dest Port	11
TCP control Bits (Flags)	6
Protocol	4
IPv6 Option Header	64
IPv6 Next Header	196
IPv6 Flow Label	31
TOS	5

Table 92 L2-IP (Ethernet) Flow Template (Continued)

Field Name ¹	Field ID
IP Version	60
ICMP Type Code	32

Note:

1. Only one Ethernet (L2-IP) flow template is supported and exported to IPFIX (V10) collectors.

Table 93 MPLS TRANSPORT Template

Field Name	Field ID
Flow Start Milliseconds	152
Flow End Milliseconds	153
VRF ID	234
Ingress Interface	10
Packet Count	2
Byte Count	1
Direction	61
MPLS_TOP_LABEL_TYPE	46
MPLS_TOP_LABEL_ADDR	47
MPLS Label-1	70

Table 94 GRE Flow Template

Field Name ¹	Field ID
IPv4 Src Addr ²	8
IPv4 Dest Addr ²	12
Ingress ID	252
Egress ID	253
Flow Start Milliseconds	152
Ingress VRF ID ²	234

Table 94 GRE Flow Template (Continued)

Field Name ¹	Field ID
Egress VRF ID ²	235
Protocol ²	4
TOS ²	5
Data Link Frame Size ³	312
Section Exported Octets ²	410
Data Link Frame Section ²	315

Notes:

1. The field names are exported only to IPFIX (V10) collectors.
2. The IP fields contain values from the outer GRE IP header.
3. The Data Link Frame section field includes the inner IP headers.

6.4.3.5 Specifying Cflowd Options on an IP Interface

When cflowd is enabled on an interface, all packets forwarded by the interface are subject to analysis according to the global cflowd configuration and sorted according to the collector configurations.

See [Table 95](#) for configuration combinations.

When the **cflowd-parameters sampling unicast type interface** option is configured in the **config>router>interface** context, the following requirements must be met to enable traffic sampling on the interface:

- Cflowd must be enabled.
- At least one cflowd collector must be configured and enabled.
- The **config>router>interface>cflowd-parameters sampling {unicast | multicast} type {acl | interface} [direction {ingress-only | egress-only | both}]** must be performed. By default, the direction is ingress-only.
- To prevent certain types of traffic from being sampled when interface sampling is enabled, use the **interface-disable-sample** command in the **config>filter>ip-filter** or **config>filter>ipv6-filter** context. The filter must be applied to the service or network interface on which the traffic to be omitted is to ingress the system.

6.4.3.5.1 Interface Configurations

CLI Syntax:

```
config>router>if#  
cflowd-parameters  
    sampling {unicast | multicast} type {acl |  
interface}  
    no sampling {unicast | multicast} type  
{acl|interface}
```

Depending on the option selected, either **acl** or **interface**, cflowd extracts traffic flow samples from an IP filter or an interface for analysis. All packets forwarded by the interface are analyzed according to the cflowd configuration.

The **acl** option must be selected to enable traffic sampling on an IP filter. Cflowd (**filter-sample**) must be enabled in at least one IP filter entry.

The **interface** option must be selected to enable traffic sampling on an interface. If cflowd is not enabled (**no cflowd**), traffic sampling will not occur on the interface.

6.4.3.5.2 Service Interfaces

CLI Syntax:

```
config>router>interface# cflowd-parameters sampling  
{unicast | multicast} type {acl | interface}
```

When enabled on a service interface, cflowd collects routed traffic flow samples through a router for analysis. Cflowd is supported on IES and VPRN services interfaces only. Layer 2 traffic is excluded. All packets forwarded by the interface are analyzed according to the cflowd configuration. On the interface level, cflowd can be associated with a filter (ACL) or an IP interface. L2 cflowd ingress sampling is supported on VPLS and Epipe SAPs.

6.4.3.6 Specifying Sampling Options in Filter Entries

Packets are matched against filter entries to determine acceptability. With cflowd, only the first packet of a flow is compared. If the first packet matches the filter criteria, an entry is added to the cflowd cache. Subsequent packets in the same flow are also sampled based on the cache entry.

Because a filter can be applied to more than one interface (when configured with a **scope template**), the **interface-disable-sample** option is intended to enable or disable traffic sampling on an interface-by-interface basis. The command can be enabled or disabled as needed instead of having to create numerous filter versions.

To enable an interface for filter traffic sampling, the following requirements must be met:

- Cflowd must be enabled globally.
- At least one cflowd collector must be configured and enabled.
- On the IP interface being used, the **config>router>interface>cflowd-parameters sampling {unicast | multicast} type acl** option must be selected.
- On the IP filter being used, the **entry>filter-sample** option must be explicitly enabled for the entries matching the traffic that should be sampled. The default is **no filter-sample**. See Filter Configuration for more information.
- The filter must be applied to a service or a network interface. The service or port must be enabled and operational.

6.4.3.6.1 Filter Configurations

CLI Syntax: config>filter>ip-filter>entry#
 [no] filter-sample
 [no] interface-disable-sample

or

CLI Syntax: config>filter>ipv6-filter>entry#
 [no] filter-sample
 [no] interface-disable-sample

When a filter policy is applied to a service or a network interface, sampling can be configured so that traffic matching the associated IP filter entry is sampled when the IP interface is set to cflowd ACL mode and the **filter-sample** command is enabled. If cflowd is either not enabled (**no filter-sample**) or set to the cflowd interface mode, sampling does not occur.

When the **interface-disable-sample** command is enabled, traffic matching the associated IP filter entry is not sampled if the IP interface is set to cflowd ACL mode.

6.4.3.6.2 Dependencies

For cflowd to be operational, the following requirements must be met:

- Cflowd must be enabled on a global level. If cflowd is disabled, any traffic sampling instances are also disabled.

- At least one collector must be configured and enabled in order for traffic sampling to occur on an enabled entity.
- If a specific collector UDP port is not identified, flows are sent to port 2055 by default.

Cflowd can also be dependent on the following entity configurations:

- [Interface Configurations](#)
- [Service Interfaces](#)
- [Filter Configurations](#)

The combination of interface and filter entry configurations determines whether flow sampling occurs. [Table 95](#) lists the expected results based on cflowd configuration dependencies.

Table 95 Cflowd Configuration Dependencies

Interface Setting	cflowd-parameter type Setting	Command ip-filter entry Setting	Expected Results
IP-filter mode	ACL	filter-sample	Traffic matching is sampled at specified rate.
IP-filter mode	ACL	no filter-sample	No traffic is sampled on this interface.
IP-filter mode or cflowd not enabled on interface	ACL	interface-disable-sample	Command is ignored. No sampling occurs.
Interface mode	Interface	interface-disable-sample	Traffic matching this IP filter entry is not sampled.
Interface mode	Interface	none	All IP traffic ingressing the interface is subject to sampling.
Interface mode	Interface	filter-sample	Filter-level action is ignored. All traffic ingressing the interface is subject to sampling.

6.5 Cflowd Configuration Management Tasks

This section describes Cflowd configuration management tasks:

6.5.1 Modifying Global Cflowd Components

Cflowd parameter modifications apply to all instances where cflowd is enabled. Changes are applied immediately. Use the following cflowd commands to modify global cflowd parameters:

CLI Syntax:

```
config>cflowd#
active-timeout minutes
no active-timeout
cache-size num-entries
no cache-size
[no] enhanced-distribution
export-mode {automatic | manual}
inactive-timeout seconds
no inactive-timeout
overflow percent
no overflow
rate sample-rate
no rate
[no] shutdown
template-retransmit seconds
no template-retransmit
```

The following example shows the cflowd command syntax to modify configuration parameters:

Example:

```
config>cflowd# active-timeout 60
config>cflowd# no inactive-timeout
config>cflowd# overflow 2
config>cflowd# rate 10
```

The following example shows an example cflowd configuration:

```
A:ALA-1>config>cflowd# info
#-----
      active-timeout 60
      overflow 2
      rate 10
#-----
A:ALA-1>config>cflowd#
```

6.5.2 Modifying Cflowd Collector Parameters

Use the following commands to modify cflowd collector and aggregation parameters:

CLI Syntax:

```
config>cflowd#
collector ip-address[:port] [version version]
no collector ip-address[:port]
    [no] aggregation
        [no] as-matrix
        [no] destination-prefix
        [no] protocol-port
        [no] raw
        [no] source-destination-prefix
        [no] source-prefix
    [no] autonomous-system-type [origin | peer]
    [no] description description-string
    [no] shutdown
template-set {basic | mpls-ip | l2-ip | mpls-
             transport}
```

If a specific collector UDP port is not identified, flows are sent to port 2055 by default.

The following example displays basic cflowd modifications:

```
A:ALA-1>config>cflowd# info
-----
active-timeout 60
overflow 2
rate 10
collector 10.10.10.1:2000 version 5
    description "AS info collector"
exit
collector 10.10.10.2:5000 version 8
    aggregation
        source-prefix
        raw
    exit
    description "Test collector"
exit
-----
A:ALA-1>config>cflowd#
```

6.6 Cflowd Configuration Command Reference

- [Command Hierarchies](#)
- [Command Descriptions](#)

6.6.1 Command Hierarchies

```

config
  — [no] cflowd
    — active-timeout minutes
    — no active-timeout
    — [no] analyze-gre-payload
    — cache-size num-entries
    — no cache-size
    — collector ip-address[:port] [version version]
    — no collector ip-address[:port]
      — [no] aggregation
        — [no] as-matrix
        — [no] destination-prefix
        — [no] protocol-port
        — [no] raw
        — [no] source-destination-prefix
        — [no] source-prefix
      — autonomous-system-type {origin | peer}
      — description description-string
      — no description
      — export-filter
        — [no] family
          — [no] ipv4
          — [no] ipv6
          — [no] l2-ip
          — [no] mcast-ipv4
          — [no] mcast-ipv6
          — [no] mpls
        — interface-list
          — [no] router router-instance interface interface-name
          — service
            — [no] ies service-id interface ip-int-name
            — [no] ies service-id subscriber-interface ip-int-name
              group-interface ip-int-name
            — [no] vprn service-id interface ip-int-name
            — [no] vprn service-id network-interface ip-int-name
            — [no] vprn service-id subscriber-interface ip-int-name
              group-interface ip-int-name
          — [no] router {router-name | vprn-svc-id}
      — router {router-name | vprn-svc-id}
      — [no] shutdown
      — template-set {basic | mpls-ip | l2-ip | mpls-transport}
  
```

- [no] **enhanced-distribution**
- **export-mode** {automatic | manual}
- **inactive-timeout** *seconds*
- **no inactive-timeout**
- [no] **inband-collector-export-only**
- **overflow** *percent*
- **no overflow**
- **rate** *sample-rate*
- **no rate**
- **sample-profile** *profile-id* [create]
- **no sample-profile** *profile-id*
 - **sample-rate** [*rate*]
- [no] **shutdown**
- **template-retransmit** *seconds*
- **no template-retransmit**
- [no] **use-vrtr-if-index**

6.6.2 Command Descriptions

6.6.2.1 Global Commands

cflowd

Syntax	[no] cflowd
Context	config>cflowd
Description	This command creates the context to configure cflowd. The no form of this command removes all configuration under cflowd including the deletion of all configured collectors. This can only be executed if cflowd is in a shutdown state.
Default	no cflowd

active-timeout

Syntax	active-timeout <i>minutes</i> no active-timeout
Context	config>cflowd
Description	This command configures the maximum amount of time before an active flow is aged out of the active cache. If an individual flow is active for this amount of time, the flow is aged out and a new flow will be created on the next packet sampled for that flow.

Existing flows do not inherit the new active-timeout value if this parameter is changed while cflowd is active. The active-timeout value for a flow is set when the flow is first created in the active cache table and does not change dynamically.

The **no** form of this command resets the inactive timeout back to the default value.

Default	active-timeout 30
Parameters	<i>minutes</i> — The value expressed in minutes before an active flow is exported.
Values	1 to 600

analyze-gre-payload

Syntax	[no] analyze-gre-payload
Context	config>cflowd
Description	This command enables cflowd analysis of the inner IP packet in a sampled GRE packet that is transiting the local router. If the GRE packet terminates on the local node, the inner IP payload is analyzed and reported using existing IPv4 or IPv6 flow templates. This behavior is not affected by this command. If this parameter is enabled and a GRE packet is transiting the local node, the inner payload is reported using the GRE Flow Template. (Template ID 308 or 309) This behavior is only supported with V10 (IPFIX) collectors. The no form of this command disables cflowd analysis of the inner IP packet in a sampled GRE packet.

cache-size

Syntax	cache-size <i>num-entries</i> no cache-size
Context	config>cflowd
Description	This command specifies the maximum number of active flows to maintain in the flow cache table. The no form of this command resets the number of active entries back to the default value.
Default	cache-size 65536
Parameters	<i>num-entries</i> — Specifies the maximum number of entries maintained in the cflowd cache. The number depends on the CPM version.
Values	

For the 7450 ESS and 7750 SR 1000 to 250000
(cfm-xp, SF/CPM3):
For the 7450 ESS and 7750 SR 1000 to 1000000
(CPM4 or CPM5):
For the 7950 XRS: 1000 to 1500000

Default

For the 7450 ESS and 7750 SR: 65536 (64K)
For the 7950 XRS: 500000

collector

Syntax	collector <i>ip-address[:port]</i> [version <i>version</i>] no collector <i>ip-address[:port]</i>				
Context	config>cflowd				
Description	This command defines a flow data collector for cflowd data. The IP address and version of the flow collector must be specified. The UDP port number is an optional parameter. If it is not set, the default of 2055 is used for all collector versions. To connect to an IPFIX (version 10) collector using the IPFIX default port, specify port 4739 when defining the collector. A maximum of 8 collectors can be configured. The no form of this command removes the flow collector definition from the config and stops the export of data to the collector. The collector needs to be shut down to be deleted.				
Parameters	<i>ip-address</i> — Specifies the address of a remote cflowd collector host to receive the exported cflowd data. Values <table><tr><td>ipv4-address</td><td>a.b.c.d</td></tr><tr><td>ipv6-address</td><td>x:x:x:x:x:x-x-[interface]</td></tr></table> <i>port</i> — Specifies the UDP port number on the remote cflowd collector host to receive the exported cflowd data. Values 1 to 65535 Default 2055 <i>version</i> — Specifies the version of the flow data collector. Values 5, 8, 9, 10 Default 5	ipv4-address	a.b.c.d	ipv6-address	x:x:x:x:x:x-x-[interface]
ipv4-address	a.b.c.d				
ipv6-address	x:x:x:x:x:x-x-[interface]				

aggregation

Syntax	[no] aggregation
Context	config>cflowd>collector
Description	This command configures the type of aggregation scheme to be exported. Specifies the type of data to be aggregated and to the collector. To configure aggregation, you must decide which type of aggregation scheme to configure: autonomous system, destination prefix, protocol port, raw, source destination, or source prefix. This can only be configured if the collector version is configured as V8. The no form of this command removes all aggregation types from the collector configuration.
Default	no aggregation

as-matrix

Syntax	[no] as-matrix
Context	config>cflowd>collector>aggregation
Description	This command specifies that the aggregation data should be based on autonomous system (AS) information. An AS matrix contains packet and byte counters for traffic from either source-destination autonomous systems or last-peer to next-peer autonomous systems. The no form of this command removes this type of aggregation from the collector configuration.
Default	no as-matrix

destination-prefix

Syntax	[no] destination-prefix
Context	config>cflowd>collector>aggregation
Description	This command specifies that the aggregation data is based on destination prefix information. The no form removes this type of aggregation from the collector configuration.

protocol-port

Syntax	[no] protocol-port
Context	config>cflowd>collector>aggregation
Description	This command specifies that flows be aggregated based on the IP protocol, source port number, and destination port number. The no form of this command removes this type of aggregation from the collector configuration.

raw

Syntax	[no] raw
Context	config>cflowd>collector>aggregation
Description	This command configures raw (unaggregated) flow data to be sent in Version 5. The no form of this command removes this type of aggregation from the collector configuration.

source-destination-prefix

Syntax	[no] source-destination-prefix
Context	config>cflowd>collector>aggregation
Description	This command configures cflowd aggregation based on source and destination prefixes. The no form of this command removes this type of aggregation from the collector configuration.

source-prefix

Syntax	[no] source-prefix
Context	config>cflowd>collector>aggregation
Description	This command configures cflowd aggregation based on source prefix information. The no form of this command removes this type of aggregation from the collector configuration.

autonomous-system-type

Syntax	autonomous-system-type { origin peer }
Context	config>cflowd>collector
Description	This command defines whether the autonomous system (AS) information included in the flow data is based on the originating AS or external peer AS of the routes. This option is only allowed if the collector is configured as Version 5 or Version 8.
Default	autonomous-system-type origin
Parameters	origin — Specifies that the AS information included in the flow data is based on the originating AS. peer — Specifies that the AS information included in the flow data is based on the peer AS.

description

Syntax	description <i>description-string</i> no description
Context	config>cflowd>collector
Description	This command creates a text description stored in the configuration file for a configuration context. The no form of this command removes the description string from the context.
Parameters	<i>description-string</i> — The description character string. Allowed values are any string up to 80 characters long composed of printable, 7-bit ASCII characters. If the string contains special characters (#, \$, spaces, etc.), the entire string must be enclosed within double quotes.

export-filter

Syntax	export-filter
Context	config>cflowd>collector
Description	This command creates the CLI context to specify cflowd data filters. These filters allow the administrator to control which flows are sent or are not sent to an associated cflowd collector.

family

Syntax	[no] family
Context	config>cflowd>collector>export-filter
Description	This command defines the address family for the flow types that should not be sent to the associated cflowd collector. Multiple family types can be defined in this context to filter out multiple address families to a given collector. The no form of this command removes the address family definition, allowing all address family types to be exported to the associated collector.
Default	no family

ipv4

Syntax	[no] ipv4
Context	config>cflowd>collector>export-filter>family
Description	This command filters IPv4 flow data from being sent to the associated collector. The no form of this command removes the filter, allowing IPv4 flow data to be sent to the associated collector.
Default	no ipv4

ipv6

Syntax	[no] ipv6
Context	config>cflowd>collector>export-filter>family
Description	This command filters IPv6 flow data from being sent to the associated collector. The no form of this command removes the filter, allowing IPv6 flow data to be sent to the associated collector.
Default	no ipv6

l2-ip

Syntax	[no] l2-ip

Context	config>cflowd>collector>export-filter>family
Description	This command filters Layer 2 IP flow data from being sent to the associated collector. The no form of this command removes the filter, allowing Layer 2 IP flow data to be sent to the associated collector.
Default	no l2-ip

mcast-ipv4

Syntax	[no] mcast-ipv4
Context	config>cflowd>collector>export-filter>family
Description	This command filters multicast IPv4 flow data from being sent to the associated collector. The no form of this command removes the filter, allowing multicast IPv4 flow data to be sent to the associated collector.
Default	no mcast-ipv4

mcast-ipv6

Syntax	[no] mcast-ipv6
Context	config>cflowd>collector>export-filter>family
Description	This command filters multicast IPv6 flow data from being sent to the associated collector. The no form of this command removes the filter, allowing multicast IPv6 flow data to be sent to the associated collector.
Default	no mcast-ipv6

mpls

Syntax	[no] mpls
Context	config>cflowd>collector>export-filter>family
Description	This command filters MPLS flow data from being sent to the associated collector. The no form of this command removes the filter, allowing MPLS flow data to be sent to the associated collector.
Default	no mpls

interface-list

Syntax	interface-list
Context	config>cflowd>collector>exp-filter
Description	This command enables the context allowing the administrator to specify which interface's flow data should be exported to the associated collector.

[Table 96](#) describes the cflowd export filter precedences.

Table 96 Cflowd Export Filter Precedence

Family Filter	Router Filter	Interface Filter	Export to Collector
0	0	0	export all
0	0	1	export if matched interface only
0	1	0	export if matched router only
0	1	1	export if router match *OR* interface match
1	0	0	not exported due to family exclusion filter
1	0	1	not exported due to family exclusion filter
1	1	0	not exported due to family exclusion filter
1	1	1	not exported due to family exclusion filter

router

Syntax	[no] router <i>router-instance</i> interface <i>interface-name</i>
Context	config>cflowd>collector>exp-filter>if-list
Description	This command identifies an interface for which ingress sampled data flows should be sent to the associated collector. The no form of this command removes the specified interface from the interface-list filter.
Parameters	<i>router-instance</i> — Specifies the router instance ID associated with the interface name Values <i>router-name</i> <i>vprn-svc-id</i> router-name: Base, management Default - Base vprn-svc-id: 1 to 2147483647 <i>interface-name</i> — Specifies the interface name, up to 32 characters and must start with a letter, for the desired router to the service interface or SAP

service

Syntax	service
Context	config>cflowd>collector>exp-filter>if-list
Description	This command enables the context to configure which service interfaces' flow data is being sent to this collector

ies

Syntax	[no] ies service-id interface ip-int-name [no] ies service-id subscriber-interface ip-int-name group-interface ip-int-name
Context	config>cflowd>collector>exp-filter>if-list>svc
Description	This command configures which IES service interfaces' flow data is being sent to this collector. The no form of the command removes the values from the configuration.
Parameters	service-id — Specifies the unique service identification number or string identifying the service in the service domain. This ID must be unique to this service and may not be used for any other service of any type. The <i>service-id</i> must be the same number used for every SR OS on which this service is defined. Values <i>service-id</i> :1 to 2147483647 <i>svc-name</i> :64 characters maximum interface ip-int-name — Specifies the name of the IP interface. Interface names must be unique within the group of defined IP interfaces for config router interface and config service ies interface commands. An interface name cannot be in the form of an IP address. Interface names can be from 1 to 32 alphanumeric characters and must start with a letter. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes. subscriber-interface ip-int-name — Specifies the interface name of a subscriber interface. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes and must start with a letter. group-interface ip-int-name — Specifies the interface name of a group interface. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes and must start with a letter.

vpn

Syntax	[no] vpn service-id interface ip-int-name [no] vpn service-id network-interface ip-int-name

[no] **vpn** *service-id* **subscriber-interface** *ip-int-name* **group-interface** *ip-int-name*

Context	config>cflowd>collector>exp-filter>if-list>svc
Description	This command configures which VPRN service interfaces' flow data is being sent to this collector. The no form of the command removes the values from the configuration.
Parameters	<i>service-id</i> — Specifies the unique service identification number or string identifying the service in the service domain. This ID must be unique to this service and may not be used for any other service of any type. The <i>service-id</i> must be the same number used for every SR OS on which this service is defined. Values <i>service-id</i>:1 to 2147483647 <i>svc-name</i>:64 characters maximum interface <i>ip-int-name</i> — Specifies the name of an IP interface. Interface names must be unique within the group of defined IP interfaces for config router interface and config service ies interface commands. An interface name cannot be in the form of an IP address. Interface names can be from 1 to 32 alphanumeric characters and must start with a letter. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes. network-interface <i>ip-int-name</i> — Specifies the name of a network interface. Interface names must be unique within the group of defined IP interfaces for config router interface and config service ies interface commands. An interface name cannot be in the form of an IP address. Interface names can be from 1 to 32 alphanumeric characters. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes and must start with a letter. subscriber-interface <i>ip-int-name</i> — Specifies an interface name of a subscriber interface. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes and must start with a letter. group-interface <i>ip-int-name</i> — Specifies an interface name of a group interface. If the string contains special characters (#, \$, spaces, and so on), the entire string must be enclosed within double quotes and must start with a letter.

router

Syntax	[no] router { <i>router-name</i> <i>vpn-svc-id</i> }
Context	config>cflowd>collector>export-filter
Description	This command allows the flow data from only specific router instances to be sent to the associated collector. Multiple router instances can be configured by issuing the command multiple times with the different router-instances.

The **no** form of this command removes the specified router-instance restriction, which means flows from that router-instance will no longer be exported. If all router-instances are removed, then flows from all router instances are sent to the associated collector.

Default	no router
Parameters	<i>router-name</i> — Specifies the router name. Only “Base” is supported.
Values	Base
	<i>vprn-svc-id</i> — Specifies the router instance VPRN service ID.
Values	1 to 2147483647

router

Syntax	router { <i>router-name</i> <i>vprn-svc-id</i> }
Context	config>cflowd>collector
Description	This command configures the flow data sent to the associated collector to be sent within the specified router context. If this parameter is not specified, flow data is exported using the management routing context.
Default	router management
Parameters	<i>router-name</i> — Specifies the router name.
Values	Base, management
Default	management
	<i>vprn-svc-id</i> — Specifies the router instance VPRN service ID.
Values	1 to 2147483647

shutdown

Syntax	[no] shutdown
Context	config>cflowd config>cflowd>collector
Description	This command administratively disables an entity. When disabled, an entity does not change, reset, or remove any configuration settings or statistics. The operational state of the entity is disabled as well as the operational state of any entities contained within. Many objects must be shut down before they may be deleted. The no form of this command administratively enables an entity.

Unlike other commands and parameters where the default state is not indicated in the configuration file. The **shutdown** and **no shutdown** states are always indicated in system generated configuration files.

Default no shutdown

template-set

Syntax **template-set {basic | mpls-ip | l2-ip | mpls-transport}**

Context config>cflowd>collector

Description This command specifies the set of templates sent to the collector when using cflowd Version 9 or Version 10.

Default template-set basic

Parameters **basic** — Specifies that basic flow data is sent.

mpls-ip — Specifies that extended flow data is sent that includes IP and MPLS flow information.

l2-ip — Specifies that extended flow data is sent that includes Layer 2 (Ethernet) and IP flow information. This template is only applicable for V10 (IPFIX) collectors.

mpls-transport — Specifies that cflowd can collect flow statistics for MPLS traffic using only the outer transport label, EXP bit value, and ingress interface as the flow identifier. This template enables the collection of flow statistics on a core router to develop LSP usage statistics.

enhanced-distribution

Syntax **[no] enhanced-distribution**

Context config>cflowd

Description This command enables the inclusion of the ingress port ID into the hash algorithm used to distribute cflowd sample traffic to cflowd processes running on the 7950 XRS CPM. By including this new attribute, cflowd may see better distribution of flows across processing tasks if there is a limited number of IP interfaces on which sampling is performed, but those interfaces use LAGs with a large number of port members.

By enabling this option, the same flow may be captured multiple times if packets are received on multiple ingress ports.

This command is only applicable to cflowd running on a 7950 XRS platform.

The **no** form of this command removes the command from the configuration and disables the inclusion of the ingress port ID in the cflowd hash algorithm.

Default no enhanced-distribution

export-mode

Syntax **export-mode** {**automatic** | **manual**}

Context config>cflowd

Description This command can be used to control how exports are generated by the cflowd process. The default behavior is for flow data to be exported automatically based on the active and inactive time-out values. The alternative mode is manual in which case flow data is only exported when the command “tools perform cflowd manual-export” is issued. The only exception is if the cflowd cache overflows, in which case the normal automatic export process is used.

Default export-mode automatic

Parameters **automatic** — cflowd flow data is automatically generated.
manual — cflowd flow data is exported only when manually triggered.

inactive-timeout

Syntax **inactive-timeout** *seconds*
no inactive-timeout

Context config>cflowd

Description This command specifies the amount of time, in seconds, that must elapse without a packet matching a flow in order for the flow to be considered inactive.

The **no** form of this command resets the inactive timeout back to the default of 15 seconds.

Existing flows will not inherit the new inactive-timeout value if this parameter is changed while cflowd is active. The inactive-timeout value for a flow is set when the flow is first created in the active cache table and does not change dynamically.

Default inactive-timeout 15

Parameters *seconds* — Specifies the amount of time, in seconds, that must elapse without a packet matching a flow in order for the flow to be considered inactive.

Values 10 to 600

inband-collector-export-only

Syntax [**no**] **inband-collector-export-only**

Context config>cflowd

Description This command, when the **inband-collector-export-only** command is enabled, allows only collectors that are reachable through inband interfaces and enables a higher flow export rate.

The **no** form of this command, the default, re-enables the use of the out-of-band management Ethernet port.

overflow

Syntax **overflow** *percent*
no overflow

Context config>cflowd

Description This command specifies the percentage of the flow cache entries removed when the maximum number of entries is exceeded. The entries removed are the entries that have not been updated for the longest amount of time.

The **no** form of this command resets the number of entries cleared from the flow cache on overflow to the default value.

Default overflow 1

Parameters *percent* — Specifies the percentage of the flow cache entries removed when the maximum number of entries is exceeded.

Values 1 to 50 percent

rate

Syntax **rate** *sample-rate*
no rate

Context config>cflowd

Description This command specifies the rate (N) at which traffic is sampled and sent for flow analysis. A packet is sampled every N packets; for example, when **sample-rate** is configured as 1, then all packets are sent to the cache. When **sample-rate** is configured as 100, then every 100th packet is sent to the cache.

The **no** form of this command resets the sample rate to the default value.

Default rate 1000

Parameters *sample-rate* — Specifies the rate at which traffic is sampled.

Values 1 to 10000

sample-profile

Syntax	sample-profile <i>profile-id</i> [create] no sample-profile <i>profile-id</i>
Context	config>cflowd
Description	This command enables the context to create and define sampling parameters. The no form of this command removes the associated sample-profile. sample-profile 1 cannot be deleted.
Parameters	<i>profile-id</i> — Specifies the rate profile. Values 1 to 5 create — Mandatory keyword when creating a sample profile. The create keyword requirement can be enabled or disabled in the environment>create context.

sample-rate

Syntax	sample-rate [<i>rate</i>]
Context	config>cflowd>sample-profile
Description	This command defines the cflowd sampling rate associated with the sample profile ID. This rate indicates that 1 in N packets are sampled at the associated interface for cflowd analysis. Only one rate profile below 1:256 can be associated with a given IOM, IMM, or XMA.
Default	sample-rate 1000
Parameters	<i>rate</i> — Specifies the rate at which traffic is sampled and forwarded for cflowd analysis. Values 1 to 10000

template-retransmit

Syntax	template-retransmit <i>seconds</i> no template-retransmit
Context	config>cflowd
Description	This command specifies the interval for sending template definitions.
Default	template-retransmit 600

Parameters	<i>seconds</i> — Specifies the value expressed in seconds before sending template definitions.
Values	10 to 600

use-vrtr-if-index

Syntax	[no] use-vrtr-if-index
Context	config>cflowd
Description	This command is used to export flow data using interface indexes (ifIndex values), which can be used directly as the index into the IF-MIB tables for retrieving interface statistics. Specifically, if this command is enabled, the ingressInterface (ID=10) and egressInterface (ID= 14) fields in IP flow templates used to export the flow data to cflowd version 9 and version 10 collectors will be populated with the IF-MIB ifIndex of that interface. In addition, for version 10 templates, two fields are available in the IP flow templates to specify the virtual router ID associated with the ingress and egress interfaces. The no form of this command removes the command from the active configuration and causes cflowd to return to the default behavior of populating the ingress and egress interface ID with the global IF index IDs.
Default	no use-vrtr-if-index

6.7 Show, Tools, and Clear Command Reference

- [Command Hierarchies](#)
- [Command Descriptions](#)

6.7.1 Command Hierarchies

- [Show Commands](#)
- [Tools Commands](#)
- [Clear Commands](#)

6.7.1.1 Show Commands

```
show
  — cflowd
      — collector [ip-address[:port]] [detail]
      — interface [ip-int-name]
      — status
```

6.7.1.2 Tools Commands

```
tools
  — dump
  — cflowd
      — cache aggregate {src-dst-proto | src-dst-proto-port} family {ipv4 | ipv6}
      — cache all family {ipv4 | ipv6}
      — packet-size protocol [clear]
      — top-flows protocols [clear]
      — top-protocols protocols [clear]
```

6.7.1.3 Clear Commands

```
clear
  — cflowd
```

6.7.2 Command Descriptions

6.7.2.1 Show Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

collector

Syntax	collector [<i>ip-address[:port]</i>] [detail]
Context	show>cflowd
Description	This command displays administrative and operational status of data collector configuration.
Parameters	<i>ip-address</i> — Displays information only about the specified collector IP address. Default all collectors <i>:port</i> — Displays information only about the collector on the specified UDP port. Default all UDP ports Values 1 to 65535 detail — Displays details about either all collectors or the specified collector.
Output	cflowd Collector Output —The following output is an example of cflowd Collector information, and Table 97 describes the output fields.

```
A:R51-CfmA# show cflowd collector

=====
Cflowd Collectors
=====
Host Address      Port  Version  AS Type  Admin  Oper      Sent
-----
138.120.135.103 2055   v5        peer    up     up        1380 records
138.120.135.103 9555   v8        origin  up     up         90 records
138.120.135.103 9996   v9         -       up     up          0 packets
138.120.214.224 2055   v5        origin  up     up        1380 records
-----
Collectors : 4
=====
```

Table 97 Show cflowd Collector Output Fields

Label	Description
Host Address	The IP address of a remote cflowd collector host to receive the exported cflowd data.
Port	The UDP port number on the remote cflowd collector host to receive the exported cflowd data.
AS Type	The style of AS reporting used in the exported flow data.
	origin Reflects the endpoints of the AS path which the flow is following.
	peer Reflects the AS of the previous and next hops for the flow.
Version	Specifies the configured version for the associated collector.
Admin	The desired administrative state for this cflowd remote collector host.
Oper	The current operational status of this cflowd remote collector host.
Recs Sent	The number of cflowd records that have been transmitted to this remote collector host.
Collectors	The total number of collectors using this IP address.

cflowd Collector Detail Output —The following output is an example of cflowd Collector information, and [Table 98](#) describes the output fields.

Sample Output

```
A:R51-CfmA# show cflowd collector detail
=====
Cflowd Collectors (detail)
=====
Address           : 138.120.135.103
Port              : 2055
Description       : Test v5 Collector
Version          : 5
AS Type           : peer
Admin State       : up
Oper State        : up
Records Sent      : 1260
Last Changed      : 09/03/2009 17:24:04
Last Pkt Sent     : 09/03/2009 18:07:10
-----
Sent              Open              Errors
```

```

-----
                                     42          0          0
=====
Address                          : 138.120.135.103
Port                             : 9555
Description                       : Test v8 Collector
Version                          : 8
AS Type                          : origin
Admin State                      : up
Oper State                       : up
Records Sent                     : 82
Last Changed                     : 09/03/2009 17:24:04
Last Pkt Sent                    : 09/03/2009 18:06:41
-----
Aggregation Type                 Status          Sent          Open          Errors
-----
as-matrix                       Disabled          0            0            0
protocol-port                   Disabled          0            0            0
source-prefix                   Enabled          21            0            0
destination-prefix             Enabled          21            0            0
source-destination-prefix       Disabled          0            0            0
raw                             Disabled          0            0            0
=====
Address                          : 138.120.135.103
Port                             : 9996
Description                       : Test v9 Collector
Version                          : 9
Admin State                      : up
Oper State                       : up
Packets Sent                    : 51
Last Changed                     : 09/03/2009 17:24:04
Last Pkt Sent                    : 09/03/2009 18:07:10
Template Set                     : Basic
-----
Traffic Type                     Template Sent      Sent          Open          Errors
-----
IPv4                            09/03/2009 18:07:29  51            1            0
MPLS                           No template sent    0            0            0
IPv6                           No template sent    0            0            0
=====
A:R51-CfmA#

```

Table 98 Show cflowd Collector Detailed Output Fields

Label	Description
Address	The IP address of a remote cflowd collector host to receive the exported cflowd data.
Port	The UDP port number on the remote cflowd collector host to receive the exported cflowd data.
Description	A user-provided descriptive string for this cflowd remote collector host.
Version	The version of the flow data sent to the collector.

Table 98 Show cflowd Collector Detailed Output Fields (Continued)

Label	Description
AS Type	The style of AS reporting used in the exported flow data.
	origin Reflects the endpoints of the AS path which the flow is following.
	peer Reflects the AS of the previous and next hops for the flow.
Admin State	The desired administrative state for this cflowd remote collector host.
Oper State	The current operational status of this cflowd remote collector host.
Records Sent	The number of cflowd records that have been transmitted to this remote collector host.
Last Changed	The time when this row entry was last changed.
Last Pkt Sent	The time when the last cflowd packet was sent to this remote collector host.
Aggregation Type	The bit mask which specifies the aggregation schemes used to aggregate multiple individual flows into an aggregated flow for export to this remote host collector.
	none No data will be exported for this remote collector host.
	raw Flow data is exported without aggregation in version 5 format.
	All other aggregation types use version 8 format to export the flow data to this remote host collector.
Collectors	The total number of collectors using this IP address.
Sent	The number of packets with flow data sent to the associated collector.
Open	This counter shows the number of partially filled packets which have some flow data but are not yet filled or have been timed out (60 seconds maximum).
Error	This counter increments when there was an error during exporting of the collector packet. The most common reason will be a UDP unreachable destination for the configured collector.

interface

Syntax	interface [<i>ip-int-name</i>]
Context	show>cflowd
Description	Displays the administrative and operational status of the interfaces with cflowd enabled.
Parameters	<i>ip-int-name</i> — Displays information only for the IP interface with the specified name. Default all interfaces with cflowd enabled
Output	The following output is an example of cflowd interface information, and Table 99 describes the output fields.

Table 99 Show cflowd Interface Output Fields

Label	Description
Interface	Displays the physical port identifier.
IPv4 Address	Displays the primary IPv4 address for the associated IP interface.
IPv6 Address	Displays the primary IPv6 address for the associated IP interface.
Router	Displays the virtual router index (Base = 0).
IF Index	Displays the Global IP interface index.
Mode	Displays the cflowd sampling type and direction. intf — Interface based sampling acl — ACL based sampling ingr — Ingress sampling egr — Egress sampling both — Both ingress and egress sampling
Admin	Displays the administrative state of the interface.
Opr-IPv4	Displays the operational state for IPv4 sampling.
Opr-IPv6	Displays the operational state for IPv6 sampling.

Sample Output

```

B:sr-002# show cflowd interface [ip-addr | ip-int-name]
=====
Cflowd Interfaces
=====
Interface                               Router      IF Index   Mode       Admin
  IPv4 Address                           Oper IPv4
  IPv6 Address                           Oper IPv6
-----
ipv4ipv6NamedIf                         Base        381        intf/ing   Up

```

```
5.5.5.5/24 Up
55::55/128 Up
ipv4NamedIf 5 254 acl-egr Up
10.10.10.10/24 Up
N/A Down
ipv6NamedIf Base 380 i/f-both Up
N/A Down
2001:db8::9/128 Up
```

Interfaces : 3
=====

B:sr-002# show cflowd interface 11.10.1.2

=====

Cflowd Interfaces

=====

```
Interface: To_Sr1
IP address: 11.10.1.2/24
Admin/Oper state: Up/Up
Sampling Mode: (ingress | egress | both)
Total Flows seen: 1302000
Pkts sampled (ingress/egress) : 60103/70102
Bytes sampled (ingress/egress) : 6010300/7010200
Active flows (ingress/egress) : 6010/7010
```

B:sr-002# show cflowd interface

=====

Cflowd Interfaces

=====

Interface	IP Address	Mode	Admin	Oper
To_Sr1	1.10.1.2/24	Interface	Up	Up
To_C2	1.12.1.2/24	Interface	Up	Up
To_Cisco_7600	1.13.1.2/24	Interface	Up	Up
To_E	1.11.1.2/24	Interface	Up	Up
To_G2	150.153.1.1/24	Interface	Up	Up
To_Sr1_Sonet	150.140.1.2/24	Interface	Up	Down
Main	120.1.1.1/24	Filter	Down	Down
New	120.2.1.1/24	Filter	Up	Up

Interfaces : 8

=====

B:sr12-002#

status

Syntax	status
Context	show>cflowd
Description	This command displays basic information regarding the administrative and operational status of cflowd.

Output The following output is an example of cflowd status information, and [Table 100](#) describes the output fields.

Sample Output

```

sr1# show cflowd status
=====
Cflowd Status
=====
Cflowd Admin Status : Enabled
Cflowd Oper Status : Enabled
Active Timeout : 1 minutes
Inactive Timeout : 30 seconds
Template Retransmit : 60 seconds
Cache Size : 65536 entries
Overflow : 1%
Sample Rate : 1
Active Flows : 34000
Overflow events 10
Dropped Flows: 0
Pkts Rcvd : 801600
Total Pkts Dropped : 0

                                Raw
Times flow created              160000
Times flow matched              224428382
Total flows flushed             150000
=====
Version Info
=====

```

Version	Status	Sent	Open	Errors
5	Enabled	92	0	0
8	Enabled	46	0	0
9	Enabled	56	1	0
10	Enabled	39	1	0

```

=====
Cflowd Status
=====
Cflowd Admin Status : Enabled
Cflowd Oper Status : Enabled
Active Timeout : 1 minutes
Inactive Timeout : 30 seconds
Template Retransmit : 60 seconds
Cache Size : 65536 entries
Overflow : 1%
Sample Rate : 1
Active Flows : 34
Total Pkts Rcvd : 801600
Total Pkts Dropped : 0

=====
Version Info
=====

```

Version	Status	Sent	Open	Errors
5	Enabled	92	0	0

```

      8           Enabled      46           0           0
      9           Enabled      56           1           0
     10           Enabled      39           1           0
=====

```

Table 100 **Show cflowd Status Fields**

Label	Description
Cflowd Admin Status	The desired administrative state for this cflowd remote collector host.
Cflowd Oper Status	The current operational status of this cflowd remote collector host.
Active Timeout	The maximum amount of time, in minutes, before an active flow will be exported. If an individual flow is active for this amount of time, the flow is exported and a new flow is created.
Inactive Timeout	Inactive timeout in seconds.
Template Retransmit	The time in seconds before template definitions are sent.
Cache Size	The maximum number of active flows to be maintained in the flow cache table.
Overflow	The percentage number of flows to be flushed when the flow cache size has been exceeded.
Sample Rate	The rate at which traffic is sampled and forwarded for cflowd analysis. one (1) All packets are analyzed. 1000 (default) Every 1000th packet is analyzed.
Active Flows	The current number of active flows being collected.
Total Pkts Rcvd	The total number of packets sampled and forwarded for cflowd analysis.
Total Pkts Dropped	The total number of packets dropped.
Aggregation Info:	
Type	The type of data to be aggregated and to the collector.
Status	enabled Specifies that the aggregation type is enabled.
	disabled Specifies that the aggregation type is disabled.

Table 100 Show cflowd Status Fields (Continued)

Label	Description
Sent	The number of packets with flow data sent to the associated collector.
Open	This counter shows the number of partially filled packets which have some flow data but are not yet filled or have been timed out (60 seconds maximum).
Error	This counter increments when there was an error during exporting of the collector packet. The most common reason will be a UDP unreachable destination for the configured collector.
Overflow events	The number of times the active cache overflowed.
Dropped Flows	Total number of flows dropped due to cache overflow events.

6.7.2.2 Tools Commands

The following command outputs are examples only; actual displays may differ depending on supported functionality and user configuration.

cache

Syntax `cache aggregate {src-dst-proto | src-dst-proto-port} family {ipv4 | ipv6}`
`cache all family {ipv4 | ipv6}`

Context `tools>dump>cflowd`

Description This command displays the contents of the cflowd active cache. This information can be displayed either in raw form where every flow entry is displayed or in an aggregated form.

[Table 101](#) describes the cflowd cache output fields.

Table 101 Tools Dump cflowd Cache Output Fields

Label	Description
Proto/Protocol	Displays the IPv4 or IPv6 protocol type.
Source Address/Src-IP	Displays the source IP address of the flow (IPv4 or IPv6).
Destination Address/Dst-IP	Displays the destination IP address of the flow (IPv4 or IPv6).

Table 101 Tools Dump cflowd Cache Output Fields (Continued)

Label	Description
Intf/Ingr	Displays the ingress interface associated with the sampled flow (only displayed with the raw (all) output).
Intf/Egr	Displays the egress interface associated with the sampled flow (only displayed with the raw (all) output).
S-Port	Displays the source protocol port number.
D-Port	Displays the destination protocol port number.
Pkt-Cnt	Displays the total number of packets sampled for the associated flow.
Byte-Cnt	Displays the total number of bytes of traffic sampled for the associated flow.
Start-Time	Displays the system time when the first packet was sampled for the associated flow.
Flags	Displays the IP flag value from the sampled IP flow header (only displayed with the raw (all) output).
ToS	Displays the ToS byte values from the sampled IP flow header (only displayed with the raw (all) output).
(Src) Mask	Displays the IP route mask for the route to the flow source IP address associated with the flow (only displayed with the raw (all) output).
(Dst) Mask	Displays the IP route mask for the route to the flow destination IP address associated with the flow (only displayed with the raw (all) output).
(Src) AS	Displays the ASN associated with the route to the flow source IP address associated with the flow (only displayed with the raw (all) output).
(Dst) AS	Displays the ASN associated with the route to the flow destination IP address associated with the flow (only displayed with the raw (all) output).
vRtr-ID	Displays the Virtual Router ID associated with the reported IP flow (only displayed with the raw (all) output).

Parameters **aggregate** — Displays the aggregated active cache flow data.

Values **src-dst-proto** — Aggregates the active flow cache based on the source and destination IP address and the IP protocol value.

src-dst-proto-port — Aggregates the active flow cache based on the source and destination IP address, IP protocol value, and the source and destination port numbers.

family — Specifies which IP address family flow data should be displayed.

Values **ipv4** — Displays the IPv4 flow data.

ipv6 — Displays the IPv6 flow data.

all — Displays the raw active cache flow data with no aggregation.

packet-size

Syntax **packet-size** *protocol* [**clear**]

Context tools>dump>cflowd

Description This command displays packet size distribution for sampled IP traffic. Values are displays in decimal format (1.0 = 100%, .500 = 50%). Separate statistics are maintained and shown for IPv4 and IPv6 traffic.

Output The following output is an example of cflowd packet size information.

Sample Output

```
SR-12# tools dump cflowd packet-size ipv4
IP packet size distribution (801600 total packets):
  1-32   64   96  128  160  192  224  256  288  320  352  384  416  448  480
  .000 .250 .000 .000 .010 .100 .500 .090 .000 .000 .000 .000 .000 .000
                                     512  544  576 1024 1536 2048 2560 3072 3584 4096 4608 9000
                                     .000 .000 .000 .050 .000 .000 .000 .000 .000 .000 .000 .000
```

top-flows

Syntax **top-flows** *protocols* [**clear**]

Context tools>dump>cflowd

Description This command displays the top 20 (highest traffic volume) flows for IPv4, IPv6 or MPLS traffic types collected since the cflowd top-flow table was last cleared or initialized.

Output The following output is an example of cflowd top flow information, and [Table 102](#) describes the output fields.

Sample Output

```
1           2           3           4           5           6           7           8
1234567890123456789012345678901234567890123456789012345678901234567890
Sr1# tools dump cflowd top-flows ipv4
```



```

Ingress i/f   SrcIP      Egress i/f   DstIP      Pr  TOS  Flgs  Pkts
vRtr-ID      S-Port  Msk AS      D-Port  Msk AS      NextHop      Avg Pkt Size Active
-----
1000          52.52.52.1      2001          123.123.123.122 0x01 55   0x10 3748
10201         0000   /8  50          0000 /8  40   202.120.130.2   220   3600
.....

      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
Sr1# tools dump cflowd top-flows ipv6
SrcIP (up to IPv6)      Ingress i/f   Src Port   vRtr ID   ToS
DstIP (upto IPv6)      Egress i/f   Dst Port   Proto     Flags
Nextthop (uptoIPv6)      Total Pkts   Avg Pkt   Active(sec)
2001:0db8:85a3:0000:0000:8a2e:0370:7334  60005        10020        0        0x12
2001:0db8:85a3:0000:0000:8a2e:0280:1234  60325        20010        17        0x23
2001:0db8:85a3:0000:0000:8a2e:1234:5678 1234567890   1500        13600
.....

      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
Sr1# tools dump cflowd top-flows mpls
Label-1   Label-2   Label-3   Label-4   Total Pkts   Avg Pkt   Active(s)
SrcIP (up to IPv6)      Ingress i/f   Src Port   ToS
DstIP (upto IPv6)      Egress i/f   Dst Port   Proto     Flags
-----

```

Table 102 Tools Dump cflowd Top-flows Out put Fields

Label	Description
Ingress	Displays the ingress interface ID.
Src IP	Displays the source IP address of the flow (IPv4 or IPv6).
Egress	Displays the egress interface ID.
Dest IP	Displays the destination IP address of the flow (IPv4 or IPv6).
Pr Proto	Displays the protocol type for flow.
TOS	Displays the Type of Service/DSCP butts filed markings.
Flgs	Displays the protocol flag markings.
Pkts	Displays the total number of packets sampled for this flow (since stats were last cleared).
vRtr-ID	Displays the vRouter context the flow was sample in.
S-Port Src Port	Displays the source protocol port number.
Msk	Displays the route prefix length for route to source IP address.

Table 102 Tools Dump cflowd Top-flows Out put Fields (Continued)

Label	Description
AS	Displays the Autonomous Systems number for the source route (the AS is either originating AS or peer AS depending on cflowd configuration).
D-Port Dst Port	Displays the destination protocol port number.
Msk	Displays the route prefix length for route to destination IP address (Forwarding route).
AS	Displays the Autonomous Systems number for the destination route (the AS is either originating AS or peer AS depending on cflowd configuration)
Nexthop	Displays the next-hop address used to forward traffic associated with the flow.
Avg pkt size	Displays the average packet size of a sampled traffic associated with this flow (total number of packets sampled/total number of packets sampled).
Active	Displays the number of seconds the flow has been active.

top-protocols

Syntax `top-protocols protocols [clear]`

Context `tools>dump>cflowd`

Description This command displays the summary information for the top 20 protocol traffic seen in the cflowd cache. All statistics are calculated based on the data collected since the last clearing of the cflowd stats with clear keyword for this command.

If the **clear** optional keyword is given, then the top-flows are displayed, and then this cache is cleared.

Output The following output is an example of cflowd top protocol traffic information, and [Table 103](#) describes the output fields.

Sample Output

```
SR# tools dump cflowd top-protocols
```

```
The top 20 IPv4 protocols seen by cflowd are:
  Current Time: 08/29/2011 15:36:15
Last Cleared Time: 08/29/2011 15:35:08
```

Protocol ID -----	Total Flows	Flows /Sec	Packets /Flow	Bytes /Pkt	Packets /Sec	Duration /Flow	% Total Bandwidth
UDP	2	0	6	100	0	6	75%
pr1	1	0	6	64	0	6	24%
TOTALS	3	0	6	88	0	6	100%

Table 103 Tools Dump cflowd Top-protocols Fields

Label	Description
Protocol ID	Displays the IPv4 or IPv6 protocol type. This will either print the well-known protocol name or the decimal protocol number.
Total Flows	Displays the total number of flows recorded since the last clearing of cflowd statistics with this protocol type.
Flows/Sec	Displays the average number of flows detected for the associated protocol type. (Total flows/number of seconds since last clear)
Packets/Flow	Displays the average number of packets per flow. (Total number of packets/total flows)
Bytes/Pkts	Displays the average number of bytes per packet for the associated protocol type. (Total number of bytes for the associated protocol/total number of packets seen for the associated protocol)
Packets/Sec	Displays the average number of packets seen for the associated protocol type. (Number of packets/time since last clear)
Duration/Flow	Displays the average lifetime of a flow for the associated protocol type. (Number of seconds since last clear/total flows)
Bandwidth Total (%)	Displays the percentage of bandwidth consumed by the associated protocol type. (Total protocol bytes/total bytes of all flows)

6.7.2.3 Clear Commands

cflowd

Syntax	cflowd
Context	clear
Description	This command clears the raw and aggregation flow caches which are sending flow data to the configured collectors. This action will trigger all the flows to be discarded. The cache restarts flow data collection from a fresh state. This command also clears global stats collector stats listed in the cflowd show commands.

7 gRPC-based RIB API

7.1 RIB/FIB API Overview

Each router stores information about how to forward IP and MPLS packets in a set of RIB (routing information base) and FIB (forwarding information base) tables. These tables are conventionally populated by the management plane of the router (static entries) and by control plane protocols such as BGP, OSPF, ISIS, RSVP, LDP or segment routing.

In some SDN (Software Defined Networking) use cases, it may be useful to augment the RIB/FIB state held by a router to also include forwarding entries programmed by an external controller. SR OS supports a powerful and flexible gRPC-based RIB API service for this purpose. Using gRPC between a controller (gRPC client) and a router (gRPC server) has many benefits:

- gRPC is open source, with broad industry support and a rich ecosystem of tools and applications.
- gRPC is fast and efficient. The combination of HTTP/2 and protocol buffers ensures that a minimum number of bytes are sent across the wire as part of an RPC.
- gRPC is supported by many languages and platforms, including C, C++, C#, Go, Java, Node.js, Python, and Ruby.

To build a gRPC client that implements the RIB API service you must obtain, from Nokia, the protobuf definition file for the Nokia SR OS RIB API service. This protobuf file defines a RIB API service and its supported RPCs. The RIB API service supports one bidirectional streaming RPC called *Modify* and one unary RPC called *GetVersion*. The *Modify* RPC is used to add, delete or replace entries in any of the following RIB/FIB tables:

- IPv4 route table of the base router
- IPv6 route table of the base router
- IPv4 tunnel table
- IPv6 tunnel table
- MPLS label forwarding table

The *GetVersion* RPC allows the client to request the overall RIB API version and the individual RIB table versions supported by the router.

For maximum programming flexibility and speed, the entries added by the RIB-API service are not processed or stored as configuration data; they are provided directly to the control plane and modeled as though learned from a pseudo-protocol. RIB-API entries have the same persistence characteristics as protocol routes: if a router (gRPC server) detects that a gRPC client has disconnected or terminated its RPC, or if the router reboots, dependent RIB API entries are removed and must be re-programmed if persistence is required.

A gRPC client cannot delete entries it does not own, including routes from other protocols, but it can supersede routes from other sources through appropriate programming of preference values.

A gRPC client can read RIB/FIB entries programmed using the RIB API service (by any client) and obtain other state information that it needs using the gNMI management interface. gNMI is another gRPC-based service supported by the router and it supports RPCs for configuration, one-time state retrieval and telemetry state subscriptions. The same client can have active gNMI and RIB API RPCs with the same target router and at the same time using the same TCP connection.

7.2 RIB/FIB API Fundamentals

The *Modify* RPC allows a gRPC client to add, modify or delete RIB/FIB entries. To accomplish this, the client sends a stream of *ModifyRequest* messages to the server (router) and receives, in return, a stream of *ModifyResponse* messages. Each *ModifyRequest* message can include multiple *Request* messages. Each *Request* message has a 64-bit ID (used to pair it with a *Response* message) and conveys one of the following instructions:

- A request to **add** an entry to one of the five supported RIB/FIB tables. The add operation requires the client to specify values for all parameters of the route, tunnel or label entry being programmed. If the add operation is successful, the RIB/FIB entry is considered owned by the client that carried out the transaction.
- A request to **replace** an entry in one of the five supported RIB/FIB tables. This operation completely replaces a RIB/FIB entry that was previously programmed by the same client. All the parameters of the new route, tunnel or label entry must be specified, even values that did not change from the previous entry.
- A request to **delete** an entry in one of the five supported RIB/FIB tables. This operation deletes a RIB/FIB entry that was previously programmed by the same client. The delete operation requires only the key values of the entry that should be deleted.
- An **end-of-rib** marker for one of the five supported RIB/FIB tables. This operation is used to accelerate the removal of stale entries associated with a RIB/FIB table, rather than waiting for purge timers to expire. Additional details are discussed in this chapter.
- A **next-hop-switch** instruction. The client sends this request in order to manually activate the primary or backup next hop associated with a specific next-hop-group of a specific tunnel or label entry. This might be done to facilitate a maintenance action or to manually revert traffic back to a primary next hop after it recovers from a failure that diverted traffic to a backup next hop.

The following general points should be noted:

- The router does not support multiple RIB API RPC sessions with the same client IP. If a client machine has multiple independent controllers, they need to interact with the router using different IP addresses.
- It is up to the client to choose a unique 64-bit identifier for each *Request* transaction, but Request IDs must increase throughout the lifetime of the RPC session.
- If a gRPC client omits any parameter that is considered mandatory by the server side, the router assumes that the intended value for the parameter is zero (0). This may cause an error if the zero value is invalid or unavailable.

- A status code of OK sent by the router to a client (in a *ModifyResponse* message) only indicates that the request was valid. In the case of an add/delete/modify operation, it does not mean that the FIB was actually modified and in the case of a next-hop-switchover it does not mean that the switchover has actually occurred.
- A RIB/FIB entry programmed by a gRPC client may be unusable because none of its next hops are resolvable or the requested label resources are not available. The entry is still accepted by the router and acknowledged with an OK status code response to the client. If at a later time the entry becomes usable, it will be activated by the router automatically.

7.2.1 RIB/FIB API Entry Persistence

All states created by the RIB API service are ephemeral. In other words, when the router reboots, none of the API-programmed entries are preserved. The necessary entries must be reprogrammed by a gRPC client in the same way that BGP routes must be relearned from BGP peers after a reboot.

The persistence of a programmed RIB/FIB entry also depends on the liveness of the RPC session with the client that owns the entry, and this in turn depends on the liveness of the underlying TCP connection. If the TCP connection with a client goes down (due to link and/or router failures, client failure, or CPM switchover by the router) the router starts a purge timer for all affected clients and marks their owned RIB/FIB entries as stale. When a client's purge timer expires all of its stale entries are removed. While a purge timer is running, the associated stale entries remain valid and usable for forwarding but are less preferred than any non-stale entry. The purge timer gives an opportunity for the disconnected client or some other client to re-program the necessary RIB/FIB tables so that forwarding continues uninterrupted.

Detection of TCP connection failures by the router (gRPC server) can be assisted by enabling TCP **keepalive** on the gRPC TCP connections. When it is enabled, TCP keepalive messages are sent to all gRPC clients, regardless of the RPCs they support (gNMI or RIB API).

On the router, TCP **keepalive** is configured by specifying 3 parameters: *idle-time*, *interval*, and *retries*. These parameters are configured in the **config>system>grpc>tcp-keepalive** context. The sending of TCP keepalives starts when the connection has been idle (no TCP segments sent or received) for more than **idle-time** seconds. At that point the router sends a probe (TCP ACK with a sequence number = current sequence number - 1) and expects a TCP ACK. It repeats this probe every **interval** seconds for the configured number of **retries** and if no response is received to any of them the connection is immediately closed, starting the purge timer if the TCP connection is supporting a Modify RPC.

When a client is done programming all entries in a particular RIB/FIB table it can optionally send an **end-of-rib** request for that table in order to immediately remove all stale RIB entries associated with that table, regardless of the owner client IP.

7.3 RIB/FIB API Configuration Overview

Configuration related to the RIB/FIB API service on the router is spread across two general areas:

- system-level gRPC configuration (**config>system>grpc** or **config>system>security>profile>grpc**)
- routing instance configuration (**config>router** or **config>service>vprn**)

To enable the router to receive and process RIB API requests from a client:

1. The RIB API service must be enabled at the gRPC system level:
config>system>grpc>rib-api>no shutdown.
2. Optionally, a non-zero purge-timeout can be configured:
config>system>grpc>rib-api>purge-timeout. The purge-timeout applies to all gRPC clients participating in the RIB API service.
3. Optionally, the sending of TCP keepalives can be enabled towards all gRPC clients by configuring values under the **config>system>grpc>tcp-keepalive** context.
4. One or more gRPC user accounts should be created, and these user accounts should be attached to a profile that authorizes the *GetVersion* and *Modify* RPCs associated with the RIB API service. Clients need to send a valid username and password when initiating any RPC.
5. Nokia recommends using TLS-based encryption between the client and server. This involves associating a **tls-server-profile** with the gRPC server. For more information, refer to the *System Management Guide*.
6. If you want to use the RIB API service to program MPLS label entries then a **reserved-label-block** must be configured using the **config>router>rib-api>mpls>reserved-label-block** command and MPLS programming functionality must be enabled using the **config>router>rib-api>mpls>no shutdown** command.

To enable the router to use RIB API tunnel entries for resolving certain types of static and BGP routes, additional configuration is needed. For more information, refer to the *Unicast Routing Protocols Guide*.

7.4 RIB/FIB API - IPv4 Route Table Programming

The RIB API service proto definition requires the client to provide values for all of the parameters listed in [Table 104](#) when performing an **add** or **replace** of an IPv4 route. When performing a **delete** operation, only the bolded parameters (the lookup keys) are required. [Table 104](#) describes the meaning of each parameter and its valid range.

Table 104 IPv4 Route Table Programming

Parameter	Type	Description
prefix	string	IPv4 prefix and prefix-length in CIDR format
preference	uint32 (0-65535)	RIB API preference, used to compare one RIB API entry to another one. The lowest preference wins.
rtm_preference	uint32 (0-255)	RTM preference, used to compare RIB API entry to other routes in RTM. The lowest preference wins.
metric	uint32 (0-16777215)	Route cost/metric
tunnel_next_hop	string	A remote IPv4 address that must correspond to an API-programmed IPv4 tunnel

The router's RIB API database can hold up to eight different gRPC-programmed entries per IPv4 prefix. Typically N entries would be associated with N different gRPC clients although the same client can program multiple entries for the same prefix as long as the preference values are unique.

When an IPv4 route entry is successfully added or modified in the RIB API database, the router assesses whether the entry is valid or invalid and constantly re-evaluates this status. The entry is invalid if its next hop cannot be resolved to a gRPC-programmed IPv4 tunnel that is up.

If the entry is valid, the router compares it to all other valid API-programmed entries for the same IPv4 prefix. The router chooses any non-stale entry over a stale entry, then the entry with the lowest preference value, and then if there is a tie, the lowest metric, and then if there is a still a tie, the entry from the client with the lowest 128-bit IP address (an IPv4 address is encoded in the lower 32 bits).

If the entry is valid and the best relative to other RIB API entries then it is submitted to the route table manager. This software task compares the API route to all other non-API routes it has for the same IPv4 prefix. The router chooses the entry with the lowest RTM preference value, and then if there is a tie, the lowest metric, and then if there is still a tie, the entry submitted by the protocol with the lowest default preference.

If the route table manager selects the API route as the best route it is sent to the FIB manager for programming into the datapath.

7.5 RIB/FIB API - IPv6 Route Table Programming

The RIB API service proto definition requires the client to provide values for all of the parameters listed in [Table 105](#) when performing an **add** or **replace** of an IPv6 route. When performing a **delete** operation, only the bolded parameters (the lookup keys) are required. [Table 105](#) describes the meaning of each parameter and its valid range.

Table 105 IPv6 Route Table Programming

Parameter	Type	Description
prefix	string	IPv6 prefix and prefix-length in CIDR format
preference	uint32 (0-65535)	RIB API preference, used to compare one RIB API entry to another one. The lowest preference wins.
rtm_preference	uint32 (0-255)	RTM preference, used to compare RIB API entry to other routes in RTM. The lowest preference wins.
metric	uint32 (0-16777215)	Route cost/metric
tunnel_next_hop	string	A remote IPv6 address that must correspond to an API-programmed IPv6 tunnel

The router's RIB API database can hold up to eight different gRPC-programmed entries per IPv6 prefix. Typically N entries would be associated with N different gRPC clients although the same client can program multiple entries for the same prefix as long as the preference values are unique.

When an IPv6 route entry is successfully added or modified in the RIB API database, the router assesses whether the entry is valid or invalid and constantly re-evaluates this status. The entry is invalid if its next hop cannot be resolved to a gRPC-programmed IPv6 tunnel that is up.

If the entry is valid, the router compares it to all other valid API-programmed entries for the same IPv6 prefix. The router chooses any non-stale entry over a stale entry, then the entry with the lowest preference value, and then if there is a tie, the lowest metric, and then if there is a still a tie, the entry from the client with the lowest 128-bit IP address (an IPv4 address is encoded in the lower 32 bits).

If the entry is valid and the best relative to other RIB API entries then it is submitted to the route table manager. This software task compares the API route to all other non-API routes it has for the same IPv6 prefix. The router chooses the entry with the lowest RTM preference value, and then if there is a tie, the lowest metric, and then if there is still a tie, the entry submitted by the protocol with the lowest default preference.

If the route table manager selects the API route as the best route it is sent to the FIB manager for programming into the datapath.

7.6 RIB/FIB API - IPv4 Tunnel Table Programming

The RIB API service proto definition requires the client to provide values for all of the parameters listed in [Table 106](#) when performing an **add** or **replace** of an IPv4 MPLS tunnel. When performing a **delete** operation, only the bolded parameters (the lookup keys) are required. [Table 106](#) describes the meaning of each parameter and its valid range.

Table 106 IPv4 Tunnel Table Programming

Parameter	Type	Description
prefix	string	IPv4 host address
preference	uint32 (0-65535)	RIB API preference, used to compare one RIB API entry to another one. The lowest preference wins.
ttm_preference	uint32 (0-255)	TTM preference, used in the programming of the tunnel in TTM
metric	uint32 (0-16777215)	Route cost/metric
next-hop-group[id]	list	A list of next-hop groups.
id	uint32 (1-32)	Unique identifier of the next-hop group. Selected by the client.
weight	uint32	Weight assigned to the next-hop-group when weighted ECMP is desired between next-hop-groups.
primary		Mandatory
ip_address	string	IPv4 or IPv6 address on a local subnet. Can be a secondary address.
pushed_label_stack	list of uint32	A list of one or more MPLS labels, up to ten MPLS labels.
backup		Optional
ip_address	string	IPv4 or IPv6 address on a local subnet. Can be a secondary address.
pushed_label_stack	list of uint32	A list of up to ten MPLS labels.

The router's RIB API database can hold up to eight different gRPC-programmed entries per IPv4 tunnel endpoint. Typically N entries would be associated with N different gRPC clients although the same client can program multiple entries for the same tunnel endpoint as long as the preference values are unique

When an IPv4 tunnel endpoint entry is successfully added or modified in the RIB API database, the router assesses whether the entry is valid or invalid and constantly re-evaluates this status. The tunnel is invalid if none of its primary next hops can be resolved to an interface that is up or if MPLS programming using the RIB API is currently administratively disabled.

If the IPv4 tunnel entry is valid the router compares it to all other valid API-programmed entries for the same IPv4 endpoint address. The router chooses any non-stale entry over a stale entry, then the entry with the lowest preference value, and then if there is a tie, the lowest metric, and then if there is a still a tie, the entry from the client with the lowest 128-bit IP address (an IPv4 address is encoded in the lower 32 bits).

If the entry is valid and the best relative to other RIB API entries then it is programmed into the FIB and added to the base router IPv4 tunnel table. The tunnel entry is now active and can be used to resolve the next hops of other routes. For more information, refer to the *Unicast Routing Protocols Guide*.

7.7 RIB/FIB API - IPv6 Tunnel Table Programming

The RIB API service proto definition requires the client to provide values for all of the parameters listed in [Table 107](#) when performing an **add** or **replace** of an IPv6 MPLS tunnel. When performing a **delete** operation, only the bolded parameters (the lookup keys) are required. [Table 107](#) describes the meaning of each parameter and its valid range.

Table 107 IPv6 Tunnel Table Programming

Parameter	Type	Description
prefix	string	IPv6 host address
preference	uint32 (0-65535)	RIB API preference, used to compare one RIB API entry to another one. The lowest preference wins.
ttm_preference	uint32 (0-255)	TTM preference, used in the programming of the tunnel in TTM
metric	uint32 (0-16777215)	Route cost/metric
next-hop-group[id]	list	A list of next-hop groups.
id	uint32 (1-32)	Unique identifier of the next-hop group. Selected by the client.
weight	uint32	Weight assigned to the next-hop-group when weighted ECMP is desired between next-hop-groups.
primary		Mandatory
ip_address	string	IPv4 or IPv6 address on a local subnet. Can be a secondary address.
pushed_label_stack	list of uint32	A list of one or more MPLS labels, up to ten MPLS labels.
backup		Optional
ip_address	string	IPv4 or IPv6 address on a local subnet. Can be a secondary address.
pushed_label_stack	list of uint32	A list of up to ten MPLS labels.

The router's RIB API database can hold up to eight different gPRC-programmed entries per IPv6 tunnel endpoint. Typically N entries would be associated with N different gRPC clients although the same client can program multiple entries for the same tunnel endpoint as long as the preference values are unique.

When an IPv6 tunnel endpoint entry is successfully added or modified in the RIB API database, the router assesses whether the entry is valid or invalid and constantly re-evaluates this status. The tunnel is invalid if none of its primary next hops can be resolved to an interface that is up or if MPLS programming using the RIB API is currently administratively disabled.

If the IPv6 tunnel entry is valid the router compares it to all other valid API-programmed entries for the same IPv6 endpoint address. The router chooses any non-stale entry over a stale entry, then the entry with the lowest preference value, and then if there is a tie, the lowest metric, and then if there is a still a tie, the entry from the client with the lowest 128-bit IP address (an IPv4 address is encoded in the lower 32 bits).

If the entry is valid and the best relative to other RIB API entries then it is programmed into the FIB and added to the base router IPv6 tunnel table. The tunnel entry is now active and can be used to resolve the next hops of other routes. For more information, refer to the *Unicast Routing Protocols Guide*.

7.8 RIB/FIB API - MPLS LFIB Programming

The RIB API service proto definition requires the client to provide values for all of the parameters listed in [Table 108](#) when performing an **add** or **replace** of an MPLS LFIB entry. When performing a **delete** operation, only the bolded parameters (the lookup keys) are required. [Table 108](#) describes the meaning of each parameter and its valid range.

Table 108 MPLS LFIB Programming

Parameter	Type	Description
prefix	string	Incoming label value
preference	uint32 (0-65535)	RIB API preference, used to compare one RIB API entry to another one. The lowest preference wins.
next-hop-group[id]	list	A list of next-hop groups. Required for a SWAP operation. Omitted when the operation is a POP.
id	uint32 (1-32)	Unique identifier of the next-hop group. Selected by the client.
weight	uint32	Weight assigned to the next-hop-group when weighted ECMP is desired between next-hop-groups.
primary		Mandatory
ip_address	string	IPv4 or IPv6 address on a local subnet. Can be a secondary address.
pushed_label_stack	list of uint32	A list of zero or more MPLS labels, up to ten MPLS labels.
backup		Optional
ip_address	string	IPv4 or IPv6 address on a local subnet. Can be a secondary address.
pushed_label_stack	list of uint32	A list of up to ten MPLS labels.
ingress-statistics	--	--
enable	bool	--
type	enum 0, 1, 2	INVALID = 0 POP = 1 SWAP = 2

The router's RIB API database can hold up to eight different gPRC-programmed entries per MPLS label value. Typically N entries would be associated with N different gRPC clients although the same client can program multiple entries for the same label value as long as the preference values are unique.

When an MPLS label entry is successfully added or modified in the RIB API database, the router assesses whether the entry is valid or invalid and constantly re-evaluates this status. The label entry is invalid if it is a SWAP operation and none of the primary next hops can be resolved to an interface that is up or if MPLS programming using the RIB API is administratively disabled or if the requested incoming label has already been allocated to another owner sharing the same reserved label block or if the requested incoming label is outside the reserved label block range.

If the label entry is valid the router compares it to all other valid API-programmed entries for the same label value. The router chooses any non-stale entry over a stale entry, then the entry with the lowest preference value, and then if there is a tie, the entry from the client with the lowest 128-bit IP address (an IPv4 address is encoded in the lower 32 bits).

If the label entry is valid and best relative to other RIB API entries then it is programmed into the forwarding plane.

7.9 RIB/FIB API - Using Next-Hop-Groups, Primary Next Hops, and Backup Next Hops

The RIB API service proto definition allows each MPLS tunnel and each MPLS label entry to have multiple next-hop-groups, each with a primary next hop and optionally one backup next hop. When a tunnel or label entry has more than one next-hop-group, this instructs the router to spray matching traffic across the next-hop-groups based on an ECMP or weighted-ECMP algorithm.

At any time, traffic hashed to a particular next-hop-group uses only the primary or backup next hop for forwarding. The selection of the active next hop within each next-hop-group is influenced by failures and by **next-hop-switch** *Request* messages made by the owner gRPC client. The specific rules are:

- If the primary next hop is resolved to an up interface when the next-hop-group is initially activated then it immediately becomes the active next hop.
- If the primary next hop is unresolved when the next-hop-group is initially activated then no next hop is immediately activated (even if the backup next hop is up) and a fixed wait-timer is started (three seconds). If the primary next hop comes up during that timer window then it is immediately activated. If the timer runs out and the primary has not yet come up the backup next hop is activated and stays active even if the primary comes up a short while later, after the timer expired.
- If the currently active next hop fails, the system automatically activates the other next hop.
- If the system receives a **next-hop-switch** *Request* targeting this specific entry and next-hop-group then the next hop indicated in the *Request* message is immediately activated, as long as it is up. If the requested next hop is down the message is ignored.



Note: The router returns a status of OK in response to a **next-hop-switch** *Request* as long as the key values identify a next-hop-group that exists for a tunnel or label entry owned by the gRPC client, even if the desired next hop is not activated.

7.10 RIB/FIB API - State and Telemetry

A gRPC client can use the gRPC gNMI service (Get RPC, Subscribe RPC) to retrieve state information from the router that can help it make better programming decisions. All states maintained by the router (and exposed to model-driven management interfaces) are available to the gRPC client.

RIB/FIB API also introduces additional YANG state models that are complementary to the programming actions. This new state is available through the following YANG paths:

- state/router/route-fib
- state/router/tunnel-fib
- state/router/label-fib
- state/router/rib-api/route
- state/router/rib-api/tunnel
- state/router/rib-api/label

The corresponding **show** commands are also provided for reference.

- **show router fib-telemetry route**
- **show router fib-telemetry tunnel**
- **show router fib-telemetry label**
- **show router rib-api route**
- **show router rib-api tunnel**
- **show router rib-api label**

The state information represented by the state/router/route-fib and state/router/tunnel-fib paths, and the **show router fib-telemetry route** and **show router fib-telemetry tunnel** show commands list are not collected by default, since it requires additional processing. In order for this state to be collected you must configure the **configure router fib-telemetry** command. If this command is not configured then these states are not collected at all, and telemetry subscriptions are not supported for any of the following paths:

- /state/router/route-fib
- /state/router/tunnel-fib
- /state/router/label-fib

It is not possible for a single telemetry subscription to include any of these three paths in addition to other state paths outside of this tree. This is because of the potential volume of information in the tables described in this chapter.

For gNMI telemetry subscriptions, the following restrictions should be noted:

- If a route, tunnel or MPLS label entry is modified, and it covered by an ON-CHANGE subscription to a state path enabled by **config>router>fib-telemetry**, the update replays the current values of the entire entry (except for statistics), including values did not change from the last update. It is up to the client to compare the update to the previous one received if it needs to know the exact properties that changed.
- Subscriptions to list keys of state paths enabled by **fib-telemetry** are not supported.

8 Standards and Protocol Support



Note: The information presented is subject to change without notice.

Nokia assumes no responsibility for inaccuracies contained herein.

Access Node Control Protocol (ANCP)

draft-ietf-ancp-protocol-02, *Protocol for Access Node Control Mechanism in Broadband Networks*

RFC 5851, *Framework and Requirements for an Access Node Control Mechanism in Broadband Multi-Service Networks*

Application Assurance (AA)

3GPP Release 12 (ADC rules over Gx interfaces)

RFC 3507, *Internet Content Adaptation Protocol (ICAP)*

Asynchronous Transfer Mode (ATM)

AF-ILMI-0065.000, *Integrated Local Management Interface (ILMI) Version 4.0*

AF-PHY-0086.001, *Inverse Multiplexing for ATM (IMA) Specification Version 1.1*

AF-TM-0121.000, *Traffic Management Specification Version 4.1*

AF-TM-0150.00, *Addendum to Traffic Management v4.1 optional minimum desired cell rate indication for UBR*

GR-1113-CORE, *Asynchronous Transfer Mode (ATM) and ATM Adaptation Layer (AAL) Protocols Generic Requirements, Issue 1*

GR-1248-CORE, *Generic Requirements for Operations of ATM Network Elements (NEs), Issue 3*

ITU-T I.432.1, *B-ISDN user-network interface - Physical layer specification: General characteristics (02/99)*

ITU-T I.610, *B-ISDN operation and maintenance principles and functions (11/95)*

RFC 1626, *Default IP MTU for use over ATM AAL5*

RFC 2684, *Multiprotocol Encapsulation over ATM Adaptation Layer 5*

Bidirectional Forwarding Detection (BFD)

RFC 5880, *Bidirectional Forwarding Detection (BFD)*

RFC 5881, *Bidirectional Forwarding Detection (BFD) IPv4 and IPv6 (Single Hop)*

RFC 5883, *Bidirectional Forwarding Detection (BFD) for Multihop Paths*

RFC 7130, *Bidirectional Forwarding Detection (BFD) on Link Aggregation Group (LAG) Interfaces*

Border Gateway Protocol (BGP)

draft-hares-idr-update-attr-low-bits-fix-01, *Update Attribute Flag Low Bits Clarification*

draft-ietf-idr-add-paths-guidelines-08, *Best Practices for Advertisement of Multiple Paths in IBGP*

draft-ietf-idr-best-external-03, *Advertisement of the best external route in BGP*

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draft-ietf-idr-bgp-gr-notification-01, *Notification Message support for BGP Graceful Restart*

draft-ietf-idr-bgp-optimal-route-reflection-10, *BGP Optimal Route Reflection (BGP-ORR)*

draft-ietf-idr-error-handling-03, *Revised Error Handling for BGP UPDATE Messages*

draft-ietf-idr-flowspec-interfaceset-03, *Applying BGP flowspec rules on a specific interface set*

draft-ietf-idr-flowspec-path-redirect-05, *Flowspec Indirection-id Redirect (localised ID)*

draft-ietf-idr-flowspec-redirect-ip-02, *BGP Flow-Spec Redirect to IP Action*

draft-ietf-idr-link-bandwidth-03, *BGP Link Bandwidth Extended Community*

draft-ietf-sidr-origin-validation-signaling-04, *BGP Prefix Origin Validation State Extended Community*

draft-uttaro-idr-bgp-persistence-03, *Support for Long-lived BGP Graceful Restart*

RFC 1772, *Application of the Border Gateway Protocol in the Internet*

RFC 1997, *BGP Communities Attribute*

RFC 2385, *Protection of BGP Sessions via the TCP MD5 Signature Option*

RFC 2439, *BGP Route Flap Damping*

RFC 2545, *Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing*

RFC 2858, *Multiprotocol Extensions for BGP-4*

RFC 2918, *Route Refresh Capability for BGP-4*

RFC 3107, *Carrying Label Information in BGP-4*

RFC 3392, *Capabilities Advertisement with BGP-4*

RFC 4271, *A Border Gateway Protocol 4 (BGP-4)*

RFC 4360, *BGP Extended Communities Attribute*

RFC 4364, *BGP/MPLS IP Virtual Private Networks (VPNs)*

RFC 4456, *BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)*

RFC 4486, *Subcodes for BGP Cease Notification Message*
RFC 4659, *BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN*
RFC 4684, *Constrained Route Distribution for Border Gateway Protocol/
MultiProtocol Label Switching (BGP/MPLS) Internet Protocol (IP) Virtual
Private Networks (VPNs)*
RFC 4724, *Graceful Restart Mechanism for BGP (helper mode)*
RFC 4760, *Multiprotocol Extensions for BGP-4*
RFC 4798, *Connecting IPv6 Islands over IPv4 MPLS Using IPv6 Provider Edge
Routers (6PE)*
RFC 4893, *BGP Support for Four-octet AS Number Space*
RFC 5004, *Avoid BGP Best Path Transitions from One External to Another*
RFC 5065, *Autonomous System Confederations for BGP*
RFC 5291, *Outbound Route Filtering Capability for BGP-4*
RFC 5396, *Textual Representation of Autonomous System (AS) Numbers (asplain)*
RFC 5549, *Advertising IPv4 Network Layer Reachability Information with an IPv6
Next Hop*
RFC 5575, *Dissemination of Flow Specification Rules*
RFC 5668, *4-Octet AS Specific BGP Extended Community*
RFC 6286, *Autonomous-System-Wide Unique BGP Identifier for BGP-4*
RFC 6810, *The Resource Public Key Infrastructure (RPKI) to Router Protocol*
RFC 6811, *Prefix Origin Validation*
RFC 6996, *Autonomous System (AS) Reservation for Private Use*
RFC 7311, *The Accumulated IGP Metric Attribute for BGP*
RFC 7607, *Codification of AS 0 Processing*
RFC 7674, *Clarification of the Flowspec Redirect Extended Community*
RFC 7752, *North-Bound Distribution of Link-State and Traffic Engineering (TE)
Information Using BGP*
RFC 7854, *BGP Monitoring Protocol (BMP)*
RFC 7911, *Advertisement of Multiple Paths in BGP*
RFC 7999, *BLACKHOLE Community*
RFC 8092, *BGP Large Communities Attribute*
RFC 8212, *Default External BGP (EBGP) Route Propagation Behavior without
Policies*

Circuit Emulation

RFC 4553, *Structure-Agnostic Time Division Multiplexing (TDM) over Packet
(SAToP)*

RFC 5086, *Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN)*

RFC 5287, *Control Protocol Extensions for the Setup of Time-Division Multiplexing (TDM) Pseudowires in MPLS Networks*

Ethernet

IEEE 802.1AB, *Station and Media Access Control Connectivity Discovery*

IEEE 802.1ad, *Provider Bridges*

IEEE 802.1ag, *Connectivity Fault Management*

IEEE 802.1ah, *Provider Backbone Bridges*

IEEE 802.1ak, *Multiple Registration Protocol*

IEEE 802.1aq, *Shortest Path Bridging*

IEEE 802.1ax, *Link Aggregation*

IEEE 802.1D, *MAC Bridges*

IEEE 802.1p, *Traffic Class Expediting*

IEEE 802.1Q, *Virtual LANs*

IEEE 802.1s, *Multiple Spanning Trees*

IEEE 802.1w, *Rapid Reconfiguration of Spanning Tree*

IEEE 802.1X, *Port Based Network Access Control*

IEEE 802.3ab, *1000BASE-T*

IEEE 802.3ac, *VLAN Tag*

IEEE 802.3ad, *Link Aggregation*

IEEE 802.3ae, *10 Gb/s Ethernet*

IEEE 802.3ah, *Ethernet in the First Mile*

IEEE 802.3ba, *40 Gb/s and 100 Gb/s Ethernet*

IEEE 802.3i, *Ethernet*

IEEE 802.3u, *Fast Ethernet*

IEEE 802.3x, *Ethernet Flow Control*

IEEE 802.3z, *Gigabit Ethernet*

ITU-T G.8031/Y.1342, *Ethernet Linear Protection Switching*

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Ethernet VPN (EVPN)

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draft-ietf-bess-evpn-pref-df-01, *Preference-based EVPN DF Election*

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draft-ietf-bess-evpn-vpls-seamless-integ-03, *(PBB-)EVPN Seamless Integration with (PBB-)VPLS*
draft-snr-bess-pbb-evpn-isid-cmacflush-01, *PBB-EVPN ISID-based CMAC-Flush*
RFC 7432, *BGP MPLS-Based Ethernet VPN*
RFC 7623, *Provider Backbone Bridging Combined with Ethernet VPN (PBB-EVPN)*
RFC 8214, *Virtual Private Wire Service Support in Ethernet VPN*
RFC 8317, *Ethernet-Tree (E-Tree) Support in Ethernet VPN (EVPN) an Provider Backbone Bridging EVPN (PBB-EVPN)*
RFC 8365, *A Network Virtualization Overlay Solution Using Ethernet VPN (EVPN)*

Frame Relay

ANSI T1.617 Annex D, *DSS1 - Signalling Specification For Frame Relay Bearer Service*
FRF.1.2, *PVC User-to-Network Interface (UNI) Implementation Agreement*
FRF.12, *Frame Relay Fragmentation Implementation Agreement*
FRF.16.1, *Multilink Frame Relay UNI/NNI Implementation Agreement*
FRF.5, *Frame Relay/ATM PVC Network Interworking Implementation*
FRF2.2, *PVC Network-to-Network Interface (NNI) Implementation Agreement*
ITU-T Q.933 Annex A, *Additional procedures for Permanent Virtual Connection (PVC) status management*

Generalized Multiprotocol Label Switching (GMPLS)

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RFC 3471, *Generalized Multi-Protocol Label Switching (GMPLS) Signaling Functional Description*
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RFC 4204, *Link Management Protocol (LMP)*
RFC 4208, *Generalized Multiprotocol Label Switching (GMPLS) User-Network Interface (UNI): Resource ReserVation Protocol-Traffic Engineering (RSVP-TE) Support for the Overlay Model*
RFC 4872, *RSVP-TE Extensions in Support of End-to-End Generalized Multi-Protocol Label Switching (GMPLS) Recovery*

RFC 5063, *Extensions to GMPLS Resource Reservation Protocol (RSVP) Graceful Restart (helper mode)*

gRPC Remote Procedure Calls (gRPC)

gnmi.proto, *gRPC Network Management Interface (gNMI), version 0.4.0*

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