Cisco Catalyst 8500 and 8500L Series Edge Platforms Software Configuration Guide

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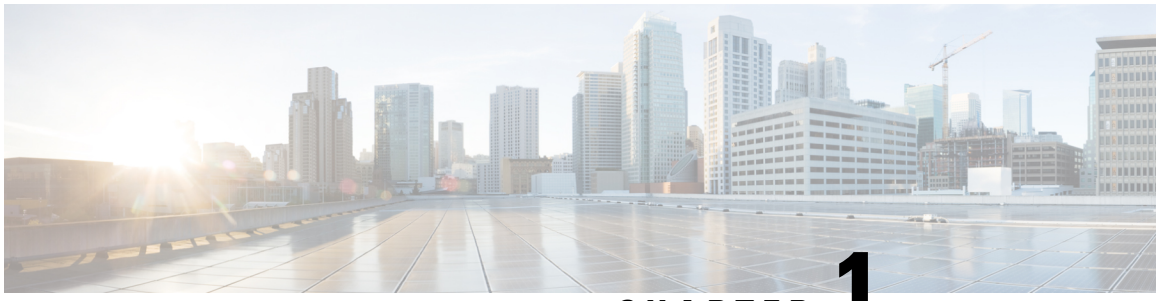


CHAPTER 1

Preface

This preface describes the objectives and organization of this document and explains how to find additional information on related products and services.

- Objectives, on page 1
- Document Revision History, on page 1
- Communications, Services, and Additional Information, on page 1

Objectives

This document provides an overview of software functionality that is specific to the Cisco Catalyst 8500 Series Edge (includes Cisco Catalyst 8500 platform and Cisco Catalyst 8500L Series platform). It is not intended as a comprehensive guide to all of the software features that can be run using the Cisco Catalyst 8500 Series Edge Platforms, but only the software aspects that are specific to this platform.

For information on general software features that are also available on the Cisco Catalyst 8500 Series Edge Platforms, see the Cisco IOS XE technology guide for that specific software feature.

Document Revision History

The Document Revision History records technical changes to this document. The table shows the Cisco IOS XE software release number and document revision number for the change, the date of the change, and a brief summary of the change.

Release No.	Date	Change Summary
IOS XE 17.4	March 17, 2021	Included information on Cisco Catalyst 8500L Series platform.
IOS XE 17.3.2	October 22, 2020	First release of the book.

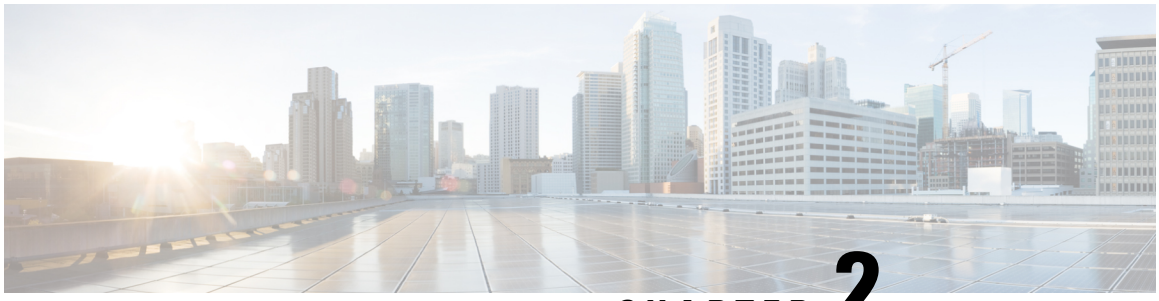
Communications, Services, and Additional Information

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.
- To get the business impact you're looking for with the technologies that matter, visit Cisco Services.

- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco Marketplace.
- To obtain general networking, training, and certification titles, visit Cisco Press.
- To find warranty information for a specific product or product family, access Cisco Warranty Finder.

Cisco Bug Search Tool

Cisco Bug Search Tool (BST) is a web-based tool that acts as a gateway to the Cisco bug tracking system that maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. BST provides you with detailed defect information about your products and software.



CHAPTER 2

Read Me First

Feature Information

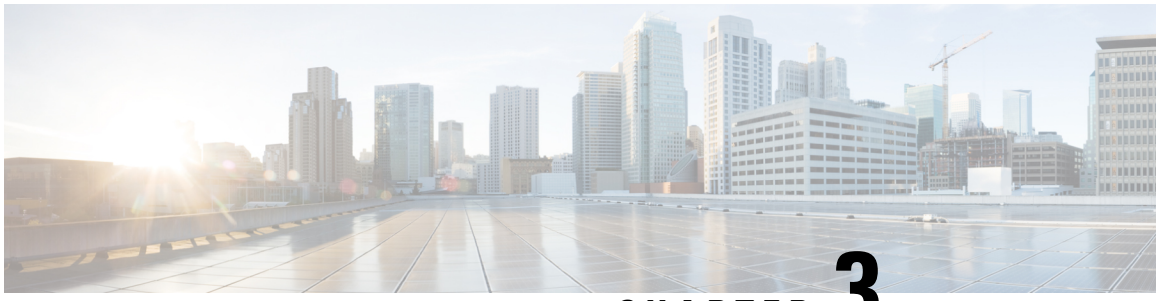
Use Cisco Feature Navigator to find information about feature support, platform support, and Cisco software image support. An account on Cisco.com is not required.

Related References

- Cisco IOS Command References, All Releases

Obtaining Documentation and Submitting a Service Request

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.
- To get the business impact you're looking for with the technologies that matter, visit Cisco Services.
- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco Marketplace.
- To obtain general networking, training, and certification titles, visit Cisco Press.
- To find warranty information for a specific product or product family, access Cisco Warranty Finder.



CHAPTER 3

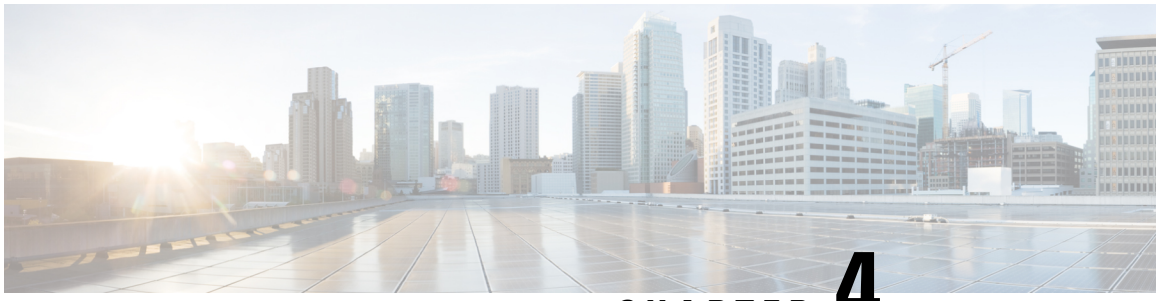
Overview

Cisco 8500 Series Catalyst Edge Platform significantly increases services performance, router throughput, and router scale at lower costs.

This document covers configuration details for the following models:

- Catalyst 8500 Platforms (C8500-12X4QC and C8500-12X)
- Catalyst 8500L Platform (C8500L-8S4X)

Features	C8500-12X4QC	C8500-12X	C8500L-8S4X
Support for In-Service Software Upgrade (ISSU)	Support exists	Support exists	Not supported
Data plane processing	QFP 3.0	QFP 3.0	Software-based
Support for Unified Threat Defense(UTD)	-	-	Support exists
Support for Fast Reroute(FRR)	Support exists	Support exists	Not supported



CHAPTER 4

Software Packaging and Architecture

The Cisco Catalyst 8500 Series Edge Platform (includes Cisco Catalyst 8500 platform and Cisco Catalyst 8500L Series platform) introduces a new software packaging model and architecture.

This chapter discusses this new packaging and architecture and contains the following sections:

- Software Packaging on the Cisco Catalyst 8500 Series Edge Platforms, on page 7
- Processes Overview, on page 10

Software Packaging on the Cisco Catalyst 8500 Series Edge Platforms

This section covers the following topics:

Cisco Catalyst 8500 Series Edge Platforms Software Overview

The Cisco Catalyst 8500 Series Edge Platforms are high-performance cloud edge platforms designed for accelerated services, multi-layer security, cloud-native agility, and edge intelligence to accelerate your journey to cloud.

Consolidated Packages

A consolidated package is a single image composed of individual software subpackage files. A single consolidated package file is a bootable file, and the Cisco Catalyst 8500 Series Edge Platforms can be run using the consolidated package.

Each consolidated package also contains a provisioning file. A provisioning file is used for booting in cases where the individual subpackages are extracted from the consolidated package, or optional subpackages are used to run the router. For additional information on the advantages and disadvantages of running a complete consolidated package, see the *Running the Cisco Catalyst 8500 Series Edge Platforms: An Overview*.

Important Information About Consolidated Packages

The important information about consolidated packages include:

- For each version of a consolidated package, the RPBase, RPControl, and ESPBase subpackages are identical among consolidated packages.

- For each version of consolidated package, the RPIOS subpackage is always different among consolidated packages.
- A consolidated package file is a bootable file. If the router is configured to run using the complete consolidated package, boot the router using the consolidated package file. If the router is configured to run using individual subpackages, boot the router using the provisioning file. For additional information on the advantages and disadvantages of running a complete consolidated package, see the *Running the Cisco Catalyst 8500 Series Edge Platforms: An Overview* section .
- If you need to install optional subpackages, then you must boot the router using the individual subpackage provisioning file method.

Individual Software SubPackages Within a Consolidated Package

This section provides an overview of the Cisco Catalyst 8500 Series Edge Platforms subpackages and the purpose of each individual subpackage. Every consolidated package will have all of these individual subpackages. To see additional information about each individual subpackages in a particular Cisco IOS XE release, see *Cisco IOS XE Release Notes* for that release.

Table 1: Individual SubPackages

SubPackage	Purpose
RPBase	Provides the operating system software for the Route Processor.
RPControl	Controls the control plane processes that interface between the IOS process and the rest of the platform.
RPAccess	Exports processing of restricted components, such as Secure Socket Layer (SSL), Secure Shell (SSH), and other security features.
RPIOS	Provides the Cisco IOS kernel, which is where IOS features are stored and run. Each consolidated package has a different RPIOS.
ESPBase	Provides the ESP operating system and control processes, and the ESP software.

Important Notes About Individual SubPackages

The important information about individual subpackage include:

- Individual subpackages cannot be downloaded from Cisco.com individually. To get these individual subpackages, users must download a consolidated package and then extract the individual subpackages from the consolidated package using the command-line interface.
- If the router is being run using individual subpackages instead of being run using a complete consolidated package, the router must be booted using a provisioning file. A provisioning file is included in all consolidated packages and is extracted from the image along with the individual subpackages whenever individual subpackages are extracted.

Provisioning Files

Note You must use the provisioning files to manage the boot process if you need to install optional subpackages.

Provisioning files manage the boot process when the Cisco Catalyst 8500 Series Edge Platforms is configured to run using individual subpackages or optional subpackages (such as the package for the Cisco WebEx Node Cisco Catalyst 8500 Series Edge Platforms Series). When individual subpackages are being used to run the Cisco Catalyst 8500 Series Edge Platforms, the router has to be configured to boot the provisioning file. The provisioning file manages the bootup of each individual subpackage and the Cisco Catalyst 8500 Series Edge Platform assumes normal operation.

Provisioning files are extracted automatically when individual subpackage files are extracted from a consolidated package.

Provisioning files are not necessary for running the router using the complete consolidated package; if you want to run the router using the complete consolidated package, simply boot the router using the consolidated package file.

Important Notes About Provisioning Files

The important information about provisioning files include:

- Each consolidated package contains two provisioning files. One of the provisioning files is always named “packages.conf”, while the other provisioning file will have a name based on the consolidated package naming structure. In any consolidated package, both provisioning files perform the exact same function.
- In most cases, the “packages.conf” provisioning file should be used to boot the router. Configuring the router to boot using this file is generally easier because the router can be configured to boot using “packages.conf”, so no changes have to be made to the boot statement when Cisco IOS XE is upgraded (the **boot system** *file-system*:**packages.conf** configuration command can remain unmodified before and after an upgrade).
- The provisioning file and individual subpackage files must be kept in the same directory. The provisioning file does not work properly if the individual subpackage files are in other directories.
- The provisioning filename can be renamed; the individual subpackage filenames cannot be renamed.
- After placing the provisioning file and the individual subpackage files in a directory and booting the router, it is highly advisable not to rename, delete, or alter any of these files. Renaming, deleting, or altering the files can lead to unpredictable router problems and behaviors.

ROMmon Image

An independent ROMmon image is released periodically separate from consolidated packages or any other software releases.

See the documentation that accompanies the ROMmon image for information on each ROMmon image. For additional information on ROMmon, see the *Cisco Catalyst 8500 Series Edge Platforms Maintain and Operate Guide*

File to Upgrade Field Programmable Hardware Devices

Starting in Cisco IOS XE Release 3.1.0S, a hardware programmable package file used to upgrade field programmable hardware devices is released as needed . A package file is provided for the field programmable device to customers in cases where a field upgrade is required. If the Cisco Catalyst 8500 Series Edge Platforms contains an incompatible version of the hardware programmable firmware, then that firmware may need to be upgraded.

Generally an upgrade is only necessary in cases where a system message indicates one of the field programmable devices on the Cisco Catalyst 8500 Series Edge Platforms needs an upgrade or a Cisco technical support representative suggests an upgrade.

For more information on upgrading field programmable hardware devices, see the *Upgrading Field Programmable Hardware Devices for Cisco Catalyst 8500 Series Edge Platforms* document.

Processes Overview

Cisco IOS XE has numerous components that run entirely as separate processes on the Cisco Catalyst 8500 Series Edge Platforms. This modular architecture increases network resiliency by distributing operating responsibility among separate processes rather than relying on Cisco IOS software for all operations.

IOS as a Process

In almost all previous Cisco router platforms, an overwhelming majority of the internal software processes are run using Cisco IOS memory.

The Cisco Catalyst 8500 Series Edge Platforms introduce a distributed software architecture that moves many operating system responsibilities out of the IOS process. In this architecture, IOS, which previously was responsible for almost all of the internal software processes, now runs as one of many Linux processes while allowing other Linux processes to share responsibility for running the router. This architecture allows for better allocation of memory so the router can run more efficiently.

Dual IOS Processes

The Cisco Catalyst 8500 Series Edge Platforms introduces a dual IOS process model that allows for increased high availability at all times.

Using SSO, a second IOS process can be enabled on a Cisco Catalyst 8500 Series Edge Router. On Cisco Catalyst 8500 Series Edge Platforms configured with dual Route Processors, the second IOS process runs on the standby Route Processor.

The state of these dual IOS processes can be checked by entering the **show platform** command.

The advantages of a second IOS process includes:

- Increased fault tolerance—In the event of an active IOS failure, the second IOS process immediately becomes the active IOS process with little to no service disruption.

File Systems on the Cisco Catalyst 8500 Series Edge Platforms

The following table provides a list of file systems that can be seen on the Cisco Catalyst 8500 Series Edge Platforms.

Table 2: File Systems

File System	Description
bootflash:	The boot flash memory file system on the active RP.
cns:	The Cisco Networking Services file directory.
harddisk:	The hard disk file system on the active RP.
nvram:	Router NVRAM. You can copy the startup configuration to NVRAM or from NVRAM.
obfl:	The file system for Onboard Failure Logging files.
system:	The system memory file system, which includes the running configuration.
tar:	The archive file system.
tmpsys:	The temporary system files file system.
usb[0-1]:	The Universal Serial Bus (USB) flash drive file systems on the active RP.

If you run into a file system not listed in the above table, enter the**?** help option or see the **copy** command reference for additional information on that file system.

Autogenerated File Directories and Files

This section discusses the autogenerated files and directories that might appear on your Cisco Catalyst 8500 Series Edge Platforms, and how the files in these directories can be managed.

The following table provides a list and descriptions of autogenerated files on the Cisco Catalyst 8500 Series Edge Platforms.

Table 3: Autogenerated Files

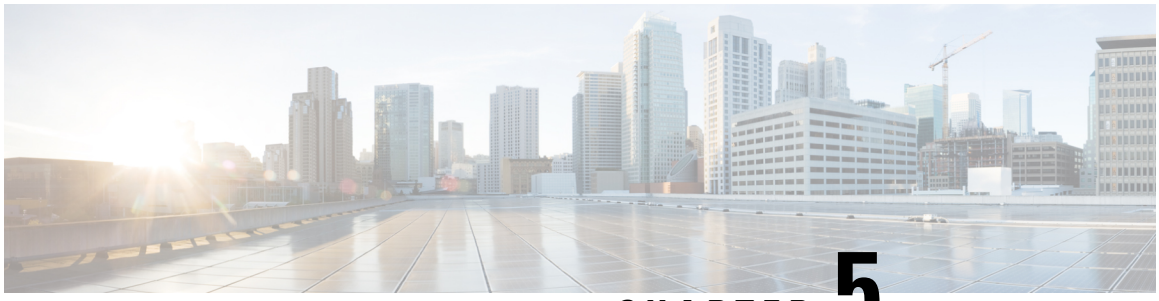
File or Directory	Description
crashinfo files	A crashinfo file may appear in the bootflash: or harddisk: file system. These files provide descriptive information of a crash and may be useful for tuning or troubleshooting purposes, but the files are not part of router operations and can be erased without impacting the functioning of the router.
core directory	The storage area for.core files. If this directory is erased, it will automatically regenerate itself at bootup. The .core files in this directory can be erased without impacting any router functionality, but the directory itself should not be erased.

File or Directory	Description
lost+found directory	This directory is created on bootup if a system check is performed. Its appearance is completely normal and does not indicate any issues with the router.
tracelogs directory	The storage area for trace files. Trace files are useful for troubleshooting. Trace files, however, are not part of router operations and can be erased without impacting the router's performance.

Important Notes About Autogenerated Directories

The important information about autogenerated directories include:

- Any autogenerated file on the bootflash: directory should not be deleted, renamed, moved, or altered in any way unless directed by customer support. Altering autogenerating files on the bootflash: can have unpredictable consequences for system performance.
- Crashinfo, core, and trace files can be deleted, but the core and tracelog directories that are automatically part of the harddisk: file system should not be deleted.



CHAPTER 5

Deploy IOS-XE and SDWAN

- Overview, on page 13
- Restrictions, on page 13
- Autonomous or Controller Mode, on page 13
- Switch Between Controller and Autonomous Modes, on page 13
- PnP Discovery Process, on page 14

Overview

You can use the universalk9 image to deploy both Cisco IOS XE SD-WAN and Cisco IOS XE on Cisco IOS XE devices. This helps in seamless upgrades of both the SD-WAN and non SD-WAN features and deployments.

Restrictions

Autonomous or Controller Mode

Access the Cisco IOS XE and Cisco IOS XE SD-WAN functionality through Autonomous and Controller execution modes, respectively. The Autonomous mode is the default mode for the routers and includes the Cisco IOS XE functionality. To access Cisco IOS XE SD-WAN functionality switch to the Controller mode.

For more information, see https://www.cisco.com/c/en/us/td/docs/routers/sdwan/configuration/sdwan-xe-gs-book/install-upgrade-17-2-later.html#Cisco_Concept.dita_42020dbf-1563-484f-8824-a0b3f468e787

Switch Between Controller and Autonomous Modes

The default mode of the device is autonomous mode. Use the **controller-mode** command in Privileged EXEC mode to switch between controller and autonomous modes.

The **controller-mode enable** command switches the device to controller mode

The **controller-mode disable** command switches the device to autonomous mode

For information see Cisco SD-WAN Getting Started Guide

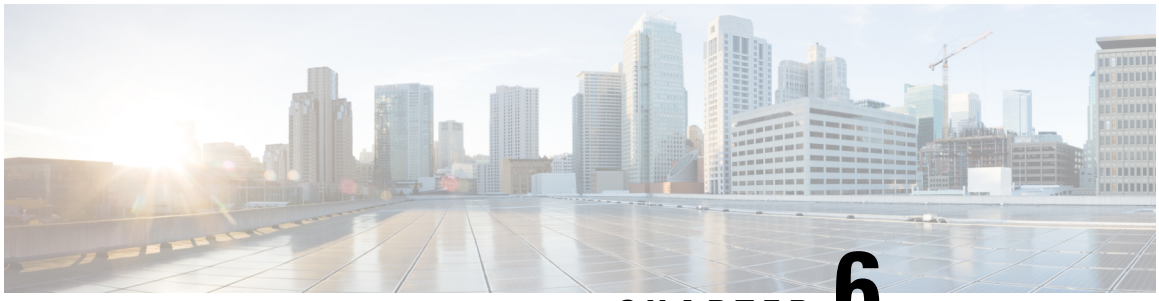
PnP Discovery Process

You can use the existing Plug and Play Workflow to determine the mode of the device.

The PnP-based discovery process determines the mode in which the device operates, based on the controller discovery and initiates a mode change, if required. This discovery is based on the controller profile attached to the device UID in the smart account/virtual account. The mode change results in a reboot of the device. Once reboot is complete, the device performs appropriate discovery process.

Plug and Play (PnP) deployment include the following discovery process scenarios:

Boot up Mode	Discovery Process	Mode Change
Autonomous	Plug and Play Connect Discovery or on-premise plug and play server discovery	No Mode change
Controller	Plug and Play Connect Discovery or on-premise plug and play server discovery	Mode change to autonomous mode



CHAPTER 6

Using Cisco IOS XE Software

This chapter provides information to prepare you to configure the Cisco Catalyst 8500 Series Edge Platforms:

- Accessing the CLI Using a Router Console, on page 15
- Using Keyboard Shortcuts, on page 19
- Using the History Buffer to Recall Commands, on page 20
- Understanding the Command Mode, on page 20
- Getting Help, on page 21
- Using the no and default Forms of Commands, on page 25
- Saving Configuration Changes, on page 25
- Managing Configuration Files, on page 25
- Filtering the Output of the show and more Commands, on page 27
- Powering Off a Router, on page 27
- Finding Support Information for Platforms and Cisco Software Images, on page 27

Accessing the CLI Using a Router Console

The following sections describe how to access the command-line interface (CLI) using a directly-connected console or by using Telnet or a modem to obtain a remote console:

Accessing the CLI Using a Directly-Connected Console

This section describes how to connect to the console port on the router and use the console interface to access the CLI.

The console port on a Cisco Catalyst 8500 Series Edge Platforms is an EIA/TIA-232 asynchronous, serial connection with no flow control and an RJ-45 connector. The console port is located on the front panel of each Route Processor (RP).

Connecting to the Console Port

To connect to the console port, complete the following steps:

SUMMARY STEPS

1. Configure your terminal emulation software with the following settings:

2. Connect to the port using the RJ-45-to-RJ-45 cable and RJ-45-to-DB-25 DTE adapter or using the RJ-45-to-DB-9 DTE adapter (labeled “Terminal”).

DETAILED STEPS

Step 1 Configure your terminal emulation software with the following settings:

- 9600 bits per second (bps)
- 8 data bits
- No parity
- 1 stop bit
- No flow control

Step 2 Connect to the port using the RJ-45-to-RJ-45 cable and RJ-45-to-DB-25 DTE adapter or using the RJ-45-to-DB-9 DTE adapter (labeled “Terminal”).

Using the Console Interface

Every RP on a Cisco Catalyst 8500 Series Edge Platforms has a console interface. Notably, a standby RP can be accessed using the console port in addition to the active RP in a dual RP configuration.

To access the CLI using the console interface, complete the following steps:

SUMMARY STEPS

1. After you attach the terminal hardware to the console port on the router and you configure your terminal emulation software with the proper settings, the following prompt appears:
2. Press **Return** to enter user EXEC mode. The following prompt appears:
3. From user EXEC mode, enter the **enable** command as shown in the following example:
4. At the password prompt, enter your system password. If an enable password has not been set on your system, this step may be skipped.The following example shows entry of the password enablepass:
5. When your enable password is accepted, the privileged EXEC mode prompt appears:
6. You now have access to the CLI in privileged EXEC mode and you can enter the necessary commands to complete your desired tasks.
7. To exit the console session, enter the **quit** command as shown in the following example:

DETAILED STEPS

Step 1 After you attach the terminal hardware to the console port on the router and you configure your terminal emulation software with the proper settings, the following prompt appears:

Example:

```
Press RETURN to get started.
```

Step 2 Press **Return** to enter user EXEC mode. The following prompt appears:

Example:

```
Router>
```

Step 3 From user EXEC mode, enter the **enable** command as shown in the following example:

Example:

```
Router> enable
```

Step 4 At the password prompt, enter your system password. If an enable password has not been set on your system, this step may be skipped.The following example shows entry of the password enablepass:

Example:

```
Password: enablepass
```

Step 5 When your enable password is accepted, the privileged EXEC mode prompt appears:

Example:

```
Router#
```

Step 6 You now have access to the CLI in privileged EXEC mode and you can enter the necessary commands to complete your desired tasks.

Step 7 To exit the console session, enter the **quit** command as shown in the following example:

Example:

```
Router# quit
```

Accessing the CLI from a Remote Console Using Telnet

This section describes how to connect to the console interface on a router using Telnet to access the CLI.

Preparing to Connect to the Router Console Using Telnet

Before you can access the router remotely using Telnet from a TCP/IP network, you need to configure the router to support virtual terminal lines (vtys) using the **line vty** global configuration command. You also should configure the vtys to require login and specify a password.

Note To prevent disabling login on the line, be careful that you specify a password with the **password** command when you configure the **login** line configuration command. If you are using authentication, authorization, and accounting (AAA), you should configure the **login authentication** line configuration command. To prevent disabling login on the line for AAA authentication when you configure a list with the **login authentication** command, you must also configure that list using the **aaa authentication login** global configuration command. For more information about AAA services, see the *Cisco IOS XE Security Configuration Guide,* and the *Cisco IOS Security Command Reference Guide* .

In addition, before you can make a Telnet connection to the router, you must have a valid host name for the router or have an IP address configured on the router. For more information about requirements for connecting

to the router using Telnet, information about customizing your Telnet services, and using Telnet key sequences, see the *Cisco IOS Configuration Fundamentals Configuration Guide.*

Using Telnet to Access a Console Interface

To access a console interface using Telnet, complete the following steps:

SUMMARY STEPS

1. From your terminal or PC, enter one of the following commands:
2. At the password prompt, enter your login password. The following example shows entry of the password mypass:
3. From user EXEC mode, enter the **enable** command as shown in the following example:
4. At the password prompt, enter your system password. The following example shows entry of the password enablepass:
5. When the enable password is accepted, the privileged EXEC mode prompt appears:
6. You now have access to the CLI in privileged EXEC mode and you can enter the necessary commands to complete your desired tasks.
7. To exit the Telnet session, use the **exit** or **logout** command as shown in the following example:

DETAILED STEPS

Step 1 From your terminal or PC, enter one of the following commands:

- **connect** *host* [*port*] [*keyword*]
- **telnet** *host* [*port*] [*keyword*]

In this syntax, *host* is the router hostname or an IP address, *port* is a decimal port number (23 is the default), and *keyword* is a supported keyword. For more information, see the *Cisco IOS Configuration Fundamentals Command Reference Guide* .

Note If you are using an access server, then you will need to specify a valid port number such as **telnet 172.20.52.40 2004**, in addition to the hostname or IP address.

The following example shows the **telnet** command to connect to the router named router:

Example:

```
unix_host% telnet router
Trying 172.20.52.40...
Connected to 172.20.52.40.
Escape character is '^]'.
unix_host% connect
```

Step 2 At the password prompt, enter your login password. The following example shows entry of the password mypass:

Example:

```
User Access Verification
Password: mypass
```

Note If no password has been configured, press **Return**.

Step 3 From user EXEC mode, enter the **enable** command as shown in the following example:

Example:

```
Router> enable
```

Step 4 At the password prompt, enter your system password. The following example shows entry of the password enablepass:

Example:

```
Password: enablepass
```

Step 5 When the enable password is accepted, the privileged EXEC mode prompt appears:

Example:

```
Router#
```

Step 6 You now have access to the CLI in privileged EXEC mode and you can enter the necessary commands to complete your desired tasks.

Step 7 To exit the Telnet session, use the **exit** or **logout** command as shown in the following example:

Example:

```
Router# logout
```

Using Keyboard Shortcuts

Commands are not case sensitive. You can abbreviate commands and parameters if the abbreviations contain enough letters to be different from any other currently available commands or parameters.

The following table lists the keyboard shortcuts for entering and editing commands.

Table 4: Keyboard Shortcuts

Keystrokes	Purpose
Ctrl-B or the **Left Arrow** key[1]	Move the cursor back one character
Ctrl-F orthe **Right Arrow** key1	Move the cursor forward one character
Ctrl-A	Move the cursor to the beginning of the command line
Ctrl-E	Move the cursor to the end of the command line
Esc B	Move the cursor back one word
Esc F	Move the cursor forward one word

[1] The arrow keys function only on ANSI-compatible terminals such as VT100s.

Using the History Buffer to Recall Commands

The history buffer stores the last 20 commands you entered. History substitution allows you to access these commands without retyping them, by using special abbreviated commands.

The following table lists the history substitution commands.

Table 5: History Substitution Commands

Command	Purpose
Ctrl-P or the **Up Arrow** key[2]	Recall commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands.
Ctrl-N or the **Down Arrow** key1	Return to more recent commands in the history buffer after recalling commands with **Ctrl-P** or the **Up Arrow** key.
Router# **show history**	While in EXEC mode, list the last several commands you have just entered.

[2] The arrow keys function only on ANSI-compatible terminals such as VT100s.

Understanding the Command Mode

The command modes available in the traditional Cisco IOS CLI are exactly the same as the command modes available in Cisco IOS XE.

You use the CLI to access Cisco IOS XE software. Because the CLI is divided into many different modes, the commands available to you at any given time depend on the mode that you are currently in. Entering a question mark (**?**) at the CLI prompt allows you to obtain a list of commands available for each command mode.

When you log in to the CLI, you are in user EXEC mode. User EXEC mode contains only a limited subset of commands. To have access to all commands, you must enter privileged EXEC mode, normally by using a password. From privileged EXEC mode, you can issue any EXEC command—user or privileged mode—or you can enter global configuration mode. Most EXEC commands are one-time commands. For example, **show** commands show important status information, and **clear** commands clear counters or interfaces. The EXEC commands are not saved when the software reboots.

Configuration modes allow you to make changes to the running configuration. If you later save the running configuration to the startup configuration, these changed commands are stored when the software is rebooted. To enter specific configuration modes, you must start at global configuration mode. From global configuration mode, you can enter interface configuration mode and a variety of other modes, such as protocol-specific modes.

ROM monitor mode is a separate mode used when the Cisco IOS XE software cannot load properly. If a valid software image is not found when the software boots or if the configuration file is corrupted at startup, the software might enter ROM monitor mode.

The following table describes how to access and exit various common command modes of the Cisco IOS XE software. It also shows examples of the prompts displayed for each mode.

Table 6: Accessing and Exiting Command Modes

Command Mode	Access Method	Prompt	Exit Method
User EXEC	Log in.	`Router>`	Use the **logout** command.
Privileged EXEC	From user EXEC mode, use the **enable** EXEC command.	`Router#`	To return to user EXEC mode, use the **disable** command.
Global configuration	From privileged EXEC mode, use the **configure terminal** privileged EXEC command.	`Router(config)#`	To return to privileged EXEC mode from global configuration mode, use the **exit** or **end** command.
Interface configuration	From global configuration mode, specify an interface using an **interface** command.	`Router(config-if)#`	To return to global configuration mode, use the **exit** command. To return to privileged EXEC mode, use the **end** command.
Diagnostic	The router boots up or accesses diagnostic mode in the following scenarios: In some cases, diagnostic mode will be reached when the IOS process or processes fail. In most scenarios, however, the router will. A user-configured access policy was configured using the **transport-map** command that directed the user into diagnostic mode. See the Chapter 4, "Console Port, Telnet, and SSH Handling" of this book for information on configuring access policies. The router was accessed using a Route Processor auxiliary port. A break signal (**Ctrl-C**, **Ctrl-Shift-6**, or the **send break** command) was entered and the router was configured to go into diagnostic mode when the break signal was received.	`Router(diag)#`	If the IOS process failing is the reason for entering diagnostic mode, the IOS problem must be resolved and the router rebooted to get out of diagnostic mode. If the router is in diagnostic mode because of a transport-map configuration, access the router through another port or using a method that is configured to connect to the Cisco IOS CLI. If the router is accessed through the Route Processor auxiliary port, access the router through another port. Accessing the router through the auxiliary port is not useful for customer purposes anyway.
ROM monitor	From privileged EXEC mode, use the **reload** EXEC command. Press the **Break** key during the first 60 seconds while the system is booting.	`>`	To exit ROM monitor mode, use the **continue** command.

Getting Help

Entering a question mark (**?**) at the CLI prompt displays a list of commands available for each command mode. You can also get a list of keywords and arguments associated with any command by using the context-sensitive help feature.

To get help specific to a command mode, a command, a keyword, or an argument, use one of the commands listed in the following table:

Table 7: Help Commands and Purpose

Command	Purpose
help	Provides a brief description of the help system in any command mode.
abbreviated-command-entry?	Provides a list of commands that begin with a particular character string. (No space between command and question mark.)
abbreviated-command-entry<Tab>	Completes a partial command name.
?	Lists all commands available for a particular command mode.
command ?	Lists the keywords or arguments that you must enter next on the command line. (Space between command and question mark.)

Finding Command Options

This section provides an example of how to display syntax for a command. The syntax can consist of optional or required keywords and arguments. To display keywords and arguments for a command, enter a question mark (**?**) at the configuration prompt or after entering part of a command followed by a space. The Cisco IOS XE software displays a list and brief description of available keywords and arguments. For example, if you were in global configuration mode and wanted to see all the keywords or arguments for the **arap** command, you would type **arap ?**.

The <cr> symbol in command help output stands for "carriage return." On older keyboards, the carriage return key is the Return key. On most modern keyboards, the carriage return key is the Enter key. The <cr> symbol at the end of command help output indicates that you have the option to press **Enter** to complete the command and that the arguments and keywords in the list preceding the <cr> symbol are optional. The <cr> symbol by itself indicates that no more arguments or keywords are available and that you must press **Enter** to complete the command.

The following table shows examples of how you can use the question mark (**?**) to assist you in entering commands.

Table 8: Finding Command Options

Command	Comment

`Router> enable`
`Password: <password>`
`Router#`
	Enter the **enable** command and password to access privileged EXEC commands. You are in privileged EXEC mode when the prompt changes to a "# " from the "> "; for example, Router> to Router# .

`Router#`
`configure terminal`
`Enter configuration commands, one per line. End with CNTL/Z.`
`Router(config)#`
	Enter the **configure terminal** privileged EXEC command to enter global configuration mode. You are in global configuration mode when the prompt changes to Router(config)# .

Command	Comment
Router(config)# **interface serial ?** <0-6> Serial interface number Router(config)# **interface serial 4 ?** / Router(config)# **interface serial 4/ ?** <0-3> Serial interface number Router(config)# **interface serial 4/0 ?** <cr> Router(config)# **interface serial 4/0** Router(config-if)#	Enter interface configuration mode by specifying the serial interface that you want to configure using the **interface serial** global configuration command. Enter **?** to display what you must enter next on the command line. In this example, you must enter the serial interface slot number and port number, separated by a forward slash. When the <cr> symbol is displayed, you can press Enter to complete the command. You are in interface configuration mode when the prompt changes to Router(config-if)# .

Router(config-if)# **?**
Interface configuration commands:
  .
  .
  .
  ip Interface Internet Protocol config
 commands
  keepalive Enable keepalive
  lan-name LAN Name command
  llc2 LLC2 Interface Subcommands
  load-interval Specify interval for load
calculation for an
  interface
  locaddr-priority Assign a priority group
  logging Configure logging for interface
  loopback Configure internal loopback on
an interface
  mac-address Manually set interface MAC address
 	
  mls mls router sub/interface commands
 	
  mpoa MPOA interface configuration
commands
  mtu Set the interface Maximum
Transmission Unit (MTU)
  netbios Use a defined NETBIOS access list
 or enable
  name-caching
  no Negate a command or set its
defaults
  nrzi-encoding Enable use of NRZI encoding
  ntp Configure NTP
  .
  .
  .
Router(config-if)#
	Enter **?** to display a list of all the interface configuration commands available for the serial interface. This example shows only some of the available interface configuration commands.

Command	Comment

`Router(config-if)# ip ?`
`Interface IP configuration subcommands:`
`  access-group  Specify access control for packets`
`  accounting  Enable IP accounting on this interface`
`  address  Set the IP address of an interface`
`  authentication  authentication subcommands`
`  bandwidth-percent  Set EIGRP bandwidth limit`
`  broadcast-address  Set the broadcast address of an interface`
`  cgmp  Enable/disable CGMP`
`  directed-broadcast  Enable forwarding of directed broadcasts`
`  dvmrp  DVMRP interface commands`
`  hello-interval  Configures IP-EIGRP hello interval`
`  helper-address  Specify a destination address for UDP broadcasts`
`  hold-time  Configures IP-EIGRP hold time`
`  .`
`  .`
`  .`
`Router(config-if)# ip`
	Enter the command that you want to configure for the interface. This example uses the **ip** command.
	Enter **?** to display what you must enter next on the command line. This example shows only some of the available interface IP configuration commands.

`Router(config-if)# ip address ?`
`  A.B.C.D  IP address`
`  negotiated  IP Address negotiated over PPP`
`Router(config-if)# ip address`
	Enter the command that you want to configure for the interface. This example uses the **ip address** command.
	Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP address or the **negotiated** keyword.
	A carriage return (<cr>) is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

`Router(config-if)# ip address 172.16.0.1 ?`
`  A.B.C.D  IP subnet mask`
`Router(config-if)# ip address 172.16.0.1`
	Enter the keyword or argument that you want to use. This example uses the 172.16.0.1 IP address.
	Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP subnet mask.
	A <cr> is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

`Router(config-if)# ip address 172.16.0.1 255.255.255.0 ?`
`  secondary  Make this IP address a secondary address`
`  <cr>`
`Router(config-if)# ip address 172.16.0.1 255.255.255.0`
	Enter the IP subnet mask. This example uses the 255.255.255.0 IP subnet mask.
	Enter **?** to display what you must enter next on the command line. In this example, you can enter the **secondary** keyword, or you can press **Enter**.
	A <cr> is displayed; you can press **Enter** to complete the command, or you can enter another keyword.

`Router(config-if)# ip address 172.16.0.1 255.255.255.0` `Router(config-if)#`	In this example, **Enter** is pressed to complete the command.

Using the no and default Forms of Commands

Almost every configuration command has a **no** form. In general, use the **no** form to disable a function. Use the command without the **no** keyword to re-enable a disabled function or to enable a function that is disabled by default. For example, IP routing is enabled by default. To disable IP routing, use the **no ip routing** command; to re-enable IP routing, use the **ip routing** command. The Cisco IOS software command reference publications provide the complete syntax for the configuration commands and describe what the **no** form of a command does.

Many CLI commands also have a **default** form. By issuing the command **default** *command-name* , you can configure the command to its default setting. The Cisco IOS software command reference publications describe the function of the **default** form of the command when the **default** form performs a different function than the plain and **no** forms of the command. To see what default commands are available on your system, enter **default ?** in the appropriate command mode.

Saving Configuration Changes

Use the **copy running-config startup-config** command to save your configuration changes to the startup configuration so that the changes will not be lost if the software reloads or a power outage occurs. For example:

```
Router# copy running-config startup-config
Building configuration...
```

It might take a minute or two to save the configuration. After the configuration has been saved, the following output appears:

```
[OK]
Router#
```

This task saves the configuration to NVRAM.

Managing Configuration Files

On the Cisco Catalyst 8500 Series Edge Platforms, the startup configuration file is stored in the nvram: file system and the running-configuration files are stored in the system: file system. This configuration file storage setup is not unique to the Cisco Catalyst 8500 Series Edge Platforms and is used on several Cisco router platforms.

As a matter of routine maintenance on any Cisco router, users should backup the startup configuration file by copying the startup configuration file from NVRAM onto one of the router's other file systems and, additionally, onto a network server. Backing up the startup configuration file provides an easy method of recovering the startup configuration file in the event the startup configuration file in NVRAM becomes unusable for any reason.

The **copy** command can be used to backup startup configuration files. The following examples show the startup configuration file in NVRAM being backed up:

Example 1: Copying a Startup Configuration File to Bootflash

```
Router# dir bootflash:
Directory of bootflash:/
  11 drwx 16384 Sep 18 2020 15:16:35 +00:00 lost+found
1648321 drwx 4096 Oct 22 2020 12:08:47 +00:00 .installer
97921 drwx 4096 Sep 18 2020 15:18:00 +00:00 .rollback_timer
12 -rw- 1910 Oct 22 2020 12:09:09 +00:00 mode_event_log
1566721 drwx 4096 Sep 18 2020 15:33:23 +00:00 core
1215841 drwx 4096 Oct 22 2020 12:09:48 +00:00 .prst_sync
1289281 drwx 4096 Sep 18 2020 15:18:18 +00:00 bootlog_history
13 -rw- 133219 Oct 22 2020 12:09:34 +00:00 memleak.tcl
14 -rw- 20109 Sep 18 2020 15:18:39 +00:00 ios_core.p7b
15 -rwx 1314 Sep 18 2020 15:18:39 +00:00 trustidrootx3_ca.ca
391681 drwx 4096 Oct 6 2020 15:08:54 +00:00 .dbpersist
522241 drwx 4096 Sep 18 2020 15:32:59 +00:00 .inv
783361 drwx 49152 Oct 27 2020 08:36:44 +00:00 tracelogs
832321 drwx 4096 Sep 18 2020 15:19:17 +00:00 pnp-info
1207681 drwx 4096 Sep 18 2020 15:19:20 +00:00 onep
750721 drwx 4096 Oct 22 2020 12:09:57 +00:00 license_evlog
946561 drwx 4096 Sep 18 2020 15:19:24 +00:00 guest-share
383521 drwx 4096 Sep 18 2020 15:34:13 +00:00 pnp-tech
1583041 drwx 4096 Oct 22 2020 11:27:38 +00:00 EFI
16 -rw- 34 Oct 6 2020 13:56:03 +00:00 pnp-tech-time
17 -rw- 82790 Oct 6 2020 13:56:14 +00:00 pnp-tech-discovery-summary
18 -rw- 8425 Oct 6 2020 15:09:18 +00:00 1g_snake
19 -rw- 6858 Oct 7 2020 10:53:21 +00:00 100g_snake
20 -rw- 4705 Oct 22 2020 13:01:54 +00:00 startup-config

26975526912 bytes total (25538875392 bytes free)
Router# copy nvram:startup-config bootflash:
Destination filename [startup-config]?
3517 bytes copied in 0.647 secs (5436 bytes/sec)
```

Example 2: Copying a Startup Configuration File to USB Flash Disk

```
Router# dir usb0:
Directory of usb0:/
43261 -rwx 208904396 Oct 27 2020 14:10:20 -07:00
c8000aep-universalk9.17.02.01.SPA.bin
255497216 bytes total (40190464 bytes free)
Router# copy nvram:startup-config usb0:
Destination filename [startup-config]?
3172 bytes copied in 0.214 secs (14822 bytes/sec)
Router# dir usb0:
Directory of usb0:/
43261 -rwx 208904396 Oct 27 2020 14:10:20 -07:00
c8000aep-universalk9.17.02.01.SPA.bin
15:40:45 -07:00 startup-config255497216 bytes total (40186880 bytes free)
```

Example 3: Copying a Startup Configuration File to a TFTP Server

```
Router# copy bootflash:startup-config tftp:
Address or name of remote host []? 172.17.16.81
Destination filename [pe24_asr-1002-confg]? /auto/tftp-users/user/startup-config
!!
3517 bytes copied in 0.122 secs (28828 bytes/sec)
```

For more detailed information on managing configuration files, see the *Managing Configuration Files* section in the *Cisco IOS XE Configuration Fundamentals Configuration Guide*

Filtering the Output of the show and more Commands

You can search and filter the output of **show** and **more** commands. This functionality is useful if you need to sort through large amounts of output or if you want to exclude output that you need not see.

To use this functionality, enter a **show** or **more** command followed by the "pipe" character (|); one of the keywords **begin**, **include**, or **exclude**; and a regular expression on which you want to search or filter (the expression is case sensitive):

show *command* | {**append** | **begin** | **exclude** | **include** | **redirect** | **section** | **tee**} *regular-expression*

The output matches certain lines of information in the configuration file. The following example illustrates how to use output modifiers with the **show interface** command when you want the output to include only lines in which the expression "protocol" appears:

```
Router# show interface | include protocol
FastEthernet0/0 is up, line protocol is up
Serial4/0 is up, line protocol is up
Serial4/1 is up, line protocol is up
Serial4/2 is administratively down, line protocol is down
Serial4/3 is administratively down, line protocol is down
```

Powering Off a Router

Before you turn off a power supply, make certain the chassis is grounded and you perform a soft shutdown on the power supply. Not performing a soft shutdown will often not harm the router, but may cause problems in certain scenarios.

To perform a soft shutdown before powering off the router, enter the **reload** command to halt the system and then wait for ROM Monitor to execute before proceeding to the next step.

The following screenshot shows an example of this process:

```
Router# reload
Proceed with reload? [confirm]
...(Some messages are omitted here)
Initializing Hardware...
Calculating the ROMMON CRC...CRC is correct.
```

Place the power supply switch in the Off position after seeing this message.

Finding Support Information for Platforms and Cisco Software Images

Cisco software is packaged in feature sets consisting of software images that support specific platforms. The feature sets available for a specific platform depend on which Cisco software images are included in a release. To identify the set of software images available in a specific release or to find out if a feature is available in a given Cisco IOS XE software image, you can use Cisco Feature Navigator or the software release notes.

Using the Cisco Feature Navigator

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS XE software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn . An account on Cisco.com is not required.

Using the Software Advisor

To see if a feature is supported by a Cisco IOS XE release, to locate the software document for that feature, or to check the minimum software requirements of Cisco IOS XE software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com at http://www.cisco.com/cgi-bin/Support/CompNav/Index.pl.

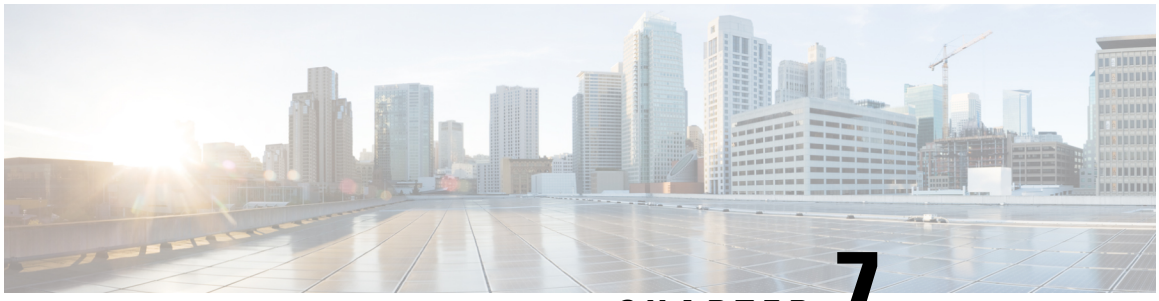
You must be a registered user on Cisco.com to access this tool.

Using the Software Release Notes

Cisco IOS XE software releases include release notes that provide the following information:

- Platform support information
- Memory recommendations
- New feature information
- Open and resolved severity 1 and 2 caveats for all platforms

Release notes are intended to be release-specific for the most current release, and the information provided in these documents may not be cumulative in providing information about features that first appeared in previous releases. Refer to Cisco Feature Navigator for cumulative feature information.



CHAPTER 7

Bay Configuration

- Bay Configuration C8500-12X4QC, on page 29
- Breakout Support, on page 35
- Bay Configuration C8500-12X, on page 37

Bay Configuration C8500-12X4QC

On C8500-12X4QC there are three built-in EPAs that are configurable.

The following table describes the port details:

Bay Number	EPA	Port Configuration	Interface numbers
Bay 0 8xSFP+	1/10G EPA	Eight 1/10G interfaces - TE0 - TE7 Disabled when 100G port in used in Bay 1	0/0/0 0/0/1 0/0/2 0/0/3 0/0/4 0/0/5 0/0/6 0/0/7 0/0/8

Bay Number	EPA	Port Configuration	Interface numbers
Bay 1 4xSFP+/1xQSFP	1/10/40/100G EPA	Four 1/10G interfaces active - TE0 - TE3 (interfaces 0/1/0 … 0/1/3) The bay can be used in the following modes: • Four 1/10G interfaces • One 40G interface active • One 100G interface. This utilizes the eight 1/10G ports of Bay 0	0/1/0 0/1/1 0/1/2 0/1/3
Bay 2 3xQSFP	40/100G EPA	Three 40G interfaces (0/1/0 to 0/1/2) One 100G interface (0/0/0) (0/0/0)	0/0/0 0/1/0 0/1/1 0/1/2

Note The speed of a 10G interface can be 1G or 10G based on the SFP transceiver plugged into to the port. Even when the speed changes the interface name is still indicated as TenGigabitEthernet.

By default , C8500-12X4QC operates Bay 1 in 10G mode and Bay 2 in 40G mode. The Bay 1 mode can be changed from 10G to 40G to 100G and vice versa. But if Bay 1 is set to 100G, all ports of Bay 0 move to *admin down* state and the ports are no longer functional.

The Bay 2 mode can be changed from 40G to 100G and vice versa. The mode change on Bay 2 does not impact traffic on Bay 1.

Use the **show platform** and **show ip interface** commands to view the bay and interface details:

```
Router#show platform
Chassis type: C8500-12X4QC

Slot      Type                State                 Insert time (ago)
--------- ------------------- --------------------- -----------------
0         C8500-12X4QC        ok                    1w3d
 0/0      BUILTIN-8x1/10G     ok                    1w3d
 0/1      BUILTIN-100/40/4x10Gok                    00:04:53
 0/2      BUILTIN-100G/3X40G  ok                    00:08:16
R0        C8500-12X4QC        ok                    1w3d
 R0/0                         ok, active            1w3d
 R0/1                         ok, standby           1w3d
F0        C8500-12X4QC        ok, active            1w3d
P0        AIR-AC-750W-R       ok                    1w3d
P1        AIR-AC-750W-R       ps, fail              1w3d
```

```
P2         C8500-FAN-1R        ok                    1w3d

Slot       CPLD Version        Firmware Version
---------  ------------------  ------------------------------------
0          19020715            12.2(20181120:104547) [user-gd_secur...
R0         19020715            12.2(20181120:104547) [user-gd_secur...
F0         19020715            12.2(20181120:104547) [user-gd_secur...
```

```
Router#show ip interface
Te0/0/0                unassigned      YES NVRAM  down                    down
Te0/0/1                unassigned      YES NVRAM  down                    down
Te0/0/2                unassigned      YES NVRAM  down                    down
Te0/0/3                unassigned      YES NVRAM  down                    down
Te0/0/4                unassigned      YES NVRAM  down                    down
Te0/0/5                unassigned      YES NVRAM  down                    down
Te0/0/6                unassigned      YES NVRAM  down                    down
Te0/0/7                unassigned      YES NVRAM  down                    down
Te0/1/0                unassigned      YES NVRAM  down                    down
Te0/1/1                unassigned      YES NVRAM  down                    down
Te0/1/2                unassigned      YES NVRAM  down                    down
Te0/1/3                unassigned      YES NVRAM  down                    down
Fo0/2/0                unassigned      YES unset  down                    down
Fo0/2/4                unassigned      YES unset  down                    down
Fo0/2/8                unassigned      YES unset  down                    down
GigabitEthernet0       10.104.33.213   YES NVRAM  up                      up
Router#
```

Bay Configuration Examples

The following examples show how mode can be changed on C8500-12X4QC to achieve different traffic speeds:

Examples

The following example shows how to change to 40G mode on Bay 1 of C8500-12X4QC:

```
Router(config)# hw-module subslot 0/1 mode 40G
Present configuration of this subslot will be erased and will not be restored.
CLI will not be available until mode change is complete and EPA returns to OK state.
Do you want to proceed? [confirm]

The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
*Oct 29 17:58:10.020 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 0 would be lost
*Oct 29 17:58:10.028 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 17:58:10.028 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 17:58:10.028 IST: BUILTIN-100/40/4x10G[0/1] : TenGigabitEthernet0/1/0 moved to
default config
*Oct 29 17:58:10.028 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 1 would be lost
*Oct 29 17:58:10.035 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 17:58:10.036 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 17:58:10.036 IST: BUILTIN-100/40/4x10G[0/1] : TenGigabitEthernet0/1/1 moved to
default config
*Oct 29 17:58:10.036 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 2 would be lost
```

```
*Oct 29 17:58:10.043 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 17:58:10.043 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 17:58:10.043 IST: BUILTIN-100/40/4x10G[0/1] : TenGigabitEthernet0/1/2 moved to
default config
*Oct 29 17:58:10.043 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 3 would be lost
*Oct 29 17:58:10.050 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 17:58:10.050 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 17:58:10.050 IST: BUILTIN-100/40/4x10G[0/1] : TenGigabitEthernet0/1/3 moved to
default config
*Oct 29 17:58:11.050 IST: BUILTIN-100/40/4x10G[0/1] : Received mode change request from 10G
 to 40G! system_configured TRUE
*Oct 29 17:58:11.057 IST: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(BUILTIN-100/40/4x10G) reloaded
on subslot 0/1
*Oct 29 17:58:11.057 IST: BUILTIN-100/40/4x10G[0/1] : EPA moving from 10G mode to 40G mode
*Oct 29 17:58:11.057 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 0 would be lost
*Oct 29 17:58:11.058 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 1 would be lost
*Oct 29 17:58:11.059 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 2 would be lost
*Oct 29 17:58:11.059 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 3 would be lost
*Oct 29 17:58:11.060 IST: BUILTIN-100/40/4x10G[0/1] : Old mode cleanup done!
*Oct 29 17:58:11.061 IST: %SPA_OIR-6-OFFLINECARD: SPA (BUILTIN-100/40/4x10G) offline in
subslot 0/1
*Oct 29 17:58:16.297 IST: BUILTIN-100/40/4x10G[0/1] : Number of ports 1
*Oct 29 17:58:16.298 IST: BUILTIN-100/40/4x10G[0/1] : XCVR namestring create: Maximum number
 of XCVR = 1
```

The following example shows how to change to 40G mode to 100G on Bay 1 of C8500-12X4QC:

```
Router(config)# hw-module subslot 0/1 mode 100G
Changing mode of subslot 0/1 to 100G will cause EPA in subslot 0/0 to go offline
Present configuration of this subslot will be erased and will not be restored.
CLI will not be available until mode change is complete and EPA returns to OK state.
Do you want to proceed? [confirm]

*Oct 29 18:09:01.360 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 0 would be lost
*Oct 29 18:09:01.368 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:01.368 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
The "[no] negotiation auto" command will have no effect with this interface
*Oct 29 18:09:01.368 IST: BUILTIN-100/40/4x10G[0/1] : FortyGigabitEthernet0/1/0 moved to
default config
*Oct 29 18:09:02.368 IST: BUILTIN-8x1/10G[0/0] : config for spa port 0 would be lost
*Oct 29 18:09:02.375 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.376 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.376 IST: BUILTIN-8x1/10G[0/0] : TenGigabitEthernet0/0/0 moved to default
config
*Oct 29 18:09:02.376 IST: BUILTIN-8x1/10G[0/0] : config for spa port 1 would be lost
*Oct 29 18:09:02.382 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.382 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
```

```
*Oct 29 18:09:02.382 IST: BUILTIN-8x1/10G[0/0] : TenGigabitEthernet0/0/1 moved to default
config
*Oct 29 18:09:02.382 IST: BUILTIN-8x1/10G[0/0] : config for spa port 2 would be lost
*Oct 29 18:09:02.389 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.389 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.389 IST: BUILTIN-8x1/10G[0/0] : TenGigabitEthernet0/0/2 moved to default
config
*Oct 29 18:09:02.389 IST: BUILTIN-8x1/10G[0/0] : config for spa port 3 would be lost
*Oct 29 18:09:02.395 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.395 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.395 IST: BUILTIN-8x1/10G[0/0] : TenGigabitEthernet0/0/3 moved to default
config
*Oct 29 18:09:02.395 IST: BUILTIN-8x1/10G[0/0] : config for spa port 4 would be lost
*Oct 29 18:09:02.402 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.402 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.402 IST: BUILTIN-8x1/10G[0/0] : TenGigabitEthernet0/0/4 moved to default
config
*Oct 29 18:09:02.402 IST: BUILTIN-8x1/10G[0/0] : config for spa port 5 would be lost
*Oct 29 18:09:02.409 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.409 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.409 IST: BUILTIN-8x1/10G[0/0] : TenGigabitEthernet0/0/5 moved to default
config
*Oct 29 18:09:02.409 IST: BUILTIN-8x1/10G[0/0] : config for spa port 6 would be lost
*Oct 29 18:09:02.415 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.415 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.415 IST: BUILTIN-8x1/10G[0/0] : TenGigabitEthernet0/0/6 moved to default
config
*Oct 29 18:09:02.415 IST: BUILTIN-8x1/10G[0/0] : config for spa port 7 would be lost
*Oct 29 18:09:02.422 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.422 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:09:02.422 IST: BUILTIN-8x1/10G[0/0] : TenGigabitEthernet0/0/7 moved to default
config
*Oct 29 18:09:03.423 IST: BUILTIN-100/40/4x10G[0/1] : Received mode change request from 40G
 to 100G! system_configured TRUE
*Oct 29 18:09:03.433 IST: BUILTIN-8x1/10G[0/0] : config for spa port 0 would be lost
*Oct 29 18:09:03.434 IST: BUILTIN-8x1/10G[0/0] : config for spa port 1 would be lost
*Oct 29 18:09:03.435 IST: BUILTIN-8x1/10G[0/0] : config for spa port 2 would be lost
*Oct 29 18:09:03.435 IST: BUILTIN-8x1/10G[0/0] : config for spa port 3 would be lost
*Oct 29 18:09:03.436 IST: BUILTIN-8x1/10G[0/0] : config for spa port 4 would be lost
*Oct 29 18:09:03.437 IST: BUILTIN-8x1/10G[0/0] : config for spa port 5 would be lost
*Oct 29 18:09:03.437 IST: BUILTIN-8x1/10G[0/0] : config for spa port 6 would be lost
*Oct 29 18:09:03.438 IST: BUILTIN-8x1/10G[0/0] : config for spa port 7 would be lost
*Oct 29 18:09:03.439 IST: BUILTIN-8x1/10G[0/0] : Old mode cleanup done!
*Oct 29 18:09:03.440 IST: %SPA_OIR-6-OFFLINECARD: SPA (BUILTIN-8x1/10G) offline in subslot
 0/0
*Oct 29 18:09:03.445 IST: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(BUILTIN-100/40/4x10G) reloaded
on subslot 0/1
*Oct 29 18:09:03.445 IST: BUILTIN-100/40/4x10G[0/1] : EPA moving from 40G mode to 100G mode
*Oct 29 18:09:03.445 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 0 would be lost
*Oct 29 18:09:03.446 IST: BUILTIN-100/40/4x10G[0/1] : Old mode cleanup done!
*Oct 29 18:09:03.446 IST: %SPA_OIR-6-OFFLINECARD: SPA (BUILTIN-100/40/4x10G) offline in
subslot 0/1
```

```
*Oct 29 18:09:08.790 IST: BUILTIN-100/40/4x10G[0/1] : Number of ports 1
*Oct 29 18:09:08.792 IST: BUILTIN-100/40/4x10G[0/1] : XCVR namestring create: Maximum number
 of XCVR = 1
Router(config)#
*Oct 29 18:09:15.552 IST: %SPA_OIR-6-ONLINECARD: SPA (BUILTIN-100/40/4x10G) online in subslot
 0/1
```

The following example shows how to change to 10G mode from 100G on Bay 1 of C8500-12X4QC:

```
Router(config)# hw-module subslot 0/1 mode 10G
Present configuration of this subslot will be erased and will not be restored.
CLI will not be available until mode change is complete and EPA returns to OK state.
Do you want to proceed? [confirm]
*Oct 29 18:14:36.484 IST: %PLATFORM_SCC-1-AUTHENTICATION_FAIL: Chassis authentication failed

*Oct 29 18:14:38.219 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 0 would be lost
*Oct 29 18:14:38.227 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:14:38.227 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:14:38.227 IST: BUILTIN-100/40/4x10G[0/1] : HundredGigE0/1/0 moved to default
config
*Oct 29 18:14:39.228 IST: BUILTIN-100/40/4x10G[0/1] : Received mode change request from
100G to 10G! system_configured TRUE
*Oct 29 18:14:39.230 IST: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(BUILTIN-100/40/4x10G) reloaded
on subslot 0/1
*Oct 29 18:14:39.230 IST: BUILTIN-100/40/4x10G[0/1] : EPA moving from 100G mode to 10G mode
*Oct 29 18:14:39.230 IST: BUILTIN-100/40/4x10G[0/1] : config for spa port 0 would be lost
*Oct 29 18:14:39.231 IST: BUILTIN-100/40/4x10G[0/1] : Old mode cleanup done!
*Oct 29 18:14:39.232 IST: %SPA_OIR-6-OFFLINECARD: SPA (BUILTIN-100/40/4x10G) offline in
subslot 0/1
*Oct 29 18:14:44.472 IST: BUILTIN-100/40/4x10G[0/1] : Number of ports 4
*Oct 29 18:14:44.475 IST: BUILTIN-100/40/4x10G[0/1] : XCVR namestring create: Maximum number
 of XCVR = 4
*Oct 29 18:15:03.336 IST: %SPA_OIR-6-ONLINECARD: SPA (BUILTIN-100/40/4x10G) online in subslot
 0/1
```

The following example shows how to change to 100G mode from 100G on Bay 2 of C8500-12X4QC:

```
Router(config)# hw-module subslot 0/2 mode 100G
Present configuration of this subslot will be erased and will not be restored.
CLI will not be available until mode change is complete and EPA returns to OK state.
Do you want to proceed? [confirm]

*Oct 29 18:17:03.394 IST: BUILTIN-100G/3X40G[0/2] : config for spa port 0 would be lost
*Oct 29 18:17:03.401 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:17:03.401 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:17:03.401 IST: BUILTIN-100G/3X40G[0/2] : FortyGigabitEthernet0/2/0 moved to
default config
*Oct 29 18:17:03.401 IST: BUILTIN-100G/3X40G[0/2] : config for spa port 1 would be lost
*Oct 29 18:17:03.406 IST: BUILTIN-100G/3X40G[0/2] : Breakout XCVR type QSFP 4X10G AC7M (546)
 is not allowed as XCVR port Fortyrnet0/2/0 is not configured in breakout
*Oct 29 18:17:03.406 IST: %IOSXE_EPA-3-XCVR_PROHIBIT: Transceiver is prohibited to come
online for interface FortyGigabitEther
*Oct 29 18:17:03.407 IST: BUILTIN-100G/3X40G[0/2] : XCVR prohibited on port
FortyGigabitEthernet0/2/0, epa_name=BUILTIN-100G/3=FortyGigabitEthernet0/2/0,
xcvr_speed=40000000, admin_state=UNSHUT xcvr_type=546

*Oct 29 18:17:03.409 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:17:03.409 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
```

```
 console as console
*Oct 29 18:17:03.409 IST: BUILTIN-100G/3X40G[0/2] : FortyGigabitEthernet0/2/4 moved to
default config
*Oct 29 18:17:03.409 IST: BUILTIN-100G/3X40G[0/2] : config for spa port 2 would be lost
*Oct 29 18:17:03.417 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:17:03.417 IST: %SYS-5-CONFIG_P: Configured programmatically by process Exec from
 console as console
*Oct 29 18:17:03.417 IST: BUILTIN-100G/3X40G[0/2] : FortyGigabitEthernet0/2/8 moved to
default config
*Oct 29 18:17:03.423 IST: BUILTIN-100G/3X40G[0/2] : Breakout XCVR type QSFP 4SFP10G CU4M
(541) is not allowed as XCVR port Forhernet0/2/4 is not configured in breakout
*Oct 29 18:17:03.423 IST: %IOSXE_EPA-3-XCVR_PROHIBIT: Transceiver is prohibited to come
online for interface FortyGigabitEther
*Oct 29 18:17:03.423 IST: BUILTIN-100G/3X40G[0/2] : XCVR prohibited on port
FortyGigabitEthernet0/2/4, epa_name=BUILTIN-100G/3=FortyGigabitEthernet0/2/4,
xcvr_speed=40000000, admin_state=UNSHUT xcvr_type=541

*Oct 29 18:17:04.418 IST: BUILTIN-100G/3X40G[0/2] : Received mode change request from 40G
to 100G! system_configured TRUE
*Oct 29 18:17:04.423 IST: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(BUILTIN-100G/3X40G) reloaded on
 subslot 0/2
*Oct 29 18:17:04.423 IST: BUILTIN-100G/3X40G[0/2] : EPA moving from 40G mode to 100G mode
*Oct 29 18:17:04.423 IST: BUILTIN-100G/3X40G[0/2] : config for spa port 0 would be lost
*Oct 29 18:17:04.424 IST: BUILTIN-100G/3X40G[0/2] : config for spa port 1 would be lost
*Oct 29 18:17:04.425 IST: BUILTIN-100G/3X40G[0/2] : config for spa port 2 would be lost
*Oct 29 18:17:04.425 IST: BUILTIN-100G/3X40G[0/2] : Old mode cleanup done!
*Oct 29 18:17:04.426 IST: %SPA_OIR-6-OFFLINECARD: SPA (BUILTIN-100G/3X40G) offline in subslot
 0/2
*Oct 29 18:17:09.685 IST: BUILTIN-100G/3X40G[0/2] : Number of ports 1
*Oct 29 18:17:09.686 IST: BUILTIN-100G/3X40G[0/2] : XCVR namestring create: Maximum number
 of XCVR = 1
Router(config)#
Router(config)#
*Oct 29 18:17:16.017 IST: %SPA_OIR-6-ONLINECARD: SPA (BUILTIN-100G/3X40G) online in subslot
 0/2
```

Breakout Support

Understand Breakout Support

Breakout support for a port helps to split a higher density port to multiple independent and logical ports. Starting from Cisco IOS XE 17.4, breakout support is introduced in Bay 2 of C8500-12X4QC that supports breakout capable 40G native ports. The breakout support is of 4X10G and uses a 3-tuple approach.

The following table explains the interface names when breakout is configured:

Table 9: Interface Names when Breakout is Configured

Sr. No	Interface names	Description
	Te0/2/0, Te0/2/1, Te0/2/2, Te0/2/3, Te0/2/4, Te0/2/5, Te0/2/6, Te0/2/7, Te0/2/8, Te0/2/9, Te0/2/10, Te0/2/11	All three 40 G native ports working in 10G breakout mode

Sr. No	Interface names	Description
	Fo0/2/0,Fo0/2/4, Te0/2/8, Te0/2/9, Te0/2/10, Te0/2/11	1st native port in 40G mode 2nd native port in 40G mode 3rd native port in 10G breakout mode
	Fo0/2/0, Te0/2/4, Te0/2/5, Te0/2/6, Te0/2/7 Fo0/2/8	1st native port in 40G mode 2nd native port 10G breakout mode 3rd native port in 40G mode
	Te0/2/0, Te0/2/1, Te0/2/2, Te0/2/3, Fo0/2/4, Fo0/2/8	1st native port in 10G breakout mode 2nd native port in 40G mode 3rd native port in 40G mode
	1st native port in 10G breakout mode 2nd native port in 40G mode 3rd native port in 40G mode	1st native port in 40G mode 2nd native port in 10G breakout mode 3rd native port in 10G breakout mode
	Te0/2/0, Te0/2/1, Te0/2/2, Te0/2/3, Te0/2/4, Te0/2/5, Te0/2/6, Te0/2/7, Fo0/2/8	1st native port in 10G breakout mode 2nd native port in 10G breakout mode 3rd native port in 40G mode
	Te0/2/0, Te0/2/1, Te0/2/2, Te0/2/3, Fo0/2/4, Te0/2/8, Te0/2/9, Te0/2/10, Te0/2/11	1st native port in 10G breakout mode 2nd native port in 40G mode 3rd native port in 10G breakout mode

Breakout Support

Note Before using the breakout capability, ensure that Bay 2 is configured in 40G mode

```
Router(config)#hw-module subslot 0/2 breakout 10G port ?

all                configure all native ports in breakout mode
native_port_0      configure native port 0 in breakout mode
native_port_4      configure native port 4 in breakout mode
native_port_8      configure native port 8 in breakout mode
```

Sample Commands to Configure Breakout Support

When native_port 0 and 8 are in 10G breakout and native_port 4 is running in 40G mode

```
hw-module subslot 0/2 breakout 10g port native_port_0
hw-module subslot 0/2 breakout 10g port native_port_8
```

When all three native 40G ports have same breakout config

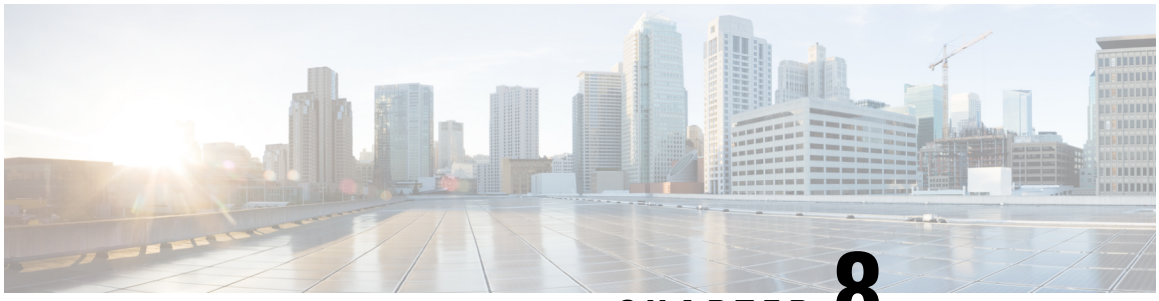
```
hw-module subslot 0/2 breakout 10g port all
hw-module subslot 0/2 breakout none port all
```

When you want to remove breakout configuration from all ports

```
hw-module subslot 0/2 breakout none port all
```

Bay Configuration C8500-12X

On C8500-12X4 there is one built-in EPA that supports ports TE0 - TE11 for SFP/SFP+ transceivers.



CHAPTER 8

Licenses and Licensing Models

This chapter provides information about the licenses that are available on Cisco Catalyst 8000 Edge Platforms Family, supported throughput options, and how to configure the available licenses and throughput. It also outlines the licensing models available on Cisco Catalyst 8000 Edge Platforms Family.

Note The information in this chapter applies predominantly to a device operating in the autonomous mode. References to the controller mode are included in certain sections for the sake of comparison and completeness. Where the information applies to controller mode, this has been called-out categorically.

For a more detailed overview on Cisco Licensing, go to https://cisco.com/go/licensingguide.

This chapter includes the following major sections:

- Feature Information for Available Licenses and Licensing Models, on page 39
- Available Licenses , on page 41
- Throughput , on page 45
- How to Configure Available Licenses and Throughput , on page 54
- Available Licensing Models, on page 69

Feature Information for Available Licenses and Licensing Models

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 10: Feature Information for Available Licenses and Licensing Models

Feature Name	Releases	Feature Information
Aggregate Throughput Throttling	Cisco IOS XE Cupertino 17.8.1a	On the *physical* platforms of Cisco Catalyst 8000 Edge Platforms Family, for throughput levels greater than 250 Mbps and Tier 2 and higher tiers, when you configure the bidirectional throughput value on the device, aggregate throughput throttling is effective. This means that traffic is throttled in an aggregate manner irrespective of the distribution of the traffic in the upstream and downstream direction. The bidirectional throughput is represented in the license PID (For example, DNA-C-**500M**-E-3Y and DNA-C-**T2**-E-3Y). The aggregate throughput is double the bidirectional throughput. See Throughput as a Numeric Value , on page 46 and Throughput as a Tier, on page 50.
Tier-Based Licenses	Cisco IOS XE Cupertino 17.7.1a	Support for tier-based throughput configuration was introduced in addition to existing bandwidth-based (numeric) throughput configuration. Starting with the lowest throughput level, the available tiers are Tier 0 (T0), Tier 1 (T1), Tier 2 (T2), and Tier3 (T3). Each tier represents a throughput level. If the license PID for a product is tier-based, the license is displayed with the tier value in the CSSM Web UI. For a product with a tier-based license, you can *configure* a tier-based throughput value, and you can also *convert* to a tier-based throughput value.
Cisco Digital Network Architecture (DNA) licenses	Cisco IOS XE Amsterdam 17.3.2	Support for Cisco DNA licenses was introduced on Cisco Catalyst 8000 Edge Platforms Family. Cisco DNA Licenses are categorised into network-stack licenses and a DNA-stack add-on licenses.
High Security License (HSECK9)	Cisco IOS XE Amsterdam 17.3.2	Support for the HSECK9 license was introduced on Cisco Catalyst 8000 Edge Platforms Family.

Feature Name	Releases	Feature Information
Cisco Unified Border Element license (Cisco UBE license) Cisco Unified Communications Manager Express license (Cisco Unified CME license) Cisco Unified Survivable Remote Site Telephony license (Cisco Unified SRST license)	Cisco IOS XE Amsterdam 17.3.2	Support for Cisco UBE, Cisco Unified CME, Cisco Unified SRST licenses was introduced on Cisco Catalyst 8000 Edge Platforms Family

Available Licenses

This section lists all the licenses that are available on Cisco Catalyst 8000 Edge Platforms Family, usage guidelines, and ordering considerations.

Cisco DNA License

A Cisco Digital Network Architecture (DNA) software license combines several feature-specific licenses.

Note A Cisco DNA license includes all feature licenses except the following: High Security (HSECK9), Cisco Unified Border Element (Cisco UBE), Cisco Unified Communications Manager Express (Cisco Unified CME), and Cisco Unified Survivable Remote Site Telephony (Cisco Unified SRST). See Ordering Considerations for a Cisco DNA License, on page 43.

Cisco DNA licenses are categorized into network-stack licenses and DNA-stack add-on licenses.

Cisco DNA Licenses Available on Catalyst 8000V Edge Software, Catalyst 8200, and 8300 Series Edge Platforms:

Network-stack licenses:

- Network Essentials
- Network Advantage: includes features available with Network Essentials, and more.
- Network Premier: includes features available Network Essentials, Network Advantage, and more.

DNA-stack add-on licenses:

- Cisco DNA Essentials: add-on license available only with Network Essentials.
- Cisco DNA Advantage: add-on license available only with Network Advantage. Includes features available with DNA Essentials and more.

- Cisco DNA Premier: add-on license available only with Network Premier. Includes features available with DNA Essentials, DNA Advantage and more.

Cisco DNA Licenses Available on Catalyst 8500 Series Edge Platforms:

Network-stack licenses:

- Network Advantage
- Network Premier: includes features available Network Advantage, and more.

DNA-stack add-on licenses:

- Cisco DNA Advantage
- Cisco DNA Premier: add-on license available only with Network Premier. Includes features available with DNA Advantage and more.

Guidelines for Using a Cisco DNA License

- Guidelines that apply to all platforms in the Cisco Catalyst 8000 Edge Platforms Family:
  - A network-stack license is a perpetual or permanent license and has no expiration date.
  - A DNA-stack add-on license is a subscription or term license and is valid only until a certain date. A 3-year and 5-year option is available for all DNA-stack add-on licenses. A 7-year subscription option is available for certain DNA-stack add-on licenses.
  - If you order a Cisco DNA license when purchasing new hardware, the license is not preconfigured on the device. You must configure the boot level license and then the throughput, on the device.
  - If you configure tier-based throughput, which is supported from Cisco IOS XE Cupertino 17.7.1a, Tier 3 (T3) is not supported with the Network Essentials and DNA Essentials licenses.

    This means, to configure T3 (throughput greater than or equal to 2.5 G), you must configure Network Advantage/ DNA Advantage, or Network Premier/DNA Premier as the boot level license.

    This also means that if you have configured T3 as the throughput, you cannot change the boot level license to Network Essentials and DNA Essentials.

- Guidelines that apply only to Catalyst 8000V Edge Software:

  On Catalyst 8000V Edge Software, when you configure a network-stack license, you must also configure the corresponding DNA-stack add-on license.

- Guidelines that apply only to Catalyst 8200, 8300, 8500 Series Edge Platforms:
  - The DNA-stack add-on license that is available with each network-stack license is optional. You can configure a network-stack license without a DNA-stack add-on license, but you cannot configure DNA-stack add-on license without the corresponding network-stack license.
  - If you use a DNA-stack add-on license, renew the license before term expiry to continue using it, or deactivate the DNA-stack add-on license and then reload the device to continue operating with the network-stack license capabilities.

Ordering Considerations for a Cisco DNA License

A Cisco DNA license subsumes all performance, boost, and technology package licenses (securityk9, uck9, and appxk9). This means that when you order a Cisco DNA network-stack license, or a Cisco DNA-stack add-on license, if a performance, boost, and technology package license is required or applicable, it is automatically added to the order.

The license Product ID (PID) you purchase can only be a DNA-stack add-on license PID.

The license PID also indicates the throughput you are entitled to. The throughput may be represented by a numeric value or a tier. For example:

- DNA-C-**10M**-E-3Y, is a license PID where the throughput is represented by a numeric value. The **10M** means that you are entitled to 10 Mbps bidirectional throughput.

  For more information about a numeric throughput value and related concepts, see sections Throughput , on page 45 and Throughput as a Numeric Value , on page 46.

- DNA-C-**T0**-E-3Y, is a license PID where the throughput is represented by a tier value. The **T0** means that you are entitled to up to 15 Mbps bidirectional throughput.

  For more information about a tier-based throughput value and related concepts, see sections Throughput , on page 45 and Throughput as a Tier, on page 50.

If the throughput you order is greater than 250 Mbps, or Tier 2 or a higher tier, an HSECK9 license is also required. See High Security License , on page 43.

High Security License

The High Security (HSECK9) license is an export-controlled license. It authorizes the use of full cryptographic functionality and throughput greater than 250 Mbps or Tier 2 and higher tiers.

Note The term "throughput" refers to encrypted throughput on physical platforms. On virtual platforms, it refers to encrypted *and* unencrypted throughput - combined.

On all devices in the Cisco Catalyst 8000 Edge Platforms Family, the HSECK9 license as displayed as: *Router US Export Lic. for DNA (DNA_HSEC)*. For example:

```
Device# show license authorization
Overall status:
  Active: PID:C8300-1N1S-4T2X,SN:FDO2250A0J5
      Status: SMART AUTHORIZATION INSTALLED on Dec 03 08:24:35 2021 UTC
      Last Confirmation code: 418b11b3

Authorizations:
  Router US Export Lic. for DNA (DNA_HSEC):
    Description: U.S. Export Restriction Compliance license for DNA based Routers
    Total available count: 1
    Enforcement type: EXPORT RESTRICTED
    Term information:
      Active: PID:C8300-1N1S-4T2X,SN:FDO2250A0J5
        Authorization type: SMART AUTHORIZATION INSTALLED
        License type: PERPETUAL
          Term Count: 1
```

```
Purchased Licenses:
  No Purchase Information Available
```

Guidelines for Using an HSECK9 License

An export-controlled license is restricted by U.S. export control laws and requires authorization *before* use. This authorization is in the form of a Smart Licensing Authorization Code (SLAC) and must be installed on the device before full cryptographic functionality is available and throughput restrictions can be lifted. A SLAC is required for each HSECK9 license you want to use. Details are provided in the configuration section of this chapter.

Ordering Considerations for an HSECK9 License

If you order your DNA license(s) in the same configuration as Catalyst 8000 hardware platforms, the option to order an HSECK9 license is available or is selected, if applicable.

If you order your DNA license(s) in a separate configuration as your Catalyst 8000 hardware platforms, you must order the HSECK9 license in the configuration for the Catalyst 8000 hardware platforms, if required.

If you plan to use an HSECK9 license with new hardware that you are ordering, provide your Smart Account and Virtual Account information *with* the hardware order. This enables Cisco to factory-install SLAC for the HSECK9 license on the hardware. You must still configure throughput on the device before you start using it.

Note If the HSECK9 license is ordered separately (not with the hardware order), SLAC cannot be factory-installed.

Cisco CUBE License

A Cisco Unified Border Element License (Cisco UBE license) does not require any boot level configuration before you enable it. After purchase, you can refer to the configuration guide to configure the available Cisco UBE features.

For information about the features available with a Cisco UBE license, see the *Cisco Unified Border Element Configuration Guide* for the required release at: https://www.cisco.com/c/en/us/support/unified-communications/unified-border-element/products-installation-and-configuration-guides-list.html.

For information about supported platforms and about purchasing a Cisco UBE license, see the datasheet at: https://www.cisco.com/c/en/us/products/collateral/unified-communications/unified-border-element/data-sheet-c78-729692.html. You must order a Cisco UBE license separately if required. It is not automatically included with any other license.

For information about how to report usage of a Cisco UBE license, see Smart Licensing Using Policy for Cisco Enterprise Routing Platforms. In the context of this licensing model, a Cisco UBE license is an *unenforced* license.

Cisco Unified CME License

A Cisco Unified Communications Manager Express License (Cisco Unified CME license) does not require any boot level configuration before you enable it. After purchase, you can refer to the configuration guide to configure the available Cisco UBE features.

For information about the features available with a Cisco Unified CME license, see the Cisco Unified Communications Manager Express System Administrator Guide.

For information about supported platforms and about purchasing a Cisco Unified CME license, see the datasheet at: https://www.cisco.com/c/en/us/products/collateral/unified-communications/unified-communications-manager-express/datasheet-c78-744069.html. You must order a Cisco Unified CME license separately if required. It is not automatically included with any other license.

For information about how to report usage of a Cisco Unified CME license, see Smart Licensing Using Policy for Cisco Enterprise Routing Platforms. In the context of this licensing model, a Cisco UBE license is an *unenforced* license.

Cisco Unified SRST License

A Cisco Unified Survivable Remote Site Telephony License (Cisco Unified SRST license) does not require any boot level configuration before you enable it. After purchase, you can refer to the configuration guide to configure the available Unified SRST features.

For information about the features available with a Cisco Unified SRST license, see the Cisco Unified SCCP and SIP SRST System Administrator Guide (All Versions).

For information about supported platforms and about purchasing a Cisco Unified SRST license, see the datasheet at: https://www.cisco.com/c/en/us/products/collateral/unified-communications/unified-communications-manager-express/datasheet-c78-744069.html. You must order a Cisco Unified SRST license separately if required. It is not automatically included with any other license.

For information about how to report usage of a Unified SRST license, see Smart Licensing Using Policy for Cisco Enterprise Routing Platforms. In the context of this licensing model, a Unified SRST license is an *unenforced* license.

Throughput

The *throughput* tells you how much data is allowed to be transferred on the device. You can configure this value in the autonomous mode. If you don't explicitly configure a throughput, the default throughput is effective.

Encrypted and Unencrypted Throughput

Encrypted throughput, also known as crypto throughput, is throughput that is protected by a cryptographic algorithm.

Unencrypted throughput on the other hand, is in plain text. Unencrypted throughput is also referred to as Cisco Express Forwarding (CEF) traffic.

Throttled and Unthrottled Throughput

Throttled throughput refers to the enforcement of a restriction on the throughput.

Unthrottled throughput means no limit is enforced, and the device throughput is at the maximum capability of the device.

Important For physical platforms (Catalyst 8200, 8300, and 8500 Series Edge Platforms), all references to "throughput" in this document refer to crypto throughput. Further, on physical platforms unencrypted throughput is unthrottled by default.

For virtual platforms (Catalyst 8000V Edge Software), all references to "throughput" in this document refer to crypto throughput *and* unencrypted throughput - combined.

Throughput Value

The throughput you are entitled to, is represented in the License product ID (PID) when you order a Cisco DNA license.

- An example of a license PID with a numeric throughput value: DNA-C-**10M**-E-3Y
- An example of a license PID with a tier-based throughput value: DNA-C-**T0**-E-3Y

Depending on the software version running on the device and the license PID you have purchased, refer to the corresponding section below for further details.

Throughput as a Numeric Value

The numeric throughput value in the license PID is bi-directional - it is the maximum throughput that is allowed *in each direction* (upstream and downstream). The aggregate throughput is the *sum* of the throughput in both directions and therefore double the bi-directional throughput.

For example, if you order license PID DNA-C-**10M**-E-3Y, 10 Mbps is the bi-directional throughput, and the throughput value you configure on the device. When you configure this value, a maximum of 10 Mbps upstream and 10 Mbps downstream throughput is supported. The aggregate throughput available is 20 Mbps.

Starting with Cisco IOS XE Cupertino 17.8.1a, for throughput levels greater than 250 Mbps, when you configure the bidirectional throughput value on the device, aggregate throughput throttling is effective. This means that traffic is throttled in an aggregate manner irrespective of the distribution of the traffic in the upstream and downstream direction. This is supported only on physical platforms.

- **Example: Throttling when throughput is greater than 250 Mbps**

  You order license PID DNA-C-**500M**-A-3Y. 500 Mbps is the bi-directional throughput and 1Gbps is the aggregate throughput. The release-wise configuration and behaviour is as follows:

  - Until Cisco IOS XE Cupertino 17.7.x, on physical and virtual plaforms: You configure a throughput of 500 Mbps on the device, and a maximum of 500 Mbps upstream and 500 Mbps downstream throughput is supported.
  - From Cisco IOS XE Cupertino 17.8.1a:

    On physical platforms, you configure a throughput of 500 Mbps on the device. A maximum of 1 Gbps upstream traffic and 0 Mbps downstream traffic, or 100 Mbps upstream traffic and 900 Mbps downstream traffic or any other ratio within the aggregate 1 Gbps limit, is supported.

    On virtual platforms, you configure a throughput of 500 Mbps on the device. A maximum of 500 Mbps upstream and 500 Mbps downstream throughput is supported.

- **Example: Throttling when throughput is equal to or lesser than 250 Mbps**

You order license PID DNA-C-**250M**-A-3Y. 250 Mbps is the bi-directional throughput, 500 Mbps is the aggregate throughput. The release-wise configuration and behaviour is as follows:

For all releases, on physical and virtual plaforms, you configure a throughput of 250 Mbps on the device. A maximum of 250 Mbps upstream and 250 Mbps downstream throughput is available.

Note On C8200-1N-4T-L, if you configure a numeric value of 250 Mbps, a maximum of 250 Mbps is available in each direction. But if you configure a tier-based value (T2), 500 Mbps is available for use in any upstream and downstream ratio.

The recommended way to arrive at the required throughput for your network is to first calculate the aggregate throughput (upstream and downstream) and divide that by 2 to arrive at the bidirectional throughput value. Finally, select the license PID that is equal to or greater than the bidirectional throughput.

The tables below provide throughput specifications for all devices in the Cisco Catalyst 8000 Edge Platforms Family:

Note Separate tables are provided for throughput specifications in the autonomous mode and SD-WAN controller mode.

Throughput and System Hardware Throttling Specifications in the Autonomous Mode

- Supported throughput: The throughput values you can configure on the device. These are the only throughput values you can configure on the specified device.
- Hardware throttled throughput: The throttling limit imposed by the system's hardware, for a supported throughput level. This column in the tables below tell you if hardware is throttled for each supported throughput level and what that hardware throttled level is. Where the value is listed as unthrottled, it means that throughput is not throttled even if you configure a limit.
- Require HSECK9?: Indicates if a supported throughput level requires an HSECK9 license (anything lesser than or equal to 250 Mbps does not require HSECK9).
- Throughput Type: All throughput values in the tables are bi-directional - this is also mentioned in the table for clarity. This column also confirms if the throughput values are encrypted or unencrypted - encrypted on physical platforms; encrypted and unencrypted on virtual platforms.

PID	Supported Throughput	Hardware Throttled Throughput	Supported Release	Require HSECK9?	Throughput Type
C8300-1N1S-4T2X (default 10M)	10M, 15M, 25M, 50M, 100M, 250M	250M	>= 17.4.1	No	Bi-directional; encrypted
	500M	500M	>= 17.4.1	Yes	
	1G	1G	>= 17.4.1	Yes	
	2.5G	unthrottled	>= 17.4.1	Yes	
C8300-2N2S-6T (default 10M)	10M, 15M, 25M, 50M, 100M, 250M	250M	>= 17.4.1	No	Bi-directional; encrypted
	500M	500M	>= 17.4.1	Yes	
	1G	1G	>= 17.4.1	Yes	
C8300-1N1S-6T (default 10M)	10M, 15M, 25M, 50M, 100M, 250M	250M	>= 17.4.1	No	Bi-directional; encrypted
	500M	500M	>= 17.4.1	Yes	
	1G	1G	>= 17.4.1	Yes	
C8300-2N2S-4T2X (default 10M)	10M, 15M, 25M, 50M, 100M, 250M	250M	>= 17.4.1	No	Bi-directional; encrypted
	500M	500M	>= 17.4.1	Yes	
	1G	1G	>= 17.4.1	Yes	
	2.5G	unthrottled	>= 17.4.1	Yes	
C8200-1N-4T (default 10M)	10M, 15M, 25M, 50M, 100M, 250M	250M	>= 17.4.1	No	Bi-directional; encrypted
	500M	500M	>= 17.4.1	Yes	
C8200-1N-4T-L (default 10M)	10M, 15M, 25M, 50M, 100M, 250M	250M	>= 17.5.1	No	Bi-directional; encrypted
C8500-12X4QC (default 2.5G)	2.5G	2.5G	>= 17.4.1	Yes	Bi-directional; encrypted
	5G	5G	>= 17.4.1	Yes	
	10G	unthrottled	>= 17.4.1	Yes	

PID	Supported Throughput	Hardware Throttled Throughput	Supported Release	Require HSECK9?	Throughput Type
C8500-12X (default 2.5G)	2.5G	2.5G	>= 17.4.1	Yes	Bi-directional; encrypted
	5G	5G	>= 17.4.1	Yes	
	10G	unthrottled	>= 17.4.1	Yes	
C8500L-8S4X (default 1G)	1G	1G	>= 17.5.1	Yes	Bi-directional; encrypted
	2.5G	2.5G	>= 17.5.1	Yes	
	5G	5G	>= 17.5.1	Yes	
	10G	unthrottled	>= 17.5.1	Yes	
C8000v (default 10M)	10M	10M	>= 17.4.1	No	Bi-directional; encrypted and unencrypted throughput
	25M	25M	>= 17.4.1	No	
	50M	50M	>= 17.4.1	No	
	100M	100M	>= 17.4.1	No	
	250M	250M	>= 17.4.1	No	
	500M	500M	>= 17.4.1	Yes	
	1G	1G	>= 17.4.1	Yes	
	2.5G	2.5G	>= 17.4.1	Yes	
	5G	5G	>= 17.4.1	Yes	
	10G	10G	>= 17.4.1	Yes	

Throughput and System Hardware Throttling Specifications in the SD-WAN Controller Mode

PID	Throughput Without HSECK9	Throughput With HSECK9	Supported Release	Throughput Type
C8300-1N1S-4T2X (default 250M)	250M	unthrottled	>=17.4.1	Bi-directional; encrypted
C8300-2N2S-6T (default 250M)	250M	1G	>=17.4.1	Bi-directional; encrypted
C8300-1N1S-6T (default 250M)	250M	1G	>=17.4.1	Bi-directional; encrypted

PID	Throughput Without HSECK9	Throughput With HSECK9	Supported Release	Throughput Type
C8300-2N2S-4T2X (default 250M)	250M	unthrottled	>=17.4.1	Bi-directional; encrypted
C8200-1N-4T (default 250M)	250M	500M	>=17.4.1	Bi-directional; encrypted
C8200-1N-4T-L (default 250M)	250M	250M	>=17.5.1	Bi-directional; encrypted
C8500-12X4QC (default unthrottled)	unthrottled	Unthrottled	>=17.4.1	Bi-directional; encrypted
C8500-12X (default unthrottled)	unthrottled	unthrottled	>=17.4.1	Bi-directional; encrypted
C8500L-8S4X (default unthrottled)	unthrottled	unthrottled	>=17.5.1	Bi-directional; encrypted
C8000v (default 250M)	250M	unthrottled	>=17.4.1	Bi-directional; encrypted and unencrypted throughput

Throughput as a Tier

Tier-based throughput configuration is supported starting with Cisco IOS XE Cupertino 17.7.1a.

A tier represents a throughput level. Starting with the lowest throughput level, the available tiers are Tier 0 (T0), Tier 1 (T1), Tier 2 (T2), and Tier 3 (T3). T2 and higher tiers require an HSECK9 license.

All tiers are not available with all Cisco DNA licenses. For example, T3 is not available with the Network Essentials and DNA-Essentials licenses. This also means that if you have T3 as the configured throughput, you cannot change the boot level license to Network Essentials and DNA Essentials.

The tier-based throughput value in a license PID is bi-directional - it is the maximum throughput that is allowed *in each direction* (upstream and downstream). The aggregate throughput is a *sum* of the throughput in both directions and therefore double the bi-directional throughput. For example, if you order license PID DNA-C-**T0**-A-3Y, T0 is the bi-directional throughput, and the throughput value you configure on the device. When you configure this value, T0 upstream and T0 downstream, is supported. T0 tier supports upto 15 Mbps throughput. Therefore the aggregate throughput is 30 Mbps.

Note Different platforms support different maximum throughput levels, therefore each tier means a different value for different platforms. For example, T2 means 1G throughput for C8300-2N2S-4T2, 500M for C8200-1N-4T, and 250M for C8200-1N-4T-L. See table Tier and Numeric Throughput Mapping for information about how numeric throughput values are mapped to tiers.

Starting with Cisco IOS XE Cupertino 17.8.1a, when you configure T2 or a highter tier, aggregate throughput throttling is effective. This means that traffic is throttled in an aggregate manner irrespective of the distribution of the traffic in the upstream and downstream direction. This is supported only on physical platforms.

- **Example: Throttling when throughput is T2 or a higher tier**

  You order license PID DNA-C-**T2**-A-3Y. With T2, the bi-directional throughput can be upto 1 Gbps and the aggregate throughput can be upto 2 Gbps. The release-wise configuration and behaviour is as follows:

  - Until Cisco IOS XE Cupertino 17.7.x, on physical and virtual plaforms: You configure T2 on the device, and depending on the device a maximum of up to 1 Gbps upstream and up to 1 Gbps downstream throughput is supported.
  - From Cisco IOS XE Cupertino 17.8.1a:

    On physical platforms, you configure T2, and depending on the device, up to 2 Gbps of aggregate throughput is available for use in any upstream and downstream ratio.

    Note On C8200-1N-4T-L, if you configure T2, 500 Mbps is available for use in any upstream and downstream ratio. But if you configure a numeric value of 250M, a maximum of 250 Mbps is available in each direction.

    On virtual platforms, you configure a throughput of T2 on the device. A maximum of 1 Gbps upstream and 1 Gbps downstream throughput is available.

- **Example: Throttling when throughput is is T0 or T1**

  You order license PID DNA-C-**T1**-A-3Y. With T1, 100 Mbps is the bi-directional throughput, 200 Mbps is the aggregate throughput. The release-wise configuration and behaviour is as follows:

  For all releases, on physical and virtual plaforms, you configure a throughput of T1 on the device. A maximum of 100 Mbps upstream and 100 Mbps downstream throughput is available.

Tier and Numeric Throughput Mapping

Y: Network Premium and DNA Premium

Y: Network Advantage and DNA Advantage

Y: Network Essentials and DNA Essentials

PID	T0		T1			T2*	T3*
						**HSECK9 License Required*	

PID	T0		T1			T2*			T3*		
	10M	15M	25M	50M	100M	250M	500M	1G	2.5G	5G	10G
C8300-1N1S-6T	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y			
C8300-2N2S-6T	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y			
C8300-1N1S-4T2X	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y		
C8300-2N2S-4T2X	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y		
C8200-1N-4T	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y				
C8200-1N-4T-L	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y					
C8500-12X									Y Y	Y Y	Y Y
C8500-12X4QC									Y Y	Y Y	Y Y
C8500L-8S4X								Y Y	Y Y	Y Y	Y Y
C8000v	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y Y	Y Y	Y Y	

Numeric vs. Tier-Based Throughput Configuration

With the introduction of tier-based throughput configuration in Cisco IOS XE Cupertino 17.7.1a, when you configure throughput on the device, both numeric and tier-based options are available. This section provides information about when to configure a numeric throughput value and when to configure tier-based throughput.

Cisco Smart Software Manager (CSSM) is a portal that enables you to manage all your Cisco software licenses. All the license PIDs you purchase are listed in the CSSM Web UI at: https://software.cisco.com → Manage licenses. Log in to the portal and in the corresponding Smart Account and Virtual Account, navigate to **Inventory** > **Licences**, to display the numeric and tier-based licenses in the account. Figure Figure 1: Numeric and Tier Values Displayed in the CSSM Web UI, on page 53 shows you how to distinguish between the two.

- If you purchase a numeric license PID, the license is displayed with the numeric throughput value *and* tier-based value in the CSSM Web UI. For such a license, we recommend that you configure only a numeric throughput value.

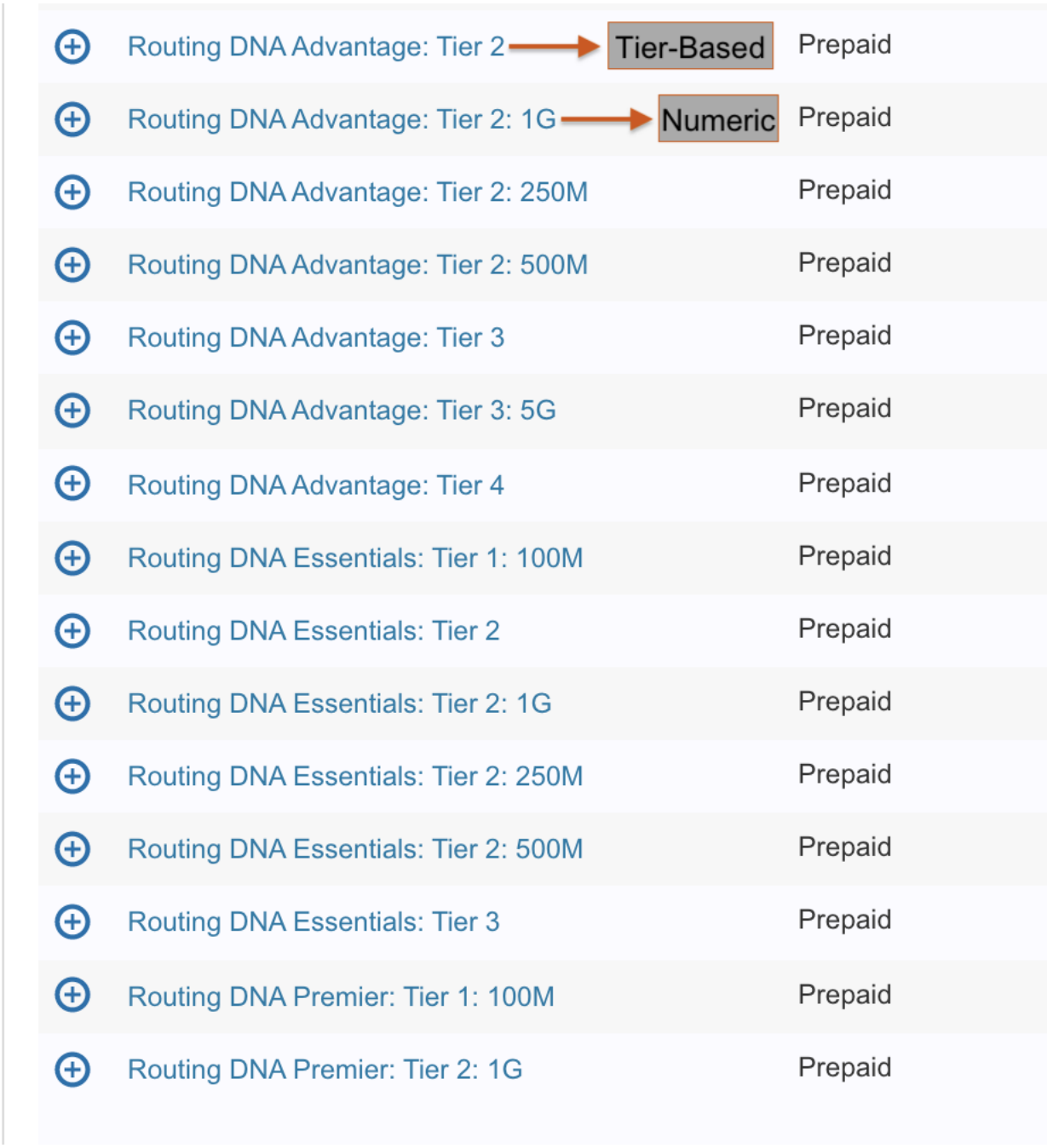
  See Configuring a Numeric Throughput, on page 58.

- If you purchase a tier-based license PID, the license is displayed with only the tier value in the CSSM Web UI. For such a license, you can either configure a tier-based throughput value to match the display in the CSSM Web UI, or you can configure a numeric throughput value.

  See Configuring a Tier-Based Throughput, on page 61 or Configuring a Numeric Throughput, on page 58.

Note There is no functional impact if you have tier-based license PID in CSSM and you configure a numeric throughput value on the device.

Figure 1: Numeric and Tier Values Displayed in the CSSM Web UI



The following scenarios further clarify when you can *convert* from numeric to tier-based throughput configuration, or from tier-based throughput configuration to numeric, when conversion is required, and when it is optional:

- You have configured a numeric throughput value on the device and the license PID is a numeric license: *You must not* convert to tier-based throughput value.

- You have configured a numeric throughput value on the device and the license PID is a tier-based license: You can convert the throughput configuration to tier-based value - but this is optional. There is no functional impact if you do not convert to a tier-based throughput value.

  If you want to convert to a tier-based value, see Converting From a Numeric Throughput Value to a Tier, on page 65

- You are upgrading to a release where tier-based throughput values are supported and the license PID is tier-based: You can convert the throughput to tier-based value after upgrade - but this is optional. There is no functional impact if you do not convert to a tier-based throughput value.

  See Upgrading from a Release Supporting Numeric Throughput to a Release Supporting Tiers, on page 68.

- You are upgrading to a release where tier-based throughput values are supported, and your license PID is numeric: *You must not* convert to a tier-based throughput value.

- You are downgrading to a release where only numeric throughput values are supported and your license PID and throughput configuration are tier-based: *You must* change configuration to a numeric throughput value, *before you downgrade.*

  See Downgrading from a Release Supporting Tiers to a Release Supporting Only Numeric Throughput, on page 68.

How to Configure Available Licenses and Throughput

This section provides information about the tasks you must complete, for the licenses available on the Cisco Catalyst 8000 Edge Platforms Family - before you can start using them.

For a Cisco DNA license: **Configure a Boot Level License → Configure Numeric or Tier-Based Throughput → Implement a Smart Licensing Using Policy Topology → Report License Usage (If Applicable)**.

For an HSECK9 license: **Configure a Boot Level License → Implement a Smart Licensing Using Policy Topology → Install SLAC**[3] **→ Enable HSECK9 on applicable platforms**[4] **→ Configure Numeric or Tier-Based Throughput → Report License Usage (If Applicable)**.

For a Cisco UBE, or Cisco Unified CME, or Cisco Unified SRST license: **Implement a Smart Licensing Using Policy Topology → Report License Usage (If Applicable)**.

Configuring a Boot Level License

If you have purchased a Cisco DNA license for a new device, or if you have an existing device and you want to change (upgrade or downgrade, add or remove) the currently configured license on your device, complete the following task.

This sets a boot level license and requires a reload before the configured changes are effective.

[3] If a SLAC has been factory-installed by Cisco manufactory (in case of new hardware), skip this step
[4] Enter the **license feature hseck9** command in global configuration mode for Catalyst 8200, and 8300 Series Edge Platforms only.

SUMMARY STEPS

1. **show version**
2. **configure terminal**
3. Depending on whether the device is a physical or virtual one, configure the applicable command:
   - For physical platforms: [**no**] **license boot level** {**network-advantage** [**addon dna-advantage**] | **network-essentials** [**addon dna-essentials**] | **network-premier** [**addon dna-premier**] }
   - For virtual platforms: [**no**] **license boot level** {**network-advantage** {**addon dna-advantage**} | **network-essentials** {**addon dna-essentials**} | **network-premier** {**addon dna-premier**} }
4. **exit**
5. **copy running-config startup-config**
6. **reload**
7. **show version**
8. **show license summary**
9. Complete usage reporting - if required

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show version**
	Example:
	`Device# show version`
	`<output truncated>`
	`Technology Package License Information:`
	
	`------------------------------------------------------------`
	`Technology Type Technology-package Technology-package`
	`Current Next Reboot`
	`------------------------------------------------------------`
	`Smart License Perpetual network-advantage network-advantage`
	`Smart License Subscription dna-advantage dna-advantage`
	
	`<output truncated>`
		Displays the currently set boot level license.
		In the accompanying example, Network Advantage and DNA Advantage licences are configured on the device.

Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	Depending on whether the device is a physical or virtual one, configure the applicable command: • For physical platforms: [**no**] **license boot level** {**network-advantage** [**addon dna-advantage**]	**network-essentials** [**addon dna-essentials**]	**network-premier** [**addon dna-premier**] } • For virtual platforms: [**no**] **license boot level** {**network-advantage** {**addon dna-advantage**}		Sets a boot level license. On all platforms, first configure a network-stack license. Only after this can you configure the corresponding add-on license. In the command syntax note how the configuration of a DNA-stack add-on license is optional on physical platforms, but mandatory on virtual platforms.

	Command or Action	Purpose

	network-essentials {**addon dna-essentials**} | **network-premier** {**addon dna-premier**} }
	Example:
	`Device(config)# license boot level network-premier addon dna-premier`
	`% use 'write' command to make license boot config take effect on next boot`
		The accompanying example, shows configuration on a C8300-1N1S-4T2X router, which is a physical platform. The network-stack license, Network Premier and the corresponding add-on license, DNA-Premier are configured.

Step 4	**exit** **Example:** `Device# exit`	Exits global configuration mode and returns to privileged EXEC mode.

Step 5	**copy running-config startup-config**
	Example:
	`Device# copy running-config startup-config`
	`Destination filename [startup-config]?`
	`Building configuration...`
	`[OK]`
	`<output truncated>`
		Saves your entries in the configuration file.

Step 6	**reload**
	Example:
	`Device# reload`
	`Proceed with reload? [confirm]`
	`*Dec 8 01:04:12.287: %SYS-5-RELOAD: Reload requested by console.`
	`Reload Reason: Reload Command.`
	`<output truncated>`
		Reloads the device. License levels configured in Step 3 are effective and displayed only after this reload.

Step 7	**show version**
	Example:
	`Device# show version`
	`<output truncated>`
	`Technology Package License Information:`
	`------------------------------------------------------`
	`Technology Type Technology-package Technology-package`
	`Current Next Reboot`
	`------------------------------------------------------`
	`Smart License Perpetual network-premier network-premier`
	`Smart License Subscription dna-premier dna-premier`
	`<output truncated>`
		Displays the currently set boot level license.
		In the accompanying example, the output confirms that Network Premier and DNA-Premier licenses are configured.

Step 8	**show license summary**
	Example:
	`Device# show license summary`
	`Account Information:`
		Displays a summary of license usage, which includes information about licenses being used, the count, and status.

	Command or Action	Purpose
	Smart Account: Eg-SA As of Dec 08 08:10:33 2021 UTC Virtual Account: Eg-VA License Usage: License Entitlement Tag Count Status network-premier_T2 (NWSTACK_T2_P) 1 IN USE dna-premier_T2 (DSTACK_T2_P) 1 IN USE	
Step 9	Complete usage reporting - if required	After you configure a license level, you may have to send a RUM report (Resource Utilization Measurement Report) to CSSM to report license usage information. To know if reporting is required, you can wait for a system message or refer to the policy using show commands. • The system message, which indicates that reporting is required: %SMART_LIC-6-REPORTING_REQUIRED: A Usage report acknowledgement will be required in [dec] days. [dec] is the amount of time (in days) left to meet reporting requirements. • If using **show** commands, refer to the output of the **show license status** privileged EXEC command and check the `Next ACK deadline` field. This means a RUM report must be sent and the acknolwedgement (ACK) from CSSM must be installed by this date. *How* you send the RUM report, depends on the topology you have implemented in the Smart Licensing Using Policy environment. For more information, see How to Configure Smart Licensing Using Policy: Workflows by Topology.

Installing SLAC for an HSECK9 License

A Smart Licensing Authorization Code (SLAC) is generated in and obtained from Cisco Smart Software Manager (CSSM) portal.

There are multiple ways in which a product may be connected to the CSSM, in order to obtain a SLAC. Each way of connecting to CSSM is called a topology. You must implement one of the supported topologies so you can then install SLAC in the corresponding method.

For information about all the methods, see the Supported Topologies section of the Smart Licensing Using Policy for Cisco Enterprise Routing Platforms document.

Required Tasks After Installing SLAC

Complete the following required tasks after installing SLAC - only if applicable to the platform:

Platform	Required Tasks After Installing SLAC
For Catalyst 8200 and 8300 Series Edge Platforms	Enter the **license feature hseck9** command in global configuration mode. This *enables* the HSECK9 license on these platforms.
For the *C8500L* models of the Catalyst 8500 Series Edge Platforms	Reload the device after installing SLAC.

Configuring a Numeric Throughput

This task shows you how to change the numeric throughput level on physical and virtual platforms. If you do not configure a throughput level, the platform's default throughput level is effective.

Configuration of a throughput level requires a reload on physical platforms (Catalyst 8200, 8300, and 8500 Series Edge Platforms). A reload is not required for virtual platforms (Catalyst 8000V Edge Software).

Before you begin

- Read the Throughput as a Numeric Value , on page 46 and Numeric vs. Tier-Based Throughput Configuration, on page 52 sections.
- Ensure that a boot level license is already configured on the device. See Configuring a Boot Level License, on page 54. In the output of the show version privileged EXEC command ensure that a license is mentioned in the `License Level` field.
- If you are configuring throughput greater than 250 Mbps, ensure that you have already installed a Smart Licensing Authorization Code (SLAC) according to the method that applies to your topology in the Smart Licensing Using Policy environment. See Installing SLAC for an HSECK9 License, on page 57.
- Note the throughput you are entitled to. This is indicated in the Cisco DNA license PID you purchase.

SUMMARY STEPS

1. Depending on whether the device is a physical or virtual one, enter the applicable command:
   - For physical platforms: **show platform hardware throughput crypto**
   - For virtual platforms: **show platform hardware throughput level**
2. **configure terminal**
3. Depending on whether the device is a physical or virtual one, configure the applicable command:
   - For physical platforms: **platform hardware throughput crypto** {**100M** | **10M** | **15M** | **1G** | **2.5G** | **250M** | **25M** | **500M** | **50M**}
   - For virtual platforms: **platform hardware throughput level MB** {**100** | **1000** | **10000** | **15** | **25** | **250** | **2500** | **50** | **500** | **5000**}
4. **exit**
5. **copy running-config startup-config**
6. **reload**
7. Depending on whether the device is a physical or virtual one, enter the applicable command:
   - For physical platforms: **show platform hardware throughput crypto**

• For virtual platforms: **show platform hardware throughput level**

DETAILED STEPS

	Command or Action	Purpose

Step 1	Depending on whether the device is a physical or virtual one, enter the applicable command:
	• For physical platforms: **show platform hardware throughput crypto**
	• For virtual platforms: **show platform hardware throughput level**
	Example:
	`Device# show platform hardware throughput crypto`
	
	`Current configured crypto throughput level: 250M`
	`  Level is saved, reboot is not required`
	`Current enforced crypto throughput level: 250M`
	`Crypto Throughput is throttled at 250M`
	`Default Crypto throughput level: 10M`
	`Current boot level is network-advantage`
	
	`OR`
	
	`Device# show platform hardware throughput level`
	`The current throughput level is 1000000 kb/s`
		Displays the currently running throughput on the device.
		In the accompanying examples,
		• The **show platform hardware throughput crypto** sample output is of a physical platform (a C8300-2N2S-4T2X). Here the throughput level is throttled at 250M.
		• The **show platform hardware throughput level** sample output is of a virtual platform (a C8000V).

Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

Step 3	Depending on whether the device is a physical or virtual one, configure the applicable command:
	• For physical platforms: **platform hardware throughput crypto** {**100M** | **10M** | **15M** | **1G** | **2.5G** | **250M** | **25M** | **500M** | **50M**}
	• For virtual platforms: **platform hardware throughput level MB** {**100** | **1000** | **10000** | **15** | **25** | **250** | **2500** | **50** | **500** | **5000**}
	Example:
	`Device(config)# platform hardware throughput crypto ?`
	`  100M  100 mbps bidirectional thput`
	
	`  10M   10 mbps bidirectional thput`
	
	`  15M   15 mbps bidirectional thput`
	
	`  1G    2 gbps aggregate thput`
	
	`  2.5G  5 gbps aggregate thput`
	
	`  250M  250 mbps bidirectional thput`
		Configures the throughput level. The displayed throughput options depend on the device.
		The following apply to both physical and virtual platforms:
		• At a minimum, you must have configured a network-stack license already. Otherwise the command is not recognized as a valid one on the command line interface.
		• If you are configuring throughput greater than 250 Mbps, you must have already installed SLAC. Options greater than 250 Mbps are displayed only if SLAC is installed.
		In the accompanying examples,
		• 1 Gbps is configured on the physical platform. Aggregate throughput throttling (Cisco IOS XE Cupertino 17.8.1a and later) is effective. After reboot, irrespective of the distribution of traffic in the upstream and downstream direction, an aggregate throughput limit of 2 Gbps is effective.

	Command or Action	Purpose
	25M 25 mbps bidirectional thput 500M 1gbps aggregate thput 50M 50 mbps bidirectional thput Device(config)# platform hardware throughput crypto 1G % These values don't take effect until the next reboot. Please save the configuration. OR Device(config)# **platform hardware throughput level MB 5000** %Throughput has been set to 5000 Mbps.	• 5000 Mbps is configured on the virtual platform. A maximum of 5000 Mbps upstream and 5000 Mbps downstream throughput is supported.
Step 4	**exit** **Example:** Device# **exit**	Exits global configuration mode and returns to privileged EXEC mode.
Step 5	**copy running-config startup-config** **Example:** Device# **copy running-config startup-config**	Saves your entries in the configuration file.
Step 6	**reload** **Example:** Device# **reload**	Reloads the device. **Note** Perform this step only if the device you are configuring throughput on is a physical platform (Catalyst 8200, 8300, and 8500 Series Edge Platforms). Skip this step if you are configuring throughput on a virtual platform (Catalyst 8000V Edge Software).
Step 7	Depending on whether the device is a physical or virtual one, enter the applicable command: • For physical platforms: **show platform hardware throughput crypto** • For virtual platforms: **show platform hardware throughput level** **Example:** Device# **show platform hardware throughput crypto** Current configured crypto throughput level: 1G Level is saved, reboot is not required Current enforced crypto throughput level: 1G Crypto Throughput is throttled at 2G(Aggregate) Default Crypto throughput level: 10M	Displays the currently running throughput on the device. **Note** On physical platforms, you can also enter the **show platform hardware qfp active feature ipsec state** privileged EXEC command to display the configured throughput level.

	Command or Action	Purpose
	OR Device# **show platform hardware throughput level** The current throughput level is 5000000 kb/s	

Configuring a Tier-Based Throughput

This task shows you how to configure a tier-based throughput level on physical and virtual platforms. If you do not configure a throughput level, the platform's default throughput level is effective.

Tier-based throughput levels are supported starting with Cisco IOS XE Cupertino 17.7.1a only.

Configuration of a throughput level requires a reload on physical platforms (Catalyst 8200, 8300, and 8500 Series Edge Platforms). A reload is not required for virtual platforms (Catalyst 8000V Edge Software).

Before you begin

- Read the Throughput as a Tier, on page 50 and Numeric vs. Tier-Based Throughput Configuration, on page 52 sections.
- Ensure that a boot level license is already configured on the device. See Configuring a Boot Level License, on page 54. In the output of the **show version** privileged EXEC command, ensure that the license is mentioned.
- If you want to configure Tier 3 (T3) ensure that the boot level license is Network Advantage/ DNA Advantage, or Network Premier/DNA Premier. T3 is not supported with Network Essentials and DNA Essentials.
- If you are configuring Tier 2 (T2) or a higher tier, ensure that you have already installed a Smart Licensing Authorization Code (SLAC) according to the method that applies to your topology in the Smart Licensing Using Policy environment. See Installing SLAC for an HSECK9 License, on page 57.
  - On physical platforms, T2 or higher tiers are not displayed if SLAC is not installed.
  - On virtual platforms, all tier options are displayed even if SLAC is not installed. But SLAC is required if you want to configure T2 or a higher tier.
- Note the throughput you are entitled to. This is indicated in the Cisco DNA license PID you purchase.

SUMMARY STEPS

1. Depending on whether the device is a physical or virtual one, enter the applicable command:
   - For physical platforms: **show platform hardware throughput crypto**
   - For virtual platforms: **show platform hardware throughput level**
2. **show license authorization**
3. **configure terminal**
4. Depending on whether the device is a physical or virtual one, configure the applicable command:
   - For physical platforms: **platform hardware throughput crypto** {**T0** | **T1** | **T2** | **T3**}
   - For virtual platforms: **platform hardware throughput level MB** {**T0** | **T1** | **T2** | **T3** }

5. **exit**
6. **copy running-config startup-config**
7. **reload**
8. Depending on whether the device is a physical or virtual one, enter the applicable command:
   - For physical platforms: **show platform hardware throughput crypto**
   - For virtual platforms: **show platform hardware throughput level**

DETAILED STEPS

	Command or Action	Purpose

Step 1	Depending on whether the device is a physical or virtual one, enter the applicable command:
	• For physical platforms: **show platform hardware throughput crypto**
	• For virtual platforms: **show platform hardware throughput level**
	Example:
	`Device# show platform hardware throughput crypto`
	`show platform hardware throughput crypto`
	
	`Current configured crypto throughput level: 250M`
	`Level is saved, reboot is not required`
	`Current enforced crypto throughput level: 250M`
	`Crypto Throughput is throttled at 250M`
	`Default Crypto throughput level: 10M`
	`Current boot level is network-premier`
	
	`OR`
	
	`Device# show platform hardware throughput level`
	`The current throughput level is 10000 kb/s`
		Displays the currently running throughput on the device.
		In the accompanying examples:
		• The **show platform hardware throughput crypto** sample output is of a physical platform (a C8300-2N2S-4T2X). Here throughput is currently throttled at 250 Mbps.
		• The **show platform hardware throughput level** sample output is of a virtual platform (a C8000V). Here the current throughput level is 10 Mbps.

Step 2	**show license authorization**
	Example:
	`Device# show license authorization`
	`Overall status:`
	`Active: PID:C8300-2N2S-4T2X,SN:FDO2250A0J5`
	`Status: SMART AUTHORIZATION INSTALLED on Mar 02 05:05:19 2022 UTC`
	`Last Confirmation code: 418b11b3`
	
	`Authorizations:`
	`Router US Export Lic. for DNA (DNA_HSEC):`
	`Description: U.S. Export Restriction Compliance license for`
	`DNA based Routers`
	`Total available count: 1`
	`Enforcement type: EXPORT RESTRICTED`
	`Term information:`
	`Active: PID:C8300-1N1S-4T2X,SN:FDO2250A0J5`
	`Authorization type: SMART AUTHORIZATION INSTALLED`
	`License type: PERPETUAL`
	`Term Count: 1`
		(Optional) Displays SLAC information on the product instance.
		In the accompanying example:
		• SLAC is installed on the physical platform. This is so we can configure T2 in the subsequent steps.
		• SLAC is not available on the virtual platform. Note how this affects throughput configuration in the subsequent steps.

	Command or Action	Purpose
	Purchased Licenses: No Purchase Information Available OR Device# **show license authorization** Overall status: Active: PID:C8000V,SN:9I8GRCH8CMN **Status: NOT INSTALLED**	
Step 3	**configure terminal** **Example:** Device# **configure terminal**	Enters global configuration mode.
Step 4	Depending on whether the device is a physical or virtual one, configure the applicable command: • For physical platforms: **platform hardware throughput crypto** {**T0** | **T1** | **T2** | **T3**} • For virtual platforms: **platform hardware throughput level MB** {**T0** | **T1** | **T2** | **T3** } **Example:** Device(config)# **platform hardware throughput crypto ?** 100M 100 mbps bidirectional thput 10M 10 mbps bidirectional thput 15M 15 mbps bidirectional thput 1G 2 gbps aggregate thput 2.5G 5 gbps aggregate thput 250M 250 mbps bidirectional thput 25M 25 mbps bidirectional thput 500M 1gbps aggregate thput 50M 50 mbps bidirectional thput T0 T0(up to 15 mbps) bidirectional thput T1 T1(up to 100 mbps) bidirectional thput T2 T2(up to 2 gbps) aggregate thput T3 T3(up to 5 gbps) aggregate thput Device(config)# **platform hardware throughput crypto T2** % **These values don't take effect until the next reboot.** **Please save the configuration.** *Mar 02 05:06:19.042:	Configures a tier-based throughput. The throughput options that are displayed, depend on the device. **Note** Only tiers are mentioned in command, for the sake of clarity. When you enter the command on the CLI, numeric and tier values are displayed - as shown in the accompanying examples. The following apply to both physical and virtual platforms: • You have configured a boot level license already. Otherwise the command for throughput configuration is not recognized as a valid one on the command line interface. • If you are configuring T2 or a higher tier, you have installed SLAC. **Note** On a physical platform, you will not be able to configure T2 or a higher tier if SLAC is not installed. On a virtual platform, if you configure T2 or a higher tier without SLAC, the product instance automatically tries to reach CSSM to request and install SLAC. If it is successful, throughput is set to the configured tier. If it is not successful, the system sets the throughput *to* 250 Mbps. If and when SLAC is installed, the throughput is automatically set to the last configured value. In the accompanying examples: • On the physical platform (**platform hardware throughput crypto**), tiers T2 and higher tiers are displayed, because SLAC is installed. If SLAC were

	Command or Action	Purpose
	%CRYPTO_SL_TP_LEVELS-6-SAVE_CONFIG_AND_RELOAD: New throughput level not applied until reload; please save config OR Device(config)# **platform hardware throughput level MB ?** 100 Mbps 1000 Mbps 10000 Mbps 15 Mbps 25 Mbps 250 Mbps 2500 Mbps 50 Mbps 500 Mbps 5000 Mbps T0 Tier0(up to 15M throughput) T1 Tier1(up to 100M throughput) T2 Tier2(up to 1G throughput) T3 Tier3(up to 10G throughput) T4 Tier4(unthrottled) Device(config)# **platform hardware throughput level MB T2** **%Requested throughput will be set once HSEC authorization code is installed**	not available, T1 would have been the highest tier displayed. Further, aggregate throughput throttling (Cisco IOS XE Cupertino 17.8.1a and later) is effective. After reboot, irrespective of the distribution of traffic in the upstream and downstream direction, an aggregate throughput limit of 2 Gbps is supported. • On the virtual platform (**platform hardware throughput level MB**), all tiers are displayed. After T2 is configured, the system message alerts you to the fact that the configuration is not set, because SLAC is not installed.
Step 5	**exit** **Example:** Device# **exit**	Exits global configuration mode and returns to privileged EXEC mode.
Step 6	**copy running-config startup-config** **Example:** Device# **copy running-config startup-config** Destination filename [startup-config]? Building configuration... [OK]	Saves your entries in the configuration file.
Step 7	**reload** **Example:** Device# **reload** Proceed with reload? [confirm] *Mar 02 05:07:00.979: %SYS-5-RELOAD: Reload requested by console. Reload Reason: Reload Command.	Reloads the device. **Note** A reload is required only for physical platforms.
Step 8	Depending on whether the device is a physical or virtual one, enter the applicable command: • For physical platforms: **show platform hardware throughput crypto**	Displays the currently running throughput on the device. In the accompanying examples: • On the physical platform, the tier value is set to T2.

	Command or Action	Purpose

	• For virtual platforms: **show platform hardware throughput level**
	Example:
	`Device# show platform hardware throughput crypto`
	`Current configured crypto throughput level: T2`
	`Level is saved, reboot is not required`
	`Current enforced crypto throughput level: 1G`
	`Crypto Throughput is throttled at 2G(Aggregate)`
	`Default Crypto throughput level: 10M`
	`Current boot level is network-premier`
	
	`OR`
	
	`Device# show platform hardware throughput level`
	`The current throughput level is 250000 kb/s`
		Note On physical platforms, you can also enter the **show platform hardware qfp active feature ipsec state** privileged EXEC command to display the configured throughput level.
		• On the virtual platform, throughput is set to 250 Mbps. If and when SLAC is installed, the throughput will be automatically set to the last configured value, which is T2.

Converting From a Numeric Throughput Value to a Tier

This task shows you how to convert a numeric throughput value to a tier-based throughput value. To know how numeric throughput values are mapped to tier values refer to the table here: Tier and Numeric Throughput Mapping.

Converting the throughput level requires a reload on physical platforms (Catalyst 8200, 8300, and 8500 Series Edge Platforms). A reload is not required for virtual platforms (Catalyst 8000V Edge Software).

Before you begin

- Read the Numeric vs. Tier-Based Throughput Configuration, on page 52 section.
- If you are converting numeric throughput that is equal or greater than 250 Mbps, ensure that a SLAC is installed on the device. See Installing SLAC for an HSECK9 License, on page 57.
- The software version running on the product instance is Cisco IOS XE Cupertino 17.7.1a or a later release.

SUMMARY STEPS

1. Depending on whether the device is a physical or virtual one, enter the applicable command:
   - For physical platforms: **show platform hardware throughput crypto**
   - For virtual platforms: **show platform hardware throughput level**
2. Depending on whether the device is a physical or virtual one, enter the applicable command:
   - For physical platforms: **license throughput crypto auto-convert**
   - For virtual platforms: **license throughput level auto-convert**
3. **copy running-config startup-config**
4. **reload**
5. Depending on whether the device is a physical or virtual one, enter the applicable command:
   - For physical platforms: **show platform hardware throughput crypto**
   - For virtual platforms: **show platform hardware throughput level**

6. Verify that conversion is complete.
   - For physical platforms: **license throughput crypto auto-convert**
   - For virtual platforms: **license throughput level auto-convert**

DETAILED STEPS

	Command or Action	Purpose

Step 1	Depending on whether the device is a physical or virtual one, enter the applicable command:
	• For physical platforms: **show platform hardware throughput crypto**
	• For virtual platforms: **show platform hardware throughput level**
	Example:
	`Device# show platform hardware throughput crypto`
	`Current configured crypto throughput level: 500M`
	`  Level is saved, reboot is not required`
	`Current enforced crypto throughput level: 500M`
	`Crypto Throughput is throttled at 500M`
	`Default Crypto throughput level: 10M`
	`Current boot level is network-premier`
	
	`OR`
	
	`Device# show platform hardware throughput level`
	`The current throughput level is 100000 kb/s`
		Displays the currently running throughput on the device.

Step 2	Depending on whether the device is a physical or virtual one, enter the applicable command:
	• For physical platforms: **license throughput crypto auto-convert**
	• For virtual platforms: **license throughput level auto-convert**
	Example:
	`Device# license throughput crypto auto-convert`
	`Crypto throughput auto-convert from level 500M to T2`
	
	`% These values don't take effect until the next reboot.`
	`Please save the configuration.`
	`*Dec  8 03:21:01.401:`
	`%CRYPTO_SL_TP_LEVELS-6-SAVE_CONFIG_AND_RELOAD:`
	`New throughput level`
	`not applied until reload; please save config`
	
	`OR`
	
	`Device# license throughput level auto-convert`
	`%Throughput tier set to T1 (100 Mbps)`
	`% Tier conversion is successful.`
	`Please write memory to save the tier config`
		Converts the numeric throughput to a tier-based throughput value. The converted tier value is displayed on the CLI.

	Command or Action	Purpose

Step 3	**copy running-config startup-config**
	Example:
	`Device# copy running-config startup-config`
	`Destination filename [startup-config]?`
	`Building configuration...`
	`[OK]`
		Saves your entries in the configuration file.
		Note Even though the command you use to convert from numeric to tier-based throughput is a privileged EXEC command, it changes running configuration from a numeric value to a tier-based value. You must therefore save configuration for the next reload to be displayed with a tier value.

Step 4	**reload**
	Example:
	`Device# reload`
	`Proceed with reload? [confirm]`
	`*Dec 8 03:24:09.534: %SYS-5-RELOAD: Reload requested by console.`
	`Reload Reason:`
	`Reload Command`
		Reloads the device.
		Note A reload is required only on physical platforms.

Step 5	Depending on whether the device is a physical or virtual one, enter the applicable command:
	• For physical platforms: **show platform hardware throughput crypto**
	• For virtual platforms: **show platform hardware throughput level**
	Example:
	`Device# show platform hardware throughput crypto`
	`Current configured crypto throughput level: T2`
	`Level is saved, reboot is not required`
	`Current enforced crypto throughput level: 1G`
	`Crypto Throughput is throttled at 1G`
	`Default Crypto throughput level: 10M`
	`Current boot level is network-premier`
	`OR`
	`Device# show platform hardware throughput level`
	`The current throughput level is 100000 kb/s`
		Displays the currently running throughput on the device.

Step 6	Verify that conversion is complete.
	• For physical platforms: **license throughput crypto auto-convert**
	• For virtual platforms: **license throughput level auto-convert**
	Example:
	`Device# license throughput crypto auto-convert`
	`Crypto throughput is already tier based, no need to convert.`
	`OR`
		Tip To cross-check that conversion is complete, you can also enter the conversion command again. If the numeric throughput value has already been converted, the system displays a message confirming this.

	Command or Action	Purpose

	`Device# license throughput level auto-convert`
	`% Tier conversion not possible since the device is already`
	`in tier licensing`	

Upgrading from a Release Supporting Numeric Throughput to a Release Supporting Tiers

If you are upgrading to Cisco IOS XE Cupertino 17.7.1 or later release ***and*** the license PID is a tier-based one, you can convert throughput configuration to a tier-based value, or you can retain the numeric throughput configuration.

Note There is no functional impact if you have tier-based license PID in CSSM and a numeric throughput value is configured on the device.

If you want to convert to a tier-based value note the required action depending on the throughput level that is configured:

Throughput Configuration Before Upgrade	Action Before Upgrade	Action After Upgrade to 17.7.1 or Later
Lesser than 250 Mbps	No action required.	Converting From a Numeric Throughput Value to a Tier, on page 65
Equal to 250 Mbps	Obtain an HSECK9 license and install SLAC if you want to convert to T2.	Converting From a Numeric Throughput Value to a Tier, on page 65
Greater than 250 Mbps	No action required.	Converting From a Numeric Throughput Value to a Tier, on page 65

Downgrading from a Release Supporting Tiers to a Release Supporting Only Numeric Throughput

If you are downgrading to a release where only numeric throughput configuration is supported, you *must* convert tier-based throughput configuration to a numeric throughput value before downgrade. This is applicable even if the license PID is a tier-based license PID.

Caution If a tier-based throughput value was configured before downgrade and you downgrade without changing to a numeric value, tier configuration is not recognized by a pre-17.7.1 image and configuration fails. Further, throughput may not be restored to the pre-downgrade level and you have to configure a numeric throughput level after downgrade.

Throughput Configuration Before Downgrade	Action Before Downgrade	Action After Downgrade to a pre-17.7.1 Version
Numeric	No action required.	No action required.
Tier	Configuring a Numeric Throughput, on page 58	No action required.

Available Licensing Models

The licensing model defines *how* you account for or report the licenses that you use, to Cisco. The following licensing models are available on the Cisco Catalyst 8000 Edge Platforms Family:

Smart Licensing Using Policy

With this licensing model, you purchase the licenses you want to use, configure them on the device, and then report license usage – as required. You do not have to complete any licensing-specific operations, such as registering or generating keys before you start using the software and the licenses that are tied to it - unless you are using export-controlled and enforced licenses.

This licensing model is supported on all products in the Cisco Catalyst 8000 Edge Platforms Family.

For more information, see Smart Licensing Using Policy for Cisco Enterprise Routing Platforms.

Pay As You Go (PAYG) Licensing

Note This licensing model is available only on Catalyst 8000V Edge Software.

Cisco Catalyst 8000V supports the PAYG licensing model with Amazon Web Services (AWS) and Microsoft Azure Marketplace - in both the autonomous mode and the controller mode. The Cisco Catalyst 8000V hourly-billed Amazon Machine Image (AMI) or the Pay As You Go licensing model allows you to consume an instance for a defined period of time.

- In the autonomous mode, you can directly launch an instance from the AWS or Azure Marketplace and start using it. The licenses are embedded in the image and the selected license package and configured throughput level are effective when you launch the instance
- In the controller mode, which is supported from Cisco IOS-XE Bengaluru 17.5.1, you must first onboard the device into Cisco SD-WAN as per Onboard Cisco Catalyst 8000V Edge Software Hosted by a Cloud Service, Using PAYG Licensing. After this, when you launch the instance from AWS, the device comes-up with the license already installed for unlimited throughput.

Managed Service Licensing Agreement

Managed Service Licensing Agreement (MSLA) is a consumption-based software licensing model designed for Cisco's Managed Service Provider business. It is available with Cisco SD-WAN controller mode.

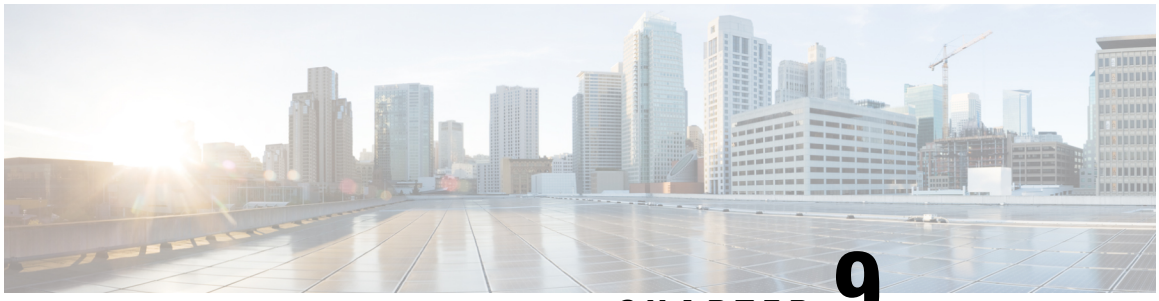
Note This licensing model is supported on all products in the Cisco Catalyst 8000 Edge Platforms Family in the Cisco SD-WAN controller mode.

For more information, see:

Managed Service Licensing Agreement (MSLA) for Cisco SD-WAN At-a-Glance

Cisco SD-WAN Getting Started Guide → *Manage Licenses for Smart Licensing Using Policy*.

Cisco vManage How-Tos for Cisco IOS XE SD-WAN Devices → *Manage Licenses for Smart Licensing Using Policy*.



CHAPTER 9

Consolidated Package Management

This chapter discusses how consolidated packages are managed and are used to run the Cisco Catalyst 8500 Series Edge Platforms.

Note This process is not applicable for C8500L-8S4X.

It contains the following sections:

- Running the Cisco Catalyst 8500 Series Edge Platforms: An Overview, on page 71
- Software File Management Using Command Sets, on page 72
- Managing and Configuring the Router to Run Using Consolidated Packages, on page 73
- Installing the Software Using install Commands, on page 75

Running the Cisco Catalyst 8500 Series Edge Platforms: An Overview

The Cisco Catalyst 8500 Series Edge Platforms can be run using a complete consolidated package.

This section covers the following topics:

Running the Cisco Catalyst 8500 Series Edge Platforms Using a Consolidated Package: An Overview

The Cisco Catalyst 8500 Series Edge Platforms can be configured to run using a consolidated package.

When the router is configured to run using a consolidated package, the entire consolidated package file is copied onto the router or accessed by the router via TFTP or another network transport method. The router runs using the consolidated package file.

When a Cisco Catalyst 8500 Series Edge Platforms is configured to run using the consolidated package file, more memory is required to process router requests because the router has to search one larger file for every request. The peak amount of memory available for passing network traffic is therefore lower when the router is configured to run using a consolidated package.

A Cisco Catalyst 8500 Series Edge Platforms configured to run using a consolidated package is booted by booting the consolidated package file.

A consolidated package can be booted and utilized using TFTP or another network transport method.Running the router using a consolidated package may be the right method of running the router in certain networking environments.

The consolidated package should be stored on bootflash:, usb[0-1]:, or a remote file system when this method is used to run the router.

Running the Cisco Catalyst 8500 Series Edge Platforms: A Summary

This section summarizes the advantages and disadvantages of each method of running your Cisco Catalyst 8500 Series Edge Platforms.

The advantages of running your router using a consolidated package include:

- Simplified installation—Only one software file needs to be managed instead of several separate images.
- Storage—A consolidated package can be used to run the router while being stored in bootflash:, on a USB Flash disk, or on a network server. A consolidated package can be booted and utilized using TFTP or another network transport method.

Software File Management Using Command Sets

Software files can be managed on the Cisco Catalyst 8500 Series Edge Platforms using three distinct command sets. This section provides overviews of the following command sets:

The request platform Command Set

The **request platform software package** command is part of the larger **request platform** command set being introduced on the Cisco Catalyst 8500 Series Edge Platforms. For additional information on each **request platform** command and the options available with each command, see the *Cisco IOS Configuration Fundamentals Command Reference* .

The **request platform software package** command, which can be used to upgrade individual subpackages and a complete consolidated package, is used to upgrade software on the Cisco Catalyst 8500 Series Edge Platforms. Notably, the **request platform software package** command is the recommended way of performing an individual subpackage upgrade, and also provides the only method of no-downtime upgrades of individual subpackages on the router when the router is running individual subpackages.

The **request platform software package** command requires that the destination device or process be specified in the command line, so the commands can be used to upgrade software on both an active or a standby processor. The **request platform software package** command allows for no downtime software upgrades in many scenarios.

The basic syntax of the command is **request platform software package install rp** *rp-slot-number* **file** *file-URL*, where *rp-slot-number* is the number of the RP slot and *file-URL* is the path to the file being used to upgrade the Cisco Catalyst 8500 Series Edge Platforms. The command has other options; see the **request platform software package** command references for information on all of the options available with this command set.

The copy Command

To upgrade a consolidated package on the Cisco Catalyst 8500 Series Edge Platforms, copy the consolidated package onto a file system, usually bootflash: or usb[0-1]: on the router, using the **copy** command as you would on most other Cisco routers. After making this copy, configure the router to boot using the consolidated package file.

See the **copy** command reference for a list of the options that are available with the **copy** command.

Managing and Configuring the Router to Run Using Consolidated Packages

This section discusses the following topics:

Quick Start Software Upgrade

The following instructions provide a quick start version of upgrading the software running the Cisco Catalyst 8500 Series Edge Platforms. These instructions assume you have access to the consolidated package and that the files will be stored in a bootflash: file system and has enough room for the file or files.

For more detailed installation examples, see the other sections of this chapter.

To upgrade the software using a quick start version, perform the following steps:

SUMMARY STEPS

1. Copy the consolidated package into bootflash: using the **copy** *URL-to-image* **bootflash:** command.
2. Enter the **dir bootflash:** command to verify your consolidated package in the directory.
3. Set up the boot parameters for your boot. Set the configuration register to 0x2 by entering the **config-register 0x2102** global configuration command, and enter the **boot system flash bootflash:***image-name*
4. Enter **copy running-config startup-config** to save your configuration.
5. Enter the **reload** command to reload the router and finish the boot. The upgraded software should be running when the reload completes.

DETAILED STEPS

Step 1 Copy the consolidated package into bootflash: using the **copy** *URL-to-image* **bootflash:** command.

Step 2 Enter the **dir bootflash:** command to verify your consolidated package in the directory.

Step 3 Set up the boot parameters for your boot. Set the configuration register to 0x2 by entering the **config-register 0x2102** global configuration command, and enter the **boot system flash bootflash:***image-name*

Step 4 Enter **copy running-config startup-config** to save your configuration.

Step 5 Enter the **reload** command to reload the router and finish the boot. The upgraded software should be running when the reload completes.

Managing and Configuring a Router to Run Using a Consolidated Package

This section documents the following procedures:

Managing and Configuring a Consolidated Package Using the copy Command

To upgrade a consolidated package on the Cisco Catalyst 8500 Series Edge Platforms using the **copy** command, copy the consolidated package into the bootflash: directory on the router using the **copy** command as you would on most other Cisco routers. After making this copy, configure the router to boot using the consolidated package file.

In the following example, the consolidated package file is copied onto the bootflash: file system from TFTP. The config-register is then set to boot using **boot system** commands, and the **boot system** commands instruct the router to boot using the consolidated package stored in the bootflash: file system. The new configuration is then saved using the **copy running-config startup-config** command, and the system is then reloaded to complete the process.

```
Router# dir bootflash:
Directory of bootflash:/
   11  drwx       16384   Dec 4 2007 04:32:46 -08:00  lost+found
86401  drwx        4096   Dec 4 2007 06:06:24 -08:00  .ssh
14401  drwx        4096   Dec 4 2007 06:06:36 -08:00  .rollback_timer
28801  drwx        4096  Mar 18 2008 17:31:17 -07:00  .prst_sync
43201  drwx        4096   Dec 4 2007 04:34:45 -08:00  .installer
   13  -rw-       45977   Apr 9 2008 16:48:46 -07:00  target_support_output.tgz.tgz
928862208 bytes total (712273920 bytes free)
Router# copy tftp bootflash:



Router# dir bootflash:


Router# config t
Enter configuration commands, one per line.  End with CNTL/Z.

Router# reload
```

Managing and Configuring a Consolidated Package Using the request platform software package install Command

In the following example, the **request platform software package install** command is used to upgrade a consolidated package running on RP 0. The **force** option, which forces the upgrade past any prompt (such as already having the same consolidated package installed), is used in this example.

```
Router# request platform software package install rp 0 file bootflash: force

--- Starting installation state synchronization ---
Finished installation state synchronization
--- Starting file path checking ---
Finished file path checking
--- Starting image file verification ---
Checking image file names
Verifying image file locations
Locating image files and validating name syntax
Inspecting image file types
Processing image file constraints
```

```
Extracting super package content
Verifying parameters
Validating package type
Copying package files
Checking and verifying packages contained in super package
Creating candidate provisioning file

  WARNING:
  WARNING: Candidate software will be installed upon reboot
  WARNING:

Finished image file verification
--- Starting candidate package set construction ---
Verifying existing software set
Processing candidate provisioning file
Constructing working set for candidate package set
Constructing working set for running package set
Checking command output
Constructing merge of running and candidate packages
Finished candidate package set construction
--- Starting compatibility testing ---
Determining whether candidate package set is compatible
WARNING:
WARNING: Candidate software combination not found in compatibility database
WARNING:
Determining whether installation is valid
Determining whether installation is valid ... skipped
Checking IPC compatibility with running software
Checking IPC compatibility with running software ... skipped
Checking candidate package set infrastructure compatibility
Checking infrastructure compatibility with running software
Checking infrastructure compatibility with running software ... skipped
Finished compatibility testing
--- Starting commit of software changes ---
Updating provisioning rollback files
Creating pending provisioning file
Committing provisioning file
Finished commit of software changes
SUCCESS: Software provisioned.  New software will load on reboot.
```

Router# **reload**

Note A reload must be performed to finish this procedure.The Managing and Configuring a Consolidated Package Using the copy Command, on page 74 includes an example of how to configure the router to boot using the consolidated package, and then an example of what happens after the reload is performed to finish the installation.

Installing the Software Using install Commands

From Cisco IOS XE Cupertino 17.7.1a, Cisco Catalyst 8000 Edge platforms are shipped in install mode by default. Users can boot the platform, and upgrade or downgrade to Cisco IOS XE software versions using a set of **install** commands.

Restrictions for Installing the Software Using install Commands

- ISSU is not covered in this feature.
- Install mode requires a reboot of the system.

Information About Installing the Software Using install Commands

From Cisco IOS XE Cupertino 17.7.1a release, for routers shipped in install mode, a set of **install** commands can be used for starting, upgrading and downgrading of platforms in install mode. This update is applicable to the Cisco Catalyst 8000 Edge platforms.

The following table describes the differences between Bundle mode and Install mode:

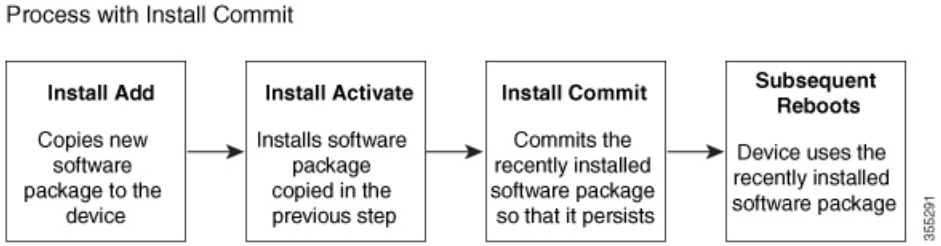
Table 11: Bundle Mode vs Install Mode

Bundle Mode	Install Mode
This mode provides a consolidated boot process, using local (hard disk, flash) or remote (TFTP) .bin image.	This mode uses the local (bootflash) packages.conf file for the boot process.
This mode uses a single .bin file.	.bin file is replaced with expanded .pkg files in this mode.
CLI: `#boot system file <filename>`	CLI: `#install add file bootflash: [activate commit]`
To upgrade in this mode, point the boot system to the new image.	To upgrade in this mode, use the **install** commands.
Image Auto-Upgrade: When a new Field-Replaceable Unit (FRU) is inserted in a modular chassis, manual intervention is required to get the new FRU running with the same version as the active FRUs.	Image Auto-Upgrade: When a new FRU is inserted in a modular chassis, the joining FRU is auto-upgraded to the image version in sync with the active FRUs.
Rollback: Rollback to the previous image with multiple Software Maintenance Updates (SMUs) may require multiple reloads.	Rollback: Enables rollback to an earlier version of Cisco IOS XE software, including multiple patches in single reload.

Install Mode Process Flow

The install mode process flow comprises three commands to perform installation and upgrade of software on platforms–**install add**, **install activate**, and **install commit**.

The following flow chart explains the install process with **install** commands:



The **install add** command copies the software package from a local or remote location to the platform. The location can be FTP, HTTP, HTTPs, or TFTP. The command extracts individual components of the .package file into subpackages and packages.conf files. It also validates the file to ensure that the image file is specific to the platform on which it is being installed.

The **install activate** command performs the required validations and provisions the packages previously added using the **install add** command. It also triggers a system reload.

The **install commit** command confirms the packages previously activated using the **install activate** command, and makes the updates persistent over reloads.

Note Installing an update replaces any previously installed software image. At any time, only one image can be installed in a device.

The following set of install commands is available:

Table 12: List of install Commands

Command	Syntax	Purpose
install add	**install add file** *location:filename.bin*	Copies the contents of the image, package, and SMUs to the software repository. File location may be local or remote. This command does the following: • Validates the file–checksum, platform compatibility checks, and so on. • Extracts individual components of the package into subpackages and packages.conf • Copies the image into the local inventory and makes it available for the next steps.

Command	Syntax	Purpose
install activate	**install activate**	Activates the package added using the **install add** command. • Use the **show install summary** command to see which image is inactive. This image will get activated. • System reloads on executing this command. Confirm if you want to proceed with the activation. Use this command with the **prompt-level none** keyword to automatically ignore any confirmation prompts.
(install activate) auto abort-timer	**install activate auto-abort timer** *<30-1200>*	The **auto-abort timer** starts automatically, with a default value of 120 minutes. If the **install commit** command is not executed within the time provided, the activation process is terminated, and the system returns to the last-committed state. • You can change the time value while executing the **install activate** command. • The **install commit** command stops the timer, and continues the installation process. • The **install activate auto-abort timer stop** command stops the timer without committing the package. • Use this command with the **prompt-level none** keyword to automatically ignore any confirmation prompts. • This command is valid only in the three-step install variant.

Command	Syntax	Purpose
install commit	**install commit**	Commits the package activated using the **install activate** command, and makes it persistent over reloads. • Use the **show install summary** command to see which image is uncommitted. This image will get committed.
install abort	**install abort**	Terminates the installation and returns the system to the last-committed state. • This command is applicable only when the package is in activated status (uncommitted state). • If you have already committed the image using the **install commit** command, use the **install rollback to** command to return to the preferred version.
install remove	**install remove {file** <*filename*> **| inactive}**	Deletes inactive packages from the platform repository. Use this command to free up space. • **file**: Removes specified files. • **inactive**: Removes all the inactive files.

Command	Syntax	Purpose
install rollback to	**install rollback to {base | label | committed | id}**	Rolls back the software set to a saved installation point or to the last-committed installation point. The following are the characteristics of this command: • Requires reload. • Is applicable only when the package is in committed state. • Use this command with the **prompt-level none** keyword to automatically ignore any confirmation prompts. **Note** If you are performing install rollback to a previous image, the previous image must be installed in install mode. Only SMU rollback is possible in bundle mode.
install deactivate	**install deactivate file** <*filename*>	Removes a package from the platform repository. This command is supported only for SMUs. • Use this command with the **prompt-level none** keyword to automatically ignore any confirmation prompts.

The following show commands are also available:

Table 13: List of show Commands

Command	Syntax	Purpose
show install log	**show install log**	Provides the history and details of all install operations that have been performed since the platform was booted.
show install package	**show install package** <*filename*>	Provides details about the .pkg/.bin file that is specified.

Command	Syntax	Purpose
show install summary	**show install summary**	Provides an overview of the image versions and their corresponding install states for all the FRUs. • The table that is displayed will state for which FRUs this information is applicable. • If all the FRUs are in sync in terms of the images present and their state, only one table is displayed. • If, however, there is a difference in the image or state information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table.
show install active	**show install active**	Provides information about the active packages for all the FRUs. If there is a difference in the information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table.
show install inactive	**show install inactive**	Provides information about the inactive packages, if any, for all the FRUs. If there is a difference in the information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table.
show install committed	**show install committed**	Provides information about the committed packages for all the FRUs. If there is a difference in the information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table.

Command	Syntax	Purpose
show install uncommitted	**show install uncommitted**	Provides information about uncommitted packages, if any, for all the FRUs. If there is a difference in the information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table.
show install rollback	**show install rollback {point-id | label}**	Displays the package associated with a saved installation point.
show version	**show version [rp-slot] [installed [user-interface] | provisioned | running]**	Displays information about the current package, along with hardware and platform information.

From Cisco IOS XE 17.7.1a, these commands replace the old install workflow as the default mode on supported platforms. The installation workflow for Cisco IOS XE 17.6.x release or earlier, described in section Consolidated Package Management, on page 71, is supported for Cisco IOS XE 17.7.x, and is the default for Cisco Catalyst 8000 Edge platforms with Cisco IOS XE 17.6.x or earlier.

Booting the Platform in Install Mode

You can install, activate, and commit a software package using a single command (one-step install) or multiple separate commands (three-step install).

If the platform is working in bundle mode, the one-step install procedure must be used to initially convert the platform from bundle mode to install mode. Subsequent installs and upgrades on the platform can be done with either one-step or three-step variants.

One-Step Installation or Converting from Bundle Mode to Install Mode

Note

- All the CLI actions (for example, add, activate, and so on) are executed on all the available FRUs.
- The configuration save prompt will appear if an unsaved configuration is detected.
- The reload prompt will appear after the second step in this workflow. Use the **prompt-level none** keyword to automatically ignore the confirmation prompts.
- If the prompt-level is set to None, and there is an unsaved configuration, the install fails. You must save the configuration before reissuing the command.

Use the one-step install procedure described below to convert a platform running in bundle boot mode to install mode. After the command is executed, the platform reboots in install boot mode.

Later, the one-step install procedure can also be used to upgrade the platform.

This procedure uses the **install add file activate commit** command in privileged EXEC mode to install a software package, and to upgrade the platform to a new version.

SUMMARY STEPS

1. **enable**
2. **install add file location:** *filename* [**activate commit**]
3. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device>enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**install add file location:** *filename* [**activate commit**] **Example:** `Device#install add file bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bin activate commit`	Copies the software install package from a local or remote location (through FTP, HTTP, HTTPs, or TFTP) to the platform and extracts the individual components of the .package file into subpackages and packages.conf files. It also performs a validation and compatibility check for the platform and image versions, activates the package, and commits the package to make it persistent across reloads. The platform reloads after this command is run.
Step 3	**exit** **Example:** `Device#exit`	Exits privileged EXEC mode and returns to user EXEC mode.

Three-Step Installation

Note

- All the CLI actions (for example, add, activate, and so on) are executed on all the available FRUs.
- The configuration save prompt will appear if an unsaved configuration is detected.
- The reload prompt will appear after the install activate step in this workflow. Use the **prompt-level none** keyword to automatically ignore the confirmation prompts.

The three-step installation procedure can be used only after the platform is in install mode. This option provides more flexibility and control to the customer during installation.

This procedure uses individual **install add**, **install activate**, and **install commit** commands for installing a software package, and to upgrade the platform to a new version.

SUMMARY STEPS

1. **enable**

2. **install add file location:** *filename*
3. **show install summary**
4. **install activate** [**auto-abort-timer** <*time*>]
5. **install abort**
6. **install commit**
7. **install rollback to committed**
8. **install remove** {**file** *filesystem: filename* | **inactive**}
9. **show install summary**
10. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device>enable`	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	**install add file location:** *filename* **Example:** `Device#install add file bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bin`	Copies the software install package from a remote location (through FTP, HTTP, HTTPs, or TFTP) to the platform, and extracts the individual components of the .package file into subpackages and packages.conf files.
Step 3	**show install summary** **Example:** `Device#show install summary`	(Optional) Provides an overview of the image versions and their corresponding install state for all the FRUs.
Step 4	**install activate** [**auto-abort-timer** <*time*>] **Example:** `Device# install activate auto-abort-timer 120`	Activates the previously added package and reloads the platform. • When doing a full software install, do not provide a package filename. • In the three-step variant, **auto-abort-timer** starts automatically with the **install activate** command; the default for the timer is 120 minutes. If the **install commit** command is not run before the timer expires, the install process is automatically terminated. The platform reloads and boots up with the last committed version.
Step 5	**install abort** **Example:** `Device#install abort`	(Optional) Terminates the software install activation and returns the platform to the last committed version. • Use this command only when the image is in activated state, and not when the image is in committed state.
Step 6	**install commit** **Example:**	Commits the new package installation and makes the changes persistent over reloads.

	Command or Action	Purpose
	`Device#install commit`	
Step 7	**install rollback to committed** **Example:** `Device#install rollback to committed`	(Optional) Rolls back the platform to the last committed state.
Step 8	**install remove** {**file** *filesystem: filename* | **inactive**} **Example:** `Device#install remove inactive`	(Optional) Deletes software installation files. • **file**: Deletes a specific file • **inactive**: Deletes all the unused and inactive installation files.
Step 9	**show install summary** **Example:** `Device#show install summary`	(Optional) Displays information about the current state of the system. The output of this command varies according to the **install** commands run prior to this command.
Step 10	**exit** **Example:** `Device#exit`	Exits privileged EXEC mode and returns to user EXEC mode.

Upgrading in Install Mode

Use either the one-step installation or the three-step installation to upgrade the platform in install mode.

Downgrading in Install Mode

Use the **install rollback** command to downgrade the platform to a previous version by pointing it to the appropriate image, provided the image you are downgrading to was installed in install mode.

The **install rollback** command reloads the platform and boots it with the previous image.

Note The **install rollback** command succeeds only if you have not removed the previous file using the **install remove inactive** command.

Alternatively, you can downgrade by installing the older image using the **install** commands.

Terminating a Software Installation

You can terminate the activation of a software package in the following ways:

- When the platform reloads after activating a new image, the auto-abort-timer is triggered (in the three-step install variant). If the timer expires before issuing the **install commit** command, the installation process is terminated, and the platform reloads and boots with the last committed version of the software image.

Alternatively, use the **install auto-abort-timer stop** command to stop this timer, without using the **install commit** command. The new image remains uncommitted in this process.

- Using the **install abort** command returns the platform to the version that was running before installing the new software. Use this command before issuing the **install commit** command.

Configuration Examples for Installing the Software Using install Commands

The following is an example of the one-step installation or converting from bundle mode to install mode:

```
Router# install add file
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bin
 activate commit
install_add_activate_commit: START Thu Oct 28 21:57:21 UTC 2021

System configuration has been modified.
Press Yes(y) to save the configuration and proceed.
Press No(n) for proceeding without saving the configuration.
Press Quit(q) to exit, you may save configuration and re-enter the command. [y/n/q]y
Building configuration...

[OK]Modified configuration has been saved

*Oct 28 21:57:39.818: %SYS-6-PRIVCFG_ENCRYPT_SUCCESS: Successfully encrypted private config
 file
*Oct 28 21:57:39.925: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install
 one-shot
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bininstall_add_activate_commit:
 Adding PACKAGE
install_add_activate_commit: Checking whether new add is allowed ....

--- Starting Add ---
Performing Add on Active/Standby
  [1] Add package(s) on R0
  [1] Finished Add on R0
Checking status of Add on [R0]
Add: Passed on [R0]
Finished Add

Image added. Version: 17.07.01.0.1515
install_add_activate_commit: Activating PACKAGE
Following packages shall be activated:
/bootflash/c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_1t3e3.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_ngwic_t1e1.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
```

```
/bootflash/c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg

This operation may require a reload of the system. Do you want to proceed? [y/n]y
--- Starting Activate ---
Performing Activate on Active/Standby

*Oct 28 22:05:49.484: %INSTALL-5-INSTALL_AUTO_ABORT_TIMER_PROGRESS: R0/0: rollback_timer:
Install auto abort timer will expire in 7200 seconds  [1] Activate package(s) on R0
  [1] Finished Activate on R0
Checking status of Activate on [R0]
Activate: Passed on [R0]
Finished Activate

--- Starting Commit ---
Performing Commit on Active/Standby
  [1] Commit package(s) on R0

Building configuration...
  [1] Finished Commit on R0
Checking status of Commit on [R0]
Commit: Passed on [R0]
Finished Commit

[OK]
*Oct 28 22:06:55.375: %SYS-6-PRIVCFG_ENCRYPT_SUCCESS: Successfully encrypted private config
 fileSend model notification for install_add_activate_commit before reload
Install will reload the system now!
SUCCESS: install_add_activate_commit  Thu Oct 28 22:07:22 UTC 2021

Router#
*Oct 28 22:07:22.661: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install one-shot PACKAGE
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.binOct
 28 22:07:26.864: %PMAN-5-EXITACTION: R0/0: pvp: Process manager is exiting: reload action
 requested

□

Press RETURN to get started!
```

The following is an example of the three-step installation:

```
Router# install add file
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bin

install_add: START Thu Oct 28 22:36:43 UTC 2021

*Oct 28 22:36:44.526: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install
 add
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bininstall_add:
 Adding PACKAGE
install_add: Checking whether new add is allowed ....

--- Starting Add ---
Performing Add on Active/Standby
  [1] Add package(s) on R0
  [1] Finished Add on R0
Checking status of Add on [R0]
Add: Passed on [R0]
Finished Add
```

```
Image added. Version: 17.07.01.0.1601
SUCCESS: install_add  Thu Oct 28 22:40:25 UTC 2021

Router#
*Oct 28 22:40:25.971: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install add PACKAGE
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bin

Router# show install log
[0|install_op_boot]: START Thu Oct 28 22:09:29 Universal 2021
[0|install_op_boot(INFO, )]: Mount IMG INI state base image
[0|install_op_boot]: END SUCCESS  Thu Oct 28 22:09:30 Universal 2021
[0|install_op_boot(INFO, )]: cleanup_trap  remote_invocation 0 operation install_op_boot
.. 0 .. 0
[1|display_install_log]: START Thu Oct 28 22:12:11 UTC 2021
[2|install_add]: START Thu Oct 28 22:36:43 UTC 2021
[2|install_add(INFO, )]: Set INSTALL_TYPE to PACKAGE
[2|install_add(CONSOLE, )]: Adding PACKAGE
[2|install_add(CONSOLE, )]: Checking whether new add is allowed ....
[2|install_add(INFO, )]: check_add_op_allowed: Install type PACKAGE
[remote|install_add]: START Thu Oct 28 22:37:12 UTC 2021
[remote|install_add]: END SUCCESS  Thu Oct 28 22:40:10 UTC 2021
[remote|install_add(INFO, )]: cleanup_trap  remote_invocation 1 operation install_add .. 0
 .. 0
[2|install_add(INFO, )]: Remote output from R0
[2|install_add(INFO, )]: install_add: START Thu Oct 28 22:37:12 UTC 2021
Expanding image file:
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bin
Verifying parameters
Expanding superpackage
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bin
... parameters verified
Validating package type
... package type validated
Copying package files
    c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg


c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

    c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

    c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

    c8000be-firmware_ngwic_t1e1.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

    c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg


c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

    c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

    c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    c8000be-firmware_sm_1t3e3.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
```

```
    c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

     c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
     c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
  WARNING: A different version of provisioning file packages.conf already exists in bootflash:

   WARNING: The provisioning file from the expanded bundle will be saved as
   WARNING: bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_0.conf
... package files copied
SUCCESS: Finished expanding all-in-one software package.
Image file expanded
SUCCESS: install_add  Thu Oct 28 22:40:10 UTC 2021
[2|install_add]: END SUCCESS  Thu Oct 28 22:40:25 UTC 2021
[2|install_add(INFO, )]: cleanup_trap  remote_invocation 0 operation install_add .. 0 .. 0
[3|COMP_CHECK]: START Thu Oct 28 22:40:26 UTC 2021
[3|COMP_CHECK]: END FAILED exit(1)  Thu Oct 28 22:40:27 UTC 2021
[3|COMP_CHECK(INFO, )]: cleanup_trap  remote_invocation 0 operation COMP_CHECK .. 1 .. 1
[4|install_activate]: START Thu Oct 28 22:42:53 UTC 2021
[4|install_activate(INFO, require user prompt)]: install_cli
[4|install_activate(CONSOLE, )]: Activating PACKAGE
[4|install_activate(INFO, )]: Acquiring transaction lock...
[4|install_activate(INFO, )]: global_trans_lock:
/bootflash/.installer/install_global_trans_lock
[4|install_activate(INFO, )]: tmp_global_trans_lock: /tmp/tmp_install_global_trans_lock
[4|install_activate(INFO, )]: tmp lock does not exist: /tmp/tmp_install_global_trans_lock
[4|install_activate(INFO, )]: global_trans_lock:
/bootflash/.installer/install_global_trans_lock
[4|install_activate(INFO, )]: tmp_global_trans_lock: /tmp/tmp_install_global_trans_lock
[4|install_activate(INFO, )]: local_trans_lock: /bootflash/.installer/install_local_trans_lock
[4|install_activate(INFO, )]: global_trans_lock:
/bootflash/.installer/install_global_trans_lock
[4|install_activate(INFO, )]: validate_lock: lock_duration is 7200
[4|install_activate(INFO, )]: install type stored in lock PACKAGE, install type PACKAGE,
install operation install_activate
[4|install_activate(INFO, )]: lock duration: 7200
[4|install_activate(INFO, )]: extend trans lock done.
/bootflash/.installer/install_global_trans_lock
[4|install_activate(INFO, require user prompt)]: install_cli
[4|install_activate( FATAL)]: Cannot proceed activate because of user input
[4|install_activate(INFO, )]: cleanup_trap  remote_invocation 0 operation install_activate
 .. 6 .. 0
[5|install_add]: START Thu Oct 28 22:45:48 UTC 2021
[5|install_add(INFO, )]: Set INSTALL_TYPE to PACKAGE
[5|install_add(CONSOLE, )]: Adding PACKAGE
[5|install_add(CONSOLE, )]: Checking whether new add is allowed ....
[5|install_add(INFO, )]: check_add_op_allowed: Install type PACKAGE
[5|install_add( FATAL)]: Super package already added. Add operation not allowed. install
remove inactive can be used to discard added packages

Router# install activate
install_activate: START Thu Oct 28 23:57:57 UTC 2021
install_activate: Activating PACKAGE

*Oct 28 23:57:57.823: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install
 activateFollowing packages shall be activated:
/bootflash/c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_1t3e3.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
```

```
/bootflash/c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_ngwic_t1e1.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

This operation may require a reload of the system. Do you want to proceed? [y/n]y
--- Starting Activate ---
Performing Activate on Active/Standby

*Oct 29 00:04:19.400: %INSTALL-5-INSTALL_AUTO_ABORT_TIMER_PROGRESS: R0/0: rollback_timer:
Install auto abort timer will expire in 7200 seconds  [1] Activate package(s) on R0
    --- Starting list of software package changes ---
    Old files list:
      Modified
c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg

      Modified
c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_ngwic_t1e1.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg

      Modified
c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_sm_1t3e3.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg

      Modified
c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified
c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
      Modified c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
    New files list:
      Added
```

```
c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

      Added
c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_ngwic_t1e1.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

      Added
c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_sm_1t3e3.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

      Added
c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added
c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
      Added c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    Finished list of software package changes
  [1] Finished Activate on R0
Checking status of Activate on [R0]
Activate: Passed on [R0]
Finished Activate

Send model notification for install_activate before reload
Install will reload the system now!
SUCCESS: install_activate  Fri Oct 29 00:05:09 UTC 2021

Router#
*Oct 29 00:05:09.504: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install activate PACKAGEOct 29 00:05:14.494: %PMAN-5-EXITACTION: R0/0: pvp: Process manager
 is exiting: reload action requested

Initializing Hardware ...

Checking for PCIe device presence...done
System integrity status: 0x610

System Bootstrap, Version 17.3(4.1r), RELEASE SOFTWARE
Copyright (c) 1994-2021 by cisco Systems, Inc.
```

```
Current image running   : Boot ROM1
Last reset cause        : LocalSoft
C8300-2N2S-6T platform with 8388608 Kbytes of main memory

□

Press RETURN to get started!

□

Router# install commit
install_commit: START Fri Oct 29 00:13:58 UTC 2021
install_commit: Committing PACKAGE

--- Starting Commit ---
Performing Commit on Active/Standby

*Oct 29 00:13:59.552: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install
 commit  [1] Commit package(s) on R0
  [1] Finished Commit on R0
Checking status of Commit on [R0]
Commit: Passed on [R0]
Finished Commit

SUCCESS: install_commit  Fri Oct 29 00:14:03 UTC 2021

Router#
*Oct 29 00:14:03.712: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install commit PACKAGE
```

The following is an example of downgrading in install mode:

```
ROUTER# install activate file bootflash:c8000be-universalk9.17.06.01a.SPA.bin activate
commit

install_add_activate_commit: START Fri Dec 10 18:07:17 GMT 2021

*Dec 10 18:07:18.405 GMT: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started
install one-shot bootflash:c8000be-universalk9.17.06.01a.SPA.bininstall_add_activate_commit:
 Adding PACKAGE
install_add_activate_commit: Checking whether new add is allowed ....

--- Starting Add ---
Performing Add on Active/Standby
  [1] Add package(s) on R0
  [1] Finished Add on R0
Checking status of Add on [R0]
Add: Passed on [R0]
Finished Add

Image added. Version: 17.06.01a.0.298
install_add_activate_commit: Activating PACKAGE
Following packages shall be activated:
/bootflash/c8000be-rpboot.17.06.01a.SPA.pkg
/bootflash/c8000be-mono-universalk9.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_nim_adpt.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_dsp_sp2700.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_async.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_1t3e3.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_10g.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_prince.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_xdsl.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_ssd.17.06.01a.SPA.pkg
```

```
/bootflash/c8000be-firmware_nim_shdsl.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_ge.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_cwan.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_bri_st_fw.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_async.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_ngwic_t1e1.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_dsp_tilegx.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_dsp_sp2700.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_dsp_analogbri.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_dreamliner.17.06.01a.SPA.pkg

This operation may require a reload of the system. Do you want to proceed? [y/n]y
--- Starting Activate ---
Performing Activate on Active/Standby
  [1] Activate package(s) on R0
  [1] Finished Activate on R0
Checking status of Activate on [R0]
Activate: Passed on [R0]
Finished Activate

--- Starting Commit ---
Performing Commit on Active/Standby
  [1] Commit package(s) on R0
Building configuration...

  [1] Finished Commit on R0
Checking status of Commit on [R0]
Commit: Passed on [R0]
Finished Commit

[OK]
*Dec 10 18:14:57.782 GMT: %SYS-6-PRIVCFG_ENCRYPT_SUCCESS: Successfully encrypted private
config fileSend model notification for install_add_activate_commit before reload
/usr/binos/conf/install_util.sh: line 164: /bootflash/.prst_sync/reload_info: No such file
 or directory
/usr/binos/conf/install_util.sh: line 168: /bootflash/.prst_sync/reload_info: No such file
 or directory
cat: /bootflash/.prst_sync/reload_info: No such file or directory
Install will reload the system now!
SUCCESS: install_add_activate_commit  Fri Dec 10 18:15:23 GMT 2021

ROUTER#
*Dec 10 18:15:23.955 GMT: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
 install one-shot PACKAGE bootflash:c8000be-universalk9.17.06.01a.SPA.binDec 10 18:15:27.708:
 %PMAN-5-EXITACTION: R0/0: pvp: Process manager is exiting: reload action requested

Initializing Hardware ...

Checking for PCIe device presence...done
System integrity status: 0x610
Rom image verified correctly

System Bootstrap, Version 17.3(5r), RELEASE SOFTWARE
Copyright (c) 1994-2021 by cisco Systems, Inc.

Current image running: Boot ROM0

Last reset cause: LocalSoft
ROUTER platform with 8388608 Kbytes of main memory

□

Press RETURN to get started!
```

```
ROUTER#
ROUTER# show version
Cisco IOS XE Software, Version 17.06.01a
Cisco IOS Software [Bengaluru], c8000be Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version
 17.6.1a, RELEASE SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2021 by Cisco Systems, Inc.
Compiled Sat 21-Aug-21 03:27 by mcpre

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software code licensed under GPL Version 2.0 is free software that comes
with ABSOLUTELY NO WARRANTY.  You can redistribute and/or modify such
GPL code under the terms of GPL Version 2.0.  For more details, see the
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.

ROM: 17.3(5r)

ROUTER uptime is 0 minutes
Uptime for this control processor is 2 minutes
System returned to ROM by LocalSoft
System image file is "bootflash:packages.conf"
Last reload reason: LocalSoft

This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

Technology Package License Information:

------------------------------------------------------------------
Technology     Type         Technology-package Technology-package
                            Current           Next Reboot
------------------------------------------------------------------
Smart License  Perpetual    None              None
Smart License  Subscription None              None

The current crypto throughput level is 250000 kbps

Smart Licensing Status: Registration Not Applicable/Not Applicable

cisco ROUTER (1RU) processor with 3747220K/6147K bytes of memory.
Processor board ID FDO2521M27S
Router operating mode: Autonomous
5 Gigabit Ethernet interfaces
2 2.5 Gigabit Ethernet interfaces
2 Cellular interfaces
32768K bytes of non-volatile configuration memory.
```

```
8388608K bytes of physical memory.
7573503K bytes of flash memory at bootflash:.
1875361792K bytes of NVMe SSD at harddisk:.
16789568K bytes of USB flash at usb0:.

Configuration register is 0x2102
```

The following is an example of terminating a software installation:

```
Router# install abort
install_abort: START Fri Oct 29 02:42:51 UTC 2021

This install abort would require a reload. Do you want to proceed? [y/n]
                                                                    *Oct 29 02:42:52.789:
 %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install aborty
--- Starting Abort ---
Performing Abort on Active/Standby

  [1] Abort package(s) on R0
  [1] Finished Abort on R0
Checking status of Abort on [R0]
Abort: Passed on [R0]
Finished Abort

Send model notification for install_abort before reload
Install will reload the system now!
SUCCESS: install_abort  Fri Oct 29 02:44:47 UTC 2021

Router#
*Oct 29 02:44:47.866: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install abort PACKAGEOct 29 02:44:51.577: %PMAN-5-EXITACTION: R0/0: pvp: Process manager
is exiting: reload action requested

Initializing Hardware ...

Checking for PCIe device presence...done
System integrity status: 0x610

System Bootstrap, Version 17.3(4.1r), RELEASE SOFTWARE
Copyright (c) 1994-2021 by cisco Systems, Inc.

Current image running   : Boot ROM1
Last reset cause        : LocalSoft
C8300-2N2S-6T platform with 8388608 Kbytes of main memory

□

Press RETURN to get started!

□
```

The following are sample outputs for show commands:

show install log

```
Device# show install log
[0|install_op_boot]: START Thu Oct 28 22:09:29 Universal 2021
[0|install_op_boot(INFO, )]: Mount IMG INI state base image
[0|install_op_boot]: END SUCCESS  Thu Oct 28 22:09:30 Universal 2021
```

show install summary

```
Device# show install summary
[ R0 ] Installed Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
            C - Activated & Committed, D - Deactivated & Uncommitted
--------------------------------------------------------------------------
Type  St   Filename/Version
--------------------------------------------------------------------------
IMG   C    17.07.01.0.1515

--------------------------------------------------------------------------
Auto abort timer: inactive
--------------------------------------------------------------------------
```

show install package *filesystem: filename*

```
Device# show install package
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bin
Package: c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bin
  Size: 831447859
  Timestamp: 2021-10-23 17:08:14 UTC
  Canonical path:
/bootflash/c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bin


  Raw disk-file SHA1sum:
    5c4e7617a6c71ffbcc73dcd034ab58bf76605e3f
  Header size:     1192 bytes
  Package type:    30000
  Package flags:   0
  Header version:  3

  Internal package information:
    Name: rp_super
    BuildTime: 2021-10-21_13.00
    ReleaseDate: 2021-10-21_03.11
    BootArchitecture: i686
    RouteProcessor: radium
    Platform: C8000BE
    User: mcpre
    PackageName: universalk9
    Build: BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117
    CardTypes:

  Package is bootable from media and tftp.
  Package contents:

  Package:
c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
    Size: 2966620
    Timestamp: 2021-10-21 20:10:44 UTC

    Raw disk-file SHA1sum:
      501d59d5f152ca00084a0da8217bf6f6b95dddb1
    Header size:     1116 bytes
    Package type:    40000
    Package flags:   0
    Header version:  3

    Internal package information:
      Name: firmware_nim_ge
      BuildTime: 2021-10-21_13.00
      ReleaseDate: 2021-10-21_03.11
      BootArchitecture: none
      RouteProcessor: radium
      Platform: C8000BE
```

```
      User: mcpre
      PackageName: firmware_nim_ge
      Build: BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117
      CardTypes:

    Package is not bootable.
  Package:
c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
    Size: 10204252
    Timestamp: 2021-10-21 20:10:43 UTC

    Raw disk-file SHA1sum:
      a57bed4ddecfd08af3b456f69d11aaeb962865ea
    Header size:     1116 bytes
    Package type:    40000
    Package flags:   0
    Header version:  3

    Internal package information:
      Name: firmware_prince
      BuildTime: 2021-10-21_13.00
      ReleaseDate: 2021-10-21_03.11
      BootArchitecture: none
      RouteProcessor: radium
      Platform: C8000BE
      User: mcpre
      PackageName: firmware_prince
      Build: BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117
      CardTypes:

    Package is not bootable.
```

show install active

```
Device# show install active
[ R0 ] Active Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
            C - Activated & Committed, D - Deactivated & Uncommitted
--------------------------------------------------------------------------
Type  St   Filename/Version
--------------------------------------------------------------------------
IMG   C    17.07.01.0.1515

--------------------------------------------------------------------------
Auto abort timer: inactive
--------------------------------------------------------------------------
```

show install inactive

```
Device# show install inactive
[ R0 ] Inactive Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
            C - Activated & Committed, D - Deactivated & Uncommitted
--------------------------------------------------------------------------
Type  St   Filename/Version
--------------------------------------------------------------------------
No Inactive Packages
```

show install committed

```
Device# show install committed
[ R0 ] Committed Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
            C - Activated & Committed, D - Deactivated & Uncommitted
--------------------------------------------------------------------------
Type  St   Filename/Version
```

```
--------------------------------------------------------------------------
IMG   C    17.07.01.0.1515

--------------------------------------------------------------------------
Auto abort timer: inactive
--------------------------------------------------------------------------
```

show install uncommitted

```
Device# show install uncommitted
[ R0 ] Uncommitted Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
            C - Activated & Committed, D - Deactivated & Uncommitted
--------------------------------------------------------------------------
Type  St   Filename/Version
--------------------------------------------------------------------------
No Uncommitted Packages
```

Troubleshooting Software Installation Using install Commands

Problem Troubleshooting the software installation

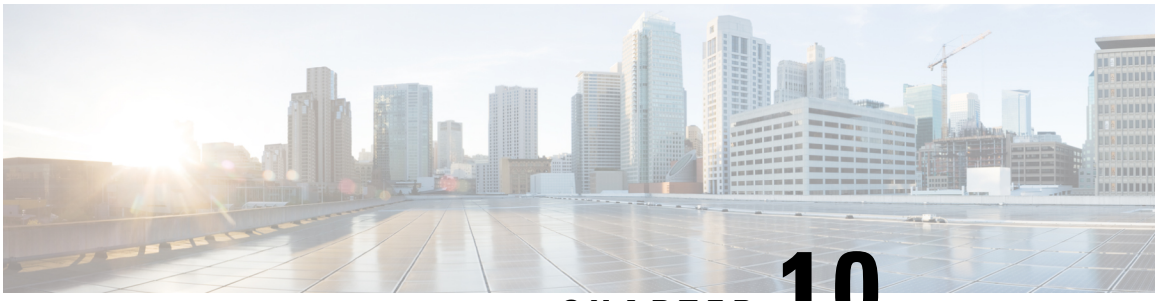
Solution Use the following show commands to view installation summary, logs, and software versions.

- **show install summary**
- **show install log**
- **show version**
- **show version running**

Problem Other installation issues

Solution Use the following commands to resolve installation issue:

- **dir** <*install directory*>
- **more location:***packages.conf*
- **show tech-support install**: this command automatically runs the **show** commands that display information specific to installation.
- **request platform software trace archive target bootflash** <*location*>: this command archives all the trace logs relevant to all the processes running on the system since the last reload, and saves this information in the specified location.

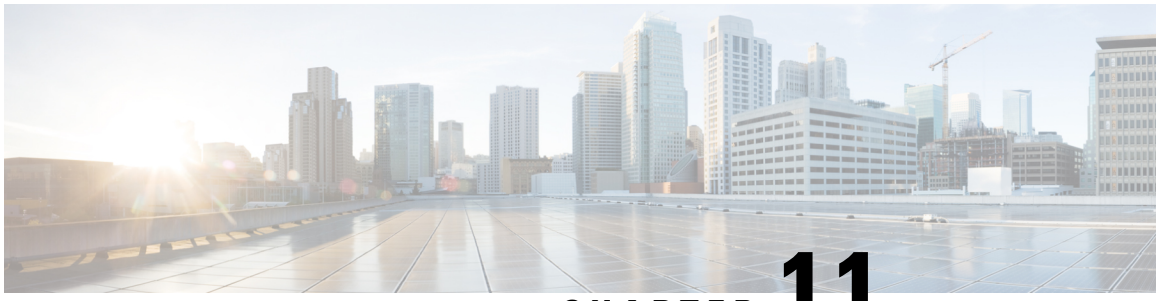


CHAPTER 10

Software Upgrade Processes

If you want to upgrade the ROMMON and IOS at the same time, perform the steps given below:

- Copy the XE image to the router and configure the boot system to point to the new image.
- Copy the ROMMON package to the router and perform the ROMMON upgrade.
- Reload the router and verify that it boots to the IOS prompt on the new XE image.
- Verify that the new ROMMON image was successfully installed using a show platform.



CHAPTER 11

High Availability Overview

Cisco High Availability (HA) enables network-wide protection by providing fast recovery from faults that may occur in any part of the network. With Cisco High Availability, network hardware and software work together and enable rapid recovery from disruptions to ensure fault transparency to users and network applications.

The unique hardware and software architecture of the Cisco 8500 Series Catalyst Edge Platform is designed to maximize router uptime during any network event, and thereby provide maximum uptime and resilience within any network scenario.

This guide covers the aspects of High Availability that are unique to the Cisco 8500 Series Catalyst Edge Platform. It is not intended as a comprehensive guide to High Availability, nor is it intended to provide information on High Availability features that are available on other Cisco routers that are configured and implemented identically on the Cisco 8500 Series Catalyst Edge Platform. The Cisco IOS feature documents and guides should be used in conjunction with this chapter to gather information about High Availability-related features that are available on multiple Cisco platforms and work identically on the Cisco 8500 Series Catalyst Edge Platform.

- Finding Feature Information in This Module, on page 101
- Contents, on page 102
- Software Redundancy on the Cisco 8500 Series Catalyst Edge Platform, on page 102
- Stateful Switchover, on page 103
- IPsec Failover, on page 104
- Bidirectional Forwarding Detection, on page 104

Finding Feature Information in This Module

Your software release might not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn . An account on Cisco.com is not required.

Contents

This section discusses various aspects of High Availability on the Cisco 8500 Series Catalyst Edge Platform and contains the following sections:

Software Redundancy on the Cisco 8500 Series Catalyst Edge Platform

This section covers the following topics:

Software Redundancy Overview

On the Cisco 8500 Series Catalyst Edge Platform, IOS runs as one of many processes within the operating system. This is different than on traditional Cisco IOS, where all processes are run within Cisco IOS. See the "IOS as a Process" section on page 2-7 for more information regarding IOS as a process on the Cisco 8500 Series Catalyst Edge Platform.

This architecture allows for software redundancy opportunities that are not available on other platforms that run Cisco IOS software. Specifically, a standby IOS process can be available on the same Route Processor as the active IOS process. This standby IOS process can be switched to in the event of an IOS failure.

On the Cisco 8500 Series Catalyst Edge Platform, the second IOS process can run only on the standby Route Processor.

Configuring two Cisco IOS processes

On the Cisco 8500 Series Catalyst Edge Platform, Cisco IOS runs as one of the many processes. This architecture supports software redundancy opportunities. Specifically, a standby Cisco IOS process is available on the same Route Processor as the active Cisco IOS process. In the event of a Cisco IOS failure, the system switches to the standby Cisco IOS process.

SUMMARY STEPS

1. enable
2. **configure terminal**
3. redundancy
4. mode SSO
5. **exit**
6. reload

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable **Example:**	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
	`Router> enable`	
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	redundancy **Example:** `Router(config)# redundancy`	Enters redundancy configuration mode.
Step 4	mode SSO **Example:** `Router(config)# mode SSO`	Configures SSO. When this command is entered, the redundant supervisor engine is reloaded and begins to work in SSO mode.

Step 5	**exit**
	Example:
	`Router(config)# exit`
	Example:
	`Router #`
		Exits configuration mode and returns to global configuration mode.

Step 6	reload **Example:** `Router # reload`	Reloads IOS.

Example

```
Router# configure terminal
Router(config)# redundancy
Router(config)# mode SSO
Router(config)# exit
Router# reload
```

Stateful Switchover

On the Cisco 8500 Series Catalyst Edge Platform, Stateful Switchover (SSO) can be used to enable a second IOS process.

Stateful Switchover is particularly useful in conjunction with Nonstop Forwarding. SSO allows the dual IOS processes to maintain state at all times, and Nonstop Forwarding lets a switchover happen seamlessly when a switchover occurs

For additional information on NSF/SSO, see the Cisco Nonstop Forwarding document.

SSO-Aware Protocol and Applications

SSO-supported line protocols and applications must be SSO-aware. A feature or protocol is SSO-aware if it maintains, either partially or completely, undisturbed operation through an RP switchover. State information for SSO-aware protocols and applications is synchronized from active to standby to achieve stateful switchover for those protocols and applications.

The dynamically created state of SSO-unaware protocols and applications is lost on switchover and must be reinitialized and restarted on switchover.

To see which protocols are SSO-aware on your router, use the following commands **show redundancy client** or **show redundancy history**.

IPsec Failover

IPSec failover is a feature that increases the total uptime (or availability) of a customer's IPSec network. Traditionally, this is accomplished by employing a redundant (standby) router in addition to the original (active) router. If the active router becomes unavailable for any reason, the standby router takes over the processing of IKE and IPSec. IPSec failover falls into two categories: stateless failover and stateful failover.

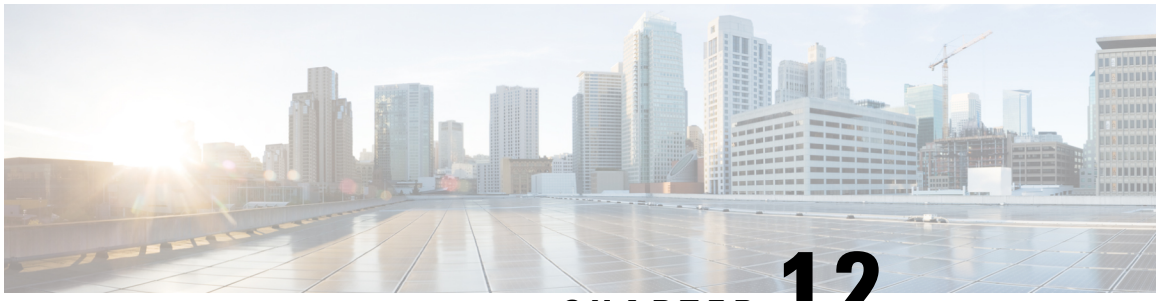
The IPsec on the Cisco 8500 Series Catalyst Edge Platform supports only stateless failover. Stateless failover uses protocols such as the Hot Standby Router Protocol (HSRP) to provide primary to secondary cutover and also allows the active and standby VPN gateways to share a common virtual IP address.

Bidirectional Forwarding Detection

Bidirectional Forwarding Detection (BFD) is a detection protocol designed to provide fast forwarding path failure detection times for all media types, encapsulations, topologies, and routing protocols. In addition to fast forwarding path failure detection, BFD provides a consistent failure detection method for network administrators. Because the network administrator can use BFD to detect forwarding path failures at a uniform rate rather than the variable rates for different routing protocol hello mechanisms, network profiling and planning is easier, and reconvergence time is consistent and predictable.

On the Cisco 8500 Series Catalyst Edge Platform, BFD for IPv4 Static Routes and BFD for BGP are supported.

For more information on BFD, see the Bidirectional Forwarding Detection document.



CHAPTER 12

Using the Management Ethernet Interface

The Cisco 8500 Series Catalyst Edge Platform have one Gigabit Ethernet Management Ethernet interface.

- Finding Feature Information in This Module, on page 105
- Contents, on page 105
- Gigabit Ethernet Management Interface Overview, on page 105
- Gigabit Ethernet Port Numbering, on page 106
- IP Address Handling in ROMmon and the Management Ethernet Port, on page 106
- Gigabit Ethernet Management Interface VRF, on page 106
- Common Ethernet Management Tasks, on page 107

Finding Feature Information in This Module

Your software release might not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn . An account on Cisco.com is not required.

Contents

This guide covers the following topics:

Gigabit Ethernet Management Interface Overview

The purpose of this interface is to allow users to perform management tasks on the router; it is basically an interface that should not and often cannot forward network traffic but can otherwise access the router, often via Telnet and SSH, and perform most management tasks on the router. The interface is most useful before a router has begun routing, or in troubleshooting scenarios when the SPA interfaces are inactive.

The following aspects of the Management Ethernet interface should be noted:

- IPv4, IPv6, and ARP are the only routed protocols supported for the interface.
- The Ethernet Management Interface cannot be used as a Lawful Intercept MD source interface.

- The Management Ethernet interface is part of its own VRF. This is discussed in more detail in the Gigabit Ethernet Management Interface VRF, on page 106.

Gigabit Ethernet Port Numbering

The Gigabit Ethernet Management port is always GigabitEthernet0.

The port can be accessed in configuration mode like any other port on the Cisco 8500 Series Catalyst Edge Platform:

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface gigabitethernet0
Router(config-if)#
```

IP Address Handling in ROMmon and the Management Ethernet Port

On the Cisco 8500 Series Catalyst Edge Platform, IP addresses can be configured in ROMmon (the **IP_ADDRESS=** and **IP_SUBNET_MASK=** commands) and through the use of the IOS command-line interface (the **ip address** command in interface configuration mode).

Assuming the IOS process has not begun running on the Cisco 8500 Series Catalyst Edge Platform, the IP address that was set in ROMmon acts as the IP address of the Management Ethernet interface. In cases where the IOS process is running and has taken control of the Management Ethernet interface, the IP address specified when configuring the Gigabit Ethernet 0 interface in the IOS CLI becomes the IP address of the Management Ethernet interface. The ROMmon-defined IP address is only used as the interface address when the IOS process is inactive.

For this reason, the IP addresses specified in ROMmon and in the IOS CLI can be identical and the Management Ethernet interface will function properly in single RP configurations.

Gigabit Ethernet Management Interface VRF

The Gigabit Ethernet Management interface is automatically part of its own VRF. This VRF, which is named “Mgmt-intf,” is automatically configured on the Cisco 8500 Series Catalyst Edge Platform and is dedicated to the Management Ethernet interface; no other interfaces can join this VRF. Therefore, this VRF does not participate in the MPLS VPN VRF or any other network-wide VRF. The Mgmt-intf VRF supports loopback interface.

Placing the management ethernet interface in its own VRF has the following effects on the Management Ethernet interface:

- Many features must be configured or used inside the VRF, so the CLI may be different for certain Management Ethernet functions on the Cisco 8500 Series Catalyst Edge Platform than on Management Ethernet interfaces on other routers.
- Prevents transit traffic from traversing the router. Because all built-in portd and the Management Ethernet interface are automatically in different VRFs, no transit traffic can enter the Management Ethernet interface and leave a built-in port, or vice versa.

- Improved security of the interface. Because the Mgmt-intf VRF has its own routing table as a result of being in its own VRF, routes can only be added to the routing table of the Management Ethernet interface if explicitly entered by a user.

The Management Ethernet interface VRF supports both IPv4 and IPv6 address families.

Common Ethernet Management Tasks

Because users can perform most tasks on a router through the Management Ethernet interface, many tasks can be done by accessing the router through the Management Ethernet interface.

This section documents tasks that might be common or slightly tricky on the Cisco 8500 Series Catalyst Edge Platform. It is not intended as a comprehensive list of all tasks that can be done using the Management Ethernet interface.

This section covers the following processes:

Viewing the VRF Configuration

The VRF configuration for the Management Ethernet interface is viewable using the **show running-config vrf** command.

This example shows the default VRF configuration:

```
Router# show running-config vrf
Building configuration...
Current configuration : 351 bytes
vrf definition Mgmt-intf
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
(some output removed for brevity)
```

Viewing Detailed VRF Information for the Management Ethernet VRF

To see detailed information about the Management Ethernet VRF, enter the **show vrf detail Mgmt-intf** command:

```
Router# show vrf detail Mgmt-intf
```

Setting a Default Route in the Management Ethernet Interface VRF

To set a default route in the Management Ethernet Interface VRF, enter the following command

ip route vrf Mgmt-intf 0.0.0.0 0.0.0.0 *next-hop-IP-address*

Setting the Management Ethernet IP Address

The IP address of the Management Ethernet port is set like the IP address on any other interface.

Below are two simple examples of configuring an IPv4 adress and an IPv6 address on the Management Ethernet interface.

IPv4 Example

```
Router(config)# interface GigabitEthernet 0
Router(config-if)# ip address
 A.B.C.D A.B.C.D
```

IPv6 Example

```
Router(config)# interface GigabitEthernet 0
```

Router(config-if)# **ipv6 address** *X:X:X:X::X*

Telnetting over the Management Ethernet Interface

Telnetting can be done through the VRF using the Management Ethernet interface.

In the following example, the router telnets to 172.17.1.1 through the Management Ethernet interface VRF:

```
Router# telnet 172.17.1.1 /vrf Mgmt-intf
```

Pinging over the Management Ethernet Interface

Pinging other interfaces using the Management Ethernet interface is done through the VRF.

In the following example, the router pings the interface with the IP address of 172.17.1.1 through the Management Ethernet interface:

```
Router# ping vrf Mgmt-intf 172.17.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.17.1.1, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 1/1/1 ms
```

Copy Using TFTP or FTP

To copy a file using TFTP through the Management Ethernet interface, the **ip tftp source-interface GigabitEthernet 0** command must be entered before entering the **copy tftp** command because the **copy tftp** command has no option of specifying a VRF name.

Similarly, to copy a file using FTP through the Management Ethernet interface, the **ip ftp source-interface GigabitEthernet 0** command must be entered before entering the **copy ftp** command because the **copy ftp** command has no option of specifying a VRF name.

TFTP Example

```
Router(config)# ip tftp source-interface gigabitethernet 0
```

FTP Example

```
Router(config)# ip ftp source-interface gigabitethernet 0
```

NTP Server

To allow the software clock to be synchronized by a Network Time Protocol (NTP) time server over the Management Ethernet interface, enter the **ntp server vrf Mgmt-intf** command and specify the IP address of the device providing the update.

The following CLI provides an example of this procedure.

```
Router(config)# ntp server vrf Mgmt-intf 172.17.1.1
```

SYSLOG Server

To specify the Management Ethernet interface as the source IP or IPv6 address for logging purposes, enter the **logging host <ip-address> vrf Mgmt-intf** command.

The following CLI provides an example of this procedure.

```
Router(config)# logging host <ip-address> vrf Mgmt-intf
```

SNMP-Related Services

To specify the Management Ethernet interface as the source of all SNMP trap messages, enter the **snmp-server source-interface traps gigabitEthernet 0** command.

The following CLI provides an example of this procedure:

```
Router(config)# snmp-server source-interface traps gigabitEthernet 0
```

Domain Name Assignment

The IP domain name assignment for the Management Ethernet interface is done through the VRF.

To define the default domain name as the Management Ethernet VRF interface, enter the **ip domain-name vrf Mgmt-intf** *domain* command.

```
Router(config)# ip domain-name vrf Mgmt-intf cisco.com
```

DNS service

To specify the Management Ethernet interface VRF as a name server, enter the **ip name-server vrf Mgmt-intf** *IPv4-or-IPv6-address* command.

```
Router(config)# ip name-server vrf Mgmt-intf
 IPv4-or-IPv6-address
```

RADIUS or TACACS+ Server

To group the Management VRF as part of a AAA server group, enter the **ip vrf forward Mgmt-intf** command when configuring the AAA server group.

The same concept is true for configuring a TACACS+ server group. To group the Management VRF as part of a TACACS+ server group, enter the **ip vrf forwarding Mgmt-intf** command when configuring the TACACS+ server group.

RADIUS Server Group Configuration

```
Router(config)# aaa group server radius hello
Router(config-sg-radius)# ip vrf forwarding Mgmt-intf
```

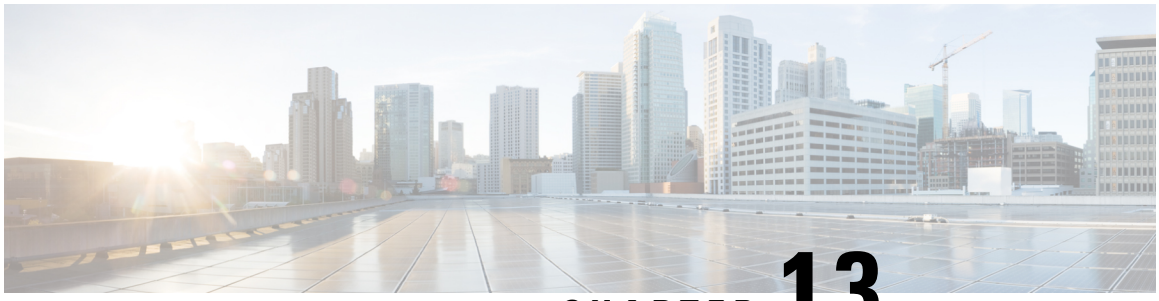
TACACS+ Server Group Example

```
outer(config)# aaa group server tacacs+ hello
Router(config-sg-tacacs+)# ip vrf forwarding Mgmt-intf
```

VTY lines with ACL

To ensure an access control list (ACL) is attached to vty lines that are and are not using VRF, use the **vrf-also** option when attaching the ACL to the vty lines.

```
Router(config)# line vty 0 4
Router(config-line)# access-class 90 in vrf-also
```



CHAPTER 13

Configuring Bridge Domain Interfaces

The Cisco 8500 Series Catalyst Edge Platform support the bridge domain interface (BDI) feature for packaging Layer 2 Ethernet segments into Layer 3 IP.

- Restrictions for Bridge Domain Interfaces, on page 111
- Information About Bridge Domain Interface, on page 112
- Configuring Bridge-Domain Virtual IP Interface, on page 120

Restrictions for Bridge Domain Interfaces

The following are the restrictions pertaining to bridge domain interfaces:

- Only 4096 bridge domain interfaces are supported per system.
- For a bridge domain interface, the maximum transmission unit (MTU) size can be configured between 1500 and 9216 bytes.
- Bridge domain interfaces support only the following features:
  - IPv4 Multicast
  - QoS marking and policing. Shaping and queuing are not supported
  - IPv4 VRF
  - IPv6 unicast forwarding
  - Dynamic routing such as BGP, OSPF, EIGRP, RIP, IS-IS, and STATIC
  - Hot Standby Router Protocol (HSRP)
  - Virtual Router Redundancy Protocol (VRRP) from IOS XE 3.8.0 onwards.
- Bridge domain interfaces do not support the following features:
  - PPP over Ethernet (PPPoE)
  - Bidirectional Forwarding Detection (BFD) protocol
  - QoS
  - Network-Based Application Recognition (NBAR) or Advanced Video Coding (AVC)

Information About Bridge Domain Interface

Bridge domain interface is a logical interface that allows bidirectional flow of traffic between a Layer 2 bridged network and a Layer 3 routed network traffic. Bridge domain interfaces are identified by the same index as the bridge domain. Each bridge domain represents a Layer 2 broadcast domain. Only one bridge domain interface can be associated with a bridge domain.

Bridge domain interface supports the following features:

- IP termination
- Layer 3 VPN termination
- Address Resolution Protocol (ARP), G-ARP, and P-ARP handling
- MAC address assignment

Prior to configuring a bridge domain interface, you must understand the following concepts:

- Ethernet Virtual Circuit Overview
- Bridge Domain Interface Encapsulation
- Assigning a MAC Address
- Support for IP Protocols
- Support for IP Forwarding
- Packet Forwarding
- Bridge Domain Interface Statistics

Ethernet Virtual Circuit Overview

An Ethernet Virtual Circuit (EVC) is an end-to-end representation of a single instance of a Layer 2 service that is offered by a provider. It embodies the different parameters on which the service is being offered. In the Cisco EVC Framework, the bridge domains are made up of one or more Layer 2 interfaces known as service instances. A service instance is the instantiation of an EVC on a given port on a given router. Service instance is associated with a bridge domain based on the configuration.

An incoming frame can be classified as service instance based on the following criteria:

- Single 802.1Q VLAN tag, priority-tagged, or 802.1ad VLAN tag
- Both QinQ (inner and outer) VLAN tags, or both 802.1ad S-VLAN and C-VLAN tags
- Outer 802.1p CoS bits, inner 802.1p CoS bits, or both
- Payload Ethernet type (five choices are supported: IPv4, IPv6, PPPoE-all, PPoE-discovery, and PPPoE-session)

Service instance also supports alternative mapping criteria:

- Untagged—Mapping to all the frames lacking a 802.1Q or 802.1ad header
- Default—Mapping to all the frames

Bridge Domain Interface Encapsulation

Security Group classification includes both Source and Destination Group, which is specified by source SGT and DGT. SGT Based PBR feature provides the PBR route-map match clause for SGT/DGT based packet classification. SGT Based PBR feature supports configuration of unlimited number of tags, but it is recommended to configure the tags based on memory available in the platform.

An EVC provides the ability to employ different encapsulations on each Ethernet flow point (EFP) present in a bridge domain. A BDI egress point may not be aware of the encapsulation of an egress packet because the packet may have egressed from one or more EFPs with different encapsulations.

In a bridge domain, if all the EFPs have different encapsulations, the BDI must be untagged (using the no 802.1Q tag). Encapsulate all the traffic in the bridge domain (popped or pushed) at the EFPs. Configure rewrite at each EFP to enable encapsulation of the traffic on the bridge domain.

In a bridge domain, if all the EFPs have the same encapsulation, configure the encapsulations on the BDI using the encapsulation command. Enabling encapsulation at the BDI ensures effective pushing or popping of tags, thereby eliminating the need for configuring the rewrite command at the EFPs. For more information on configuring the encapsulations on the BDI, see the How to Configure a Bridge Domain Interface.

Assigning a MAC Address

All the bridge domain interfaces on the Cisco Catalyst 8500 Series Edge Platforms share a common MAC address. The first bridge domain interface on a bridge domain is allocated a MAC address. Thereafter, the same MAC address is assigned to all the bridge domain interfaces that are created in that bridge domain.

Note You can configure a static MAC address on a bridge domain interface using the **mac-address** command.

Support for IP Protocols

Brigde domain interfaces enable the Cisco 8500 Series Catalyst Edge Platform to act as a Layer 3 endpoint on the Layer 2 bridge domain for the following IP-related protocols:

- ARP
- DHCP
- HTTP
- ICMP
- NTP
- RARP
- SNMP
- TCP
- Telnet
- TFTP
- UDP

Support for IP Forwarding

Bridge domain interface supports the following IP forwarding features:

- IPv4 input and output access control lists (ACL)
- IPv4 input and output QoS policies. The operations supported for the input and output service policies on a bridge domain interface are:
    - Classification
    - Marking

- Policing
- IPv4 L3 VRFs

Packet Forwarding

A bridge domain interface provides bridging and forwarding services between the Layer 2 and Layer 3 network infrastructure.

Layer 2 to Layer 3

During a packet flow from a Layer 2 network to a Layer 3 network, if the destination MAC address of the incoming packet matches the bridge domain interface MAC address, or if the destination MAC address is a multicast address, the packet or a copy of the packet is forwarded to the bridge domain interface.

Note MAC address learning cannot not be performed on the bridge domain interface.

Layer 3 to Layer 2

When a packet arrives at a Layer 3 physical interface of a router, a route lookup action is performed. If route lookup points to a bridge domain interface, then the bridge domain interface adds the layer 2 encapsulation and forwards the frame to the corresponding bridge domain. The byte counters are updated.

During a Layer 2 lookup on a bridge domain to which the bridge domain interface belongs, the bridge domain forwards the packets to the correct service instance based on the destination MAC address.

Link States of a Bridge Domain and a Bridge Domain Interface

Bridge domain interface acts as a routable IOS interface on Layer 3 and as a port on a bridge domain. Both bridge domain interfaces and bridge domains operate with individual administrative states.

Shutting down a bridge domain interface stops the Layer 3 data service, but does not override or impact the state of the associated bridge domain.

Shutting down a bridge domain stops Layer 2 forwarding across all the associated members including service instances and bridge domain interfaces. The associated service instances influence operational state of a bridge domain. Bridge domain interface cannot be operational unless one of the associated service instances is up.

Note Because a bridge domain interface is an internal interface, the operational state of bridge domain interface does not affect the bridge domain operational state.

BDI Initial State

The initial administrative state of a BDI depends on how the BDI is created. When you create a BDI at boot time in the startup configuration, the default administrative state for the BDI is up. It will remain in this state unless the startup configuration includes the shutdown command. This behavior is consistent with all the other interfaces. When you create a BDI dynamically at command prompt, the default administrative state is down.

BDI Link State

A BDI maintains a link state that comprises of three states: administratively down, operationally down, and up. The link state of a BDI is derived from two independent inputs: the BDI administrative state set by the corresponding users and the fault indication state from the lower levels of the interface states. It defines a BDI link state based on the state of the two inputs.

Fault Indication State	BDI Admin{start straddle 2 columns}{end straddle 2 columns}	
{start emdash} {end emdash}	**Shutdown**	**No Shutdown**
No faults asserted	Admin-down	Up
At least one fault asserted	Admin-down	Operationally-Down

Bridge Domain Interface Statistics

For virtual interfaces, such as the bridge domain interface, protocol counters are periodically queried from the QFP.

When packets flow from a Layer 2 bridge domain network to a Layer 3 routing network through the bridge domain interface, the packets are treated as bridge domain interface input packets and bytes. When packets arrive at a Layer 3 interface and are forwarded through the bridge domain interface to a Layer 2 bridge domain, the packets are treated as output packets and bytes, and the counters are updated accordingly.

A BDI maintains a standard set of Layer 3 packet counters as the case with all Cisco IOS interfaces. Use the show interface command to view the Layer 3 packet counters.

The convention of the counters is relative to the Layer 3 cloud. For example, input refers to the traffic entry to the Layer 3 cloud from the Layer 2 BD, while output refers to the traffic exit from the Layer 3 cloud to the Layer 2 BD.

Use the **show interfaces accounting** command to display the statistics for the BDI status. Use the **show interface** <*if-name*> command to display the overall count of the packets and bytes that are transmitted and received.

Creating or Deleting a Bridge Domain Interface

When you define an interface or subinterface for a Cisco IOS router, you name it and specify how it is assigned an IP address.You can create a bridge domain interface before adding a bridge domain to the system. This new bridge domain interface will be activated after the associated bridge domain is configured.

Note When a bridge domain interface is created, a bridge domain is automatically created.

When you create the bridge domain interface and the bridge domain, the system maintains the required associations for mapping the bridge domain-bridge domain interface pair.

The mapping of bridge domain and bridge domain interface is maintained in the system. The bridge domain interface uses the index of the associated bridge domain to show the association.

Bridge Domain Interface Scalability

The following table lists the bridge domain interface scalability numbers, based on the type of Cisco 8500 Series Catalyst Edge Platform Forwarding Processors.

Table 14: Bridge Domain Interface Scalability Numbers Based on the Type of Cisco 8500 Series Catalyst Edge Platform Forwarding Processor

Description
Maximum bridge domain interfaces per router

Bridge-Domain Virtual IP Interface

The Virtual IP Interface (VIF) feature helps to associate multiple BDI interfaces with a BD instance. The BD-VIF interface inherits all the existing L3 features of IOS logical IP interface.

Note You must configure every BD-VIF interface with a unique MAC address and it should belong to a different VRF.

The Virtual IP Interface (VIF) feature has the following limitations:

- BD-VIF interface does not support IP multicast.
- Number of BD-VIF interfaces with automatically generated MAC address varies on the basis of platforms.
- BD-VIF Interface does not support MPLS.
- The maximum number of BD-VIF interfaces per bridge-domain and the total number of BD-VIF interface for per system vary based on the type of platforms.

The maximum number of BD-VIF supported on Cisco Catalyst 8500 Series Edge Platforms are:

- C8500-12X4QC supports maximum 100 BD-VIF for a Bridge Domain
- C8500-12X (support maximum 16 BD-VIF for a Bridge Domain

From Cisco IOS XE 17.7 release, BD-VIF supports Flexible Netflow (FNF).

How to Configure a Bridge Domain Interface

To configure a bridge domain interface, perform the following steps:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface BDI** *{interface number}*
4. **encapsulation** *encapsulation dot1q <first-tag> [second-dot1q <second-tag>]*
5. Do one of the following:

6. **match security-group destination tag** *sgt-number*
7. **mac address** *{mac-address}*
8. **no shut**
9. **shut**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface BDI** *{interface number}* **Example:** `Router(config-if)# interface BDI3`	Specifies a bridge domain interface on a Cisco 8500 Series Catalyst Edge Platform.
Step 4	**encapsulation** *encapsulation dot1q <first-tag> [second-dot1q <second-tag>]* **Example:** `Router(config-if)# encapsulation dot1Q 1 second-dot1q 2`	Defines the encapsulation type. The example shows how to define dot1q as the encapsulation type.
Step 5	Do one of the following: **Example:** **ip address** *ip-address mask* **Example:** **Example:** **ipv6 address** *{X:X:X:X::X* **link-local** | *X:X:X:X::X/prefix [***anycast** | **eui-64***]* | **autoconfig** *[***default***]}* **Example:** `Router(config-if)# ip address 2.2.2.1 255.255.255.0` **Example:** **Example:**	Specifies either the IPv4 or IPv6 address for the bridge domain interface.

	Command or Action	Purpose
	`Router(config-if)# ipv6 address AB01:CD1:123:C::/64 eui-64`	
Step 6	**match security-group destination tag** *sgt-number* **Example:** `Router(config-route-map)# match security-group destination tag 150`	Configures the value for security-group destination security tag.
Step 7	**mac address** *{mac-address}* **Example:** `Router(config-if)# mac-address 1.1.3`	Specifies the MAC address for the bridge domain interface.
Step 8	**no shut** **Example:** `Router(config-if)# no shut`	Enables the bridge domain interface on the Cisco 8500 Series Catalyst Edge Platform.
Step 9	**shut** **Example:** `Router(config-if)# shut`	Disables the bridge domain interface on the Cisco 8500 Series Catalyst Edge Platform.

Example

The following example shows the configuration of a bridge domain interface at IP address 2.2.2.1 255.255.255.0:

```
Router# configure terminal
Router(config)# interface BDI3
Router(config-if)# encapsulation dot1Q 1 second-dot1q 2
Router(config-if)# ip address 2.2.2.1 255.255.255.0
Router(config-if)# mac-address 1.1.3
Router(config-if)# no shut
Router(config-if)# exit
```

Displaying and Verifying Bridge Domain Interface Configuration

SUMMARY STEPS

1. **enable**
2. **show interfaces bdi**
3. **show platform software interface fp active name**
4. **show platform hardware qfp active interface if-name**
5. **debug platform hardware qfp feature**
6. **platform trace runtime process forwarding-manager module**

7. **platform trace boottime process forwarding-manager module interfaces**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**show interfaces bdi** **Example:** `Router# show interfaces BDI3`	Displays the configuration summary of the corresponding BDI.
Step 3	**show platform software interface fp active name** **Example:** `Router# show platform software interface fp active name BDI4`	Displays the bridge domain interface configuration in a Forwarding Processor.
Step 4	**show platform hardware qfp active interface if-name** **Example:** `Router# show platform hardware qfp active interface if-name BDI4`	Displays the bridge domain interface configuration in a data path.
Step 5	**debug platform hardware qfp feature** **Example:** `Router# debug platform hardware qfp active feature l2bd client all`	The selected CPP L2BD Client debugging is on.
Step 6	**platform trace runtime process forwarding-manager module** **Example:** `Router(config)# platform trace runtime slot F0 bay 0 process forwarding-manager module interfaces level info`	Enables the Forwarding Manager Route Processor and Embedded Service Processor trace messages for the Forwarding Manager process.
Step 7	**platform trace boottime process forwarding-manager module interfaces** **Example:** `Router(config)# platform trace boottime slot`	Enables the Forwarding Manager Route Processor and Embedded Service Processor trace messages for the Route Processor Forwarding Manager process during bootup.

	Command or Action	Purpose
	`R0 bay 1 process forwarding-manager forwarding-manager level max`	

What to do next

For additional information on the commands and the options available with each command, see the Cisco IOS Configuration Fundamentals Command Reference Guide located at:

{start hypertext}http://www.cisco.com/en/US/docs/ios/fundamentals/command/reference/cf_book.html{end hypertext}

Configuring Bridge-Domain Virtual IP Interface

```
enable
configure terminal
[no] interface BD-VIF interface-number
  [[no] vrf forwarding vrf-name]
  [[no] mac address mac-address]
  [[no] ip address ip-address mask]
  [[no] ipv6 address {X:X:X:X::X link-local| X:X:X:X::X/prefix [anycast | eui-64] | autoconfig
 [default]}]

exit
```

To delete BD-VIF interface, use the 'no' form of the command.

Associating VIF Interface with a Bridge Domain

```
enable
configure terminal
bridge-domain bridge-domain number
[no] member BD-VIF interface-number
exit
```

Verifying Bridge-Domain Virtual IP Interface

All existing show commands for interface and IP interface can be used for the BD-VIF interface.

show interface bd-vif *bd-vif-id*

show ip interface bd-vif *bd-vif-id*

show bd-vif interfaces in fman-fp

show pla sof inter fp ac brief | i BD_VIF

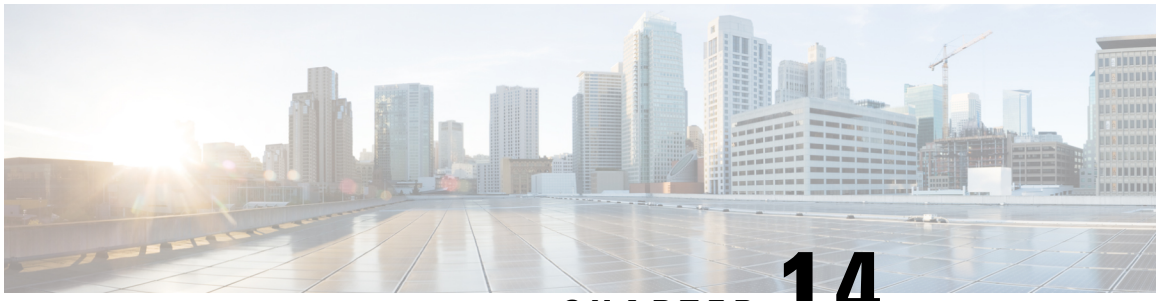
Example Configuration Bridge-Domain Virtual IP Interface

```
Detail sample:

interface Port-channel1
mtu 9000
no ip address
```

```
 !Ethernet service endpoint one per neutron network
service instance 1756 ethernet
  description 4e8e5957-649f-477b-9e5b-f1f75b21c03c
  encapsulation dot1q 1756
  rewrite ingress tag pop 1 symmetric
  bridge-domain 1756
!
interface BD-VIF5001
no shutdown
vrf forwarding vrf5001
ip address 10.0.0.1 255.255.255.0
interface BD-VIF5002
no shutdown
vrf forwarding vrf5002
ip address 10.0.0.2 255.255.255.0

bridge-domain 1756
member Port-channel1 service-instance 1756
member bd-vif5001
member bd-vif5002
```



CHAPTER 14

EVPN VPWS over SR-TE Preferred Path

The Ethernet VPN Virtual Private Wire Service (EVPN VPWS) functionality implements the signaling and encapsulation techniques for establishing an EVPN instance between a pair of PEs. This enhancement extends EVPN VPWS to support the specification of an SR-TE policy using the **preferred path** feature.

- Feature Information for EVPN VPWS over SR-TE Preferred Path, on page 123
- Restrictions for EVPN VPWS over SR-TE Preferred Path, on page 123
- Information About EVPN VPWS over SR-TE Preferred Path, on page 124
- How to Configure EVPN VPWS over SR-TE Preferred Path, on page 124
- Verifying EVPN VPWS over SR-TE Preferred Path , on page 125

Feature Information for EVPN VPWS over SR-TE Preferred Path

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use the Cisco Feature Navigator to find information about platform support and Cisco software image support. To access the Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 15: Feature Information for EVPN VPWS over SR-TE Preferred Path

Feature Name	Releases	Feature Information
EVPN VPWS over SR-TE Preferred Path	Cisco IOS XE Cupertino 17.7.1a	This feature was introduced.

Restrictions for EVPN VPWS over SR-TE Preferred Path

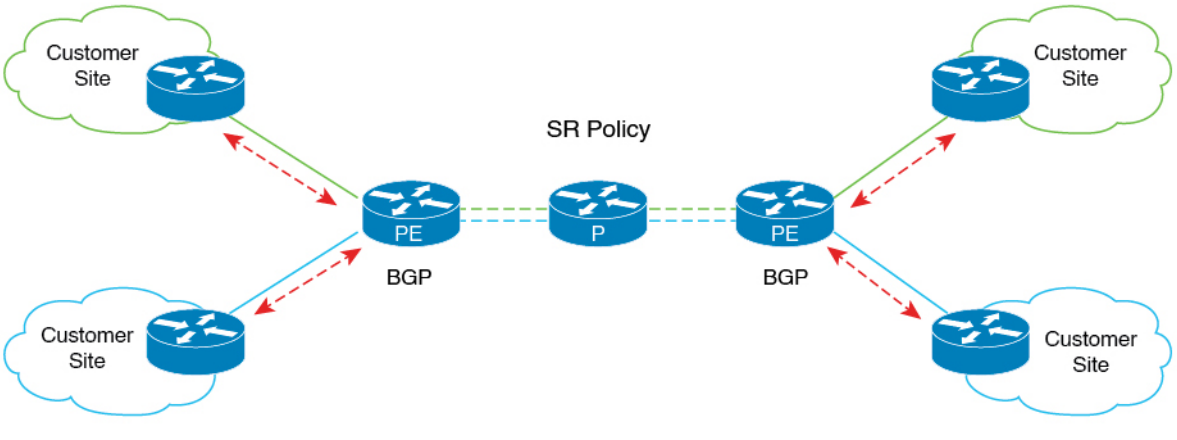
- SR On-Demand Next Hop (ODN) policy is not supported; only SR static policy is supported.
- SR Per-Flow Policy (PFP) is not supported; only SR Per-Destination Policy (PDP) is supported.
- Interior Gateway Protocol (IGP) is Intermediate System-to-Intermediate system (IS-IS).

Information About EVPN VPWS over SR-TE Preferred Path

The EVPN VPWS functionality implements the signaling and encapsulation techniques for establishing an EVPN instance between a pair of PEs. This enhancement enables EVPN VPWS to support the specification of an SR-TE policy using the **preferred path** feature. This feature includes the **fallback disable** option, which disables the default behavior of falling back on an alternate path if the preferred path is down.

The following figure illustrates the architecture:

Figure 2: EVPN VPWS over SR-TE Architecture



How to Configure EVPN VPWS over SR-TE Preferred Path

The following sections provide information about the tasks involved in configuring EVPN VPWS over the SR-TE preferred path.

Configuring EVPN VPWS over SR-TE Preferred Path

The following example shows how to enable EVPN VPWS over the configured SR-TE preferred path:

```
l2vpn evpn instance 100 point-to-point
 rd 100:100
 route-target export 100:100
 route-target import 100:100
 !
 vpws context vc100
  preferred-path segment-routing traffic-eng policy p-100
  service target 100 source 100
interface GigabitEthernet0/0/3
service instance 100 ethernet
encapsulation dot1q 100
```

Configuring EVPN VPWS over SR-TE Preferred Path with Fallback Disable

The **fallback disable** command prevents a device from using the default path if the preferred path SR policy goes down.

```
l2vpn evpn instance 100 point-to-point
rd 100:100
route-target export 100:100
route-target import 100:100
vpws context vc100
service target 100 source 100
member GigabitEthernet0/0/3 service-instance 100
preferred-path segment-routing traffic-eng policy p-100 disable-fallback
```

Removing Fallback Disable from EVPN VPWS over SR-TE Preferred Path

The following example shows how to remove the fallback disable option in EVPN VPWS over SR-TE preferred path:

```
l2vpn evpn instance 100 point-to-point
 vpws context vc100
  preferred-path segment-routing traffic-eng policy p-100
```

Disabling EVPN VPWS over SR-TE Preferred Path Configuration

The following example shows how to disable the EVPN VPWS over SR-TE preferred path configuration:

```
l2vpn evpn instance 100 point-to-point
 vpws context vc100
 no  preferred-path segment-routing traffic-eng policy p-100 disable-fallback
```

Verifying EVPN VPWS over SR-TE Preferred Path

The following sample outputs show how to to verify the EVPN VPWS over SR-TE preferred path and fallback disable configurations.

- The following is a sample output showing the EVPN VPWS configuration over an SR-TE preferred path:

```
device# show l2vpn evpn vpws VC ID 100 detail
EVPN name: vc100, state: up, type: point-to-point
  EVPN ID: 100
  VPWS Service Instance ID: Source 1, Target 2
  Labels: Local 17, Remote 17
  Next Hop Address: 6.6.6.6
  Associated member interface Gi0/0/3 up, Gi0/0/3:3000 status is up
  Output interface: Tu65536, imposed label stack {16016 17}
  Preferred path:   active
  Default path: ready

device# show l2vpn evpn vpws vc preferred-path
Tunnel         EVPN ID  Source    Target    Name      Status
-------------       ------   --------  --------  --------  ----------
Tunnel65536     100       1         2            vc100        up
```

- The following is a sample output showing the EVPN VPWS configuration over an SR-TE preferred path, with fallback disabled:

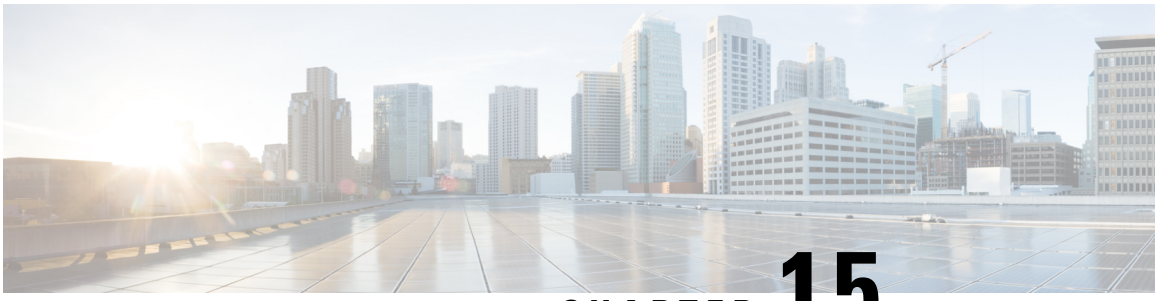
```
device# show l2vpn evpn vpws VC ID 100 detail
EVPN name: vc100, state: up, type: point-to-point
  EVPN ID: 100
  VPWS Service Instance ID: Source 1, Target 2
  Labels: Local 17, Remote 17
  Next Hop Address: 6.6.6.6
  Associated member interface Gi0/0/3 up, Gi0/0/3:3000 status is up
  Output interface: Tu65536, imposed label stack {16016 17}
  Preferred path:   active
  Default path:  disabled
Dataplane:
SSM segment/switch IDs: 25037/12290 (used), PWID: 1
Rx Counters
1241 input transit packets, 463266 bytes
0 drops
Tx Counters
828 output transit packets, 402840 bytes
0 drops
24 VC FSM state transitions, Last 10 shown
DpUp: Act -> Est, Mon Sep 06 23:32:43.809 (2w2d ago)
RemDn: Est -> RemWait, Mon Sep 06 23:32:43.809 (2w2d ago)
RemUp: RemWait -> Act, Mon Sep 06 23:32:43.816 (2w2d ago)
DpUp: Act -> Est, Mon Sep 06 23:32:43.816 (2w2d ago)
DpDn: Est -> Act, Mon Sep 06 23:35:57.944 (2w2d ago)
DpUp: Act -> Est, Mon Sep 06 23:43:50.071 (2w2d ago)
DpDn: Est -> Act, Mon Sep 06 23:46:15.361 (2w2d ago)
DpUp: Act -> Est, Mon Sep 06 23:54:11.508 (2w2d ago)
DpDn: Est -> Act, Tue Sep 07 00:00:11.248 (2w2d ago)
DpUp: Act -> Est, Tue Sep 07 00:06:27.355 (2w2d ago)
```

- The following is a sample output showing the EVPN VPWS configuration over an SR-TE preferred path, with fallback disable option removed:

```
device# show l2vpn evpn vpws VC ID 100 detail
EVPN name: vc100, state: up, type: point-to-point
  EVPN ID: 100
  VPWS Service Instance ID: Source 1, Target 2
  Labels: Local 17, Remote 17
  Next Hop Address: 6.6.6.6
  Associated member interface Gi0/0/3 up, Gi0/0/3:3000 status is up
  Output interface: Tu65536, imposed label stack {16016 17}
  Preferred path:   active
  Default path:  ready
```

- The following is a sample output showing the EVPN VPWS configuration over an SR-TE preferred path disabled:

```
device# show l2vpn evpn vpws VC ID 100 detail
EVPN name: vc100, state: up, type: point-to-point
  EVPN ID: 100
  VPWS Service Instance ID: Source 1, Target 2
  Labels: Local 17, Remote 17
  Next Hop Address: 6.6.6.6
  Associated member interface Gi0/0/3 up, Gi0/0/3:3000  status is up
  Output interface: Gi0/0/0, imposed label stack {16 16}
  Preferred path: not configured
  Default path:  active
```



CHAPTER 15

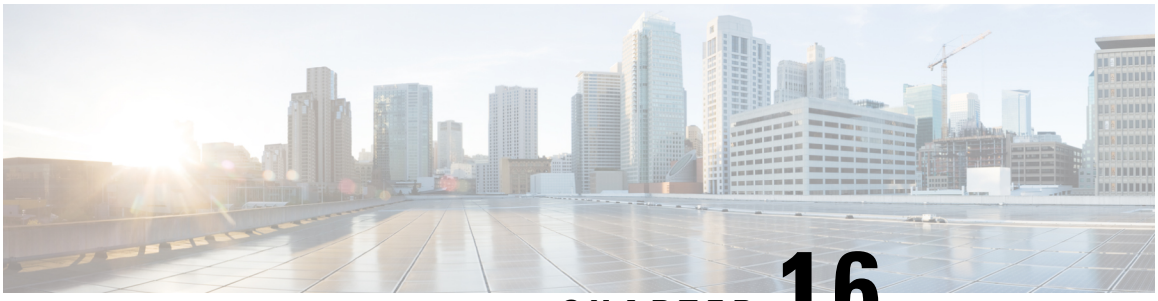
Configuring SFP+

SUMMARY STEPS

1. **enable** *source-interface gigabitethernet slot/port*
2. **configure terminal**
3. **interface tengigabitethernet** *slot/port*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** *source-interface gigabitethernet slot/port* **Example:** `Router# enable`	Enables the privileged EXEC mode. If prompted, enter your password.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 3	**interface tengigabitethernet** *slot/port* **Example:** `Router(config)# interface tengigabitethernet 4/11`	Specifies the 10-Gigabit Ethernet interface to be configured. Here: slot/port—Specifies the location of the interface.



CHAPTER 16

Cisco Thousand Eyes Enterprise Agent Application Hosting

This chapter provides information on Cisco Thousand Eyes Enterprise Agent Application Hosting. The following sections are included in this chapter:

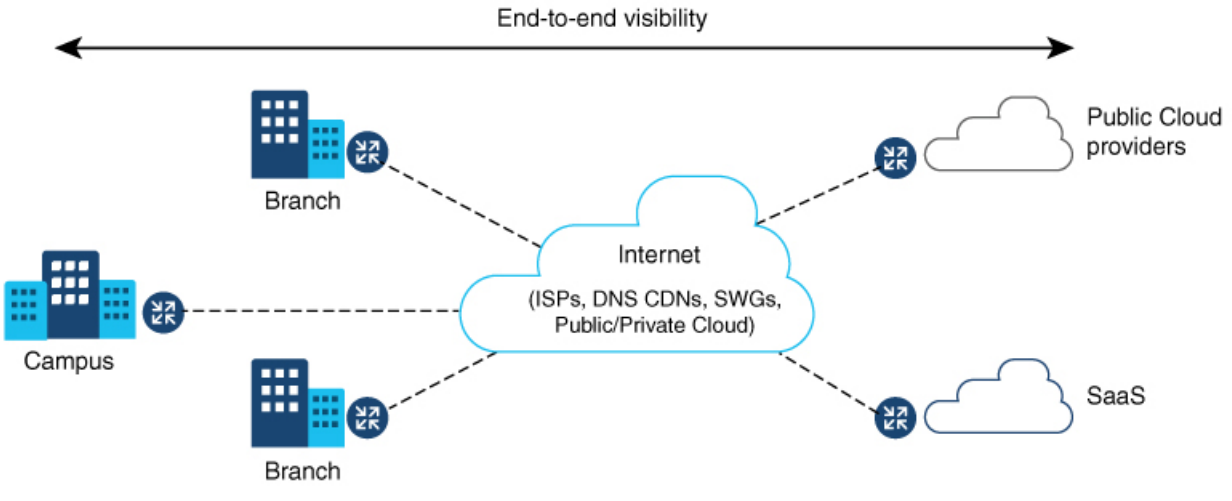
- Cisco ThousandEyes Enterprise Agent Application Hosting, on page 129
- Supported Platforms and System Requirements, on page 130
- Workflow to Install and Run the Cisco ThousandEyes Application, on page 131
- Modifying the Agent Parameters, on page 135
- Uninstalling the Application, on page 135
- Troubleshooting the Cisco ThousandEyes Application, on page 135

Cisco ThousandEyes Enterprise Agent Application Hosting

Cisco ThousandEyes is a network intelligence platform that allows you to use its agents to run a variety of tests from its agents to monitor the network and application performance. This application enables you to view end-to-end paths across networks and services that impact your business. Cisco ThousandEyes application actively monitors the network traffic paths across internal, external, and internet networks in real time, and helps to analyse the network performance. Also, isco ThousandEyes application provides application availability insights that are enriched with routing and device data for a multidimensional view of digital experience.

From Cisco IOS XE Release 17.8.1, you can use application-hosting capabilities to deploy the Cisco ThousandEyes Enterprise Agent as a container application on Cisco Catalyst 8500 and Catalyst 8500L Series Edge Platforms. This agent application runs as a docker image using Cisco IOx docker-type option. For more information on how to configure Cisco ThousandEyes in controller mode, see Cisco SD-WAN Systems and Interfaces Configuration Guide.

Figure 3: Network View through ThousandEyes Application



Feature Information for Cisco ThousandEyes Enterprise Agent Application Hosting

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 16: Feature Information for ThousandEyes Enterprise Agent Application Hosting

Feature Name	Releases	Feature Information
Cisco ThousandEyes Enterprise Agent Application Hosting	Cisco IOS XE 17.8.1	With the integration of ThousandEyes Agent Application running on routing platforms using the app-hosting capabilities as container, you can have visibility into application experience with deep insights into the Internet, cloud providers, and enterprise networks.

Supported Platforms and System Requirements

The following table lists the supported platforms and system requirements.

Platforms	Bootflash	FRU Storage	DRAM
Cisco Catalyst 8500 Series Edge Platforms			
C8500-12X4QC	32 GB	(Default) 32 GB eUSB (Optional) HDD	16 GB

Platforms	Bootflash	FRU Storage	DRAM
C8500-12X	32 GB	(Default) 32 GB eUSB (Optional) HDD	16 GB
Cisco Catalyst 8500L Series Edge Platforms			
C8500L-8S4X	16 GB	(Default) 32GB M.2 USB	16 GB

Note The minimum DRAM and bootflash storage requirement for running Cisco ThousandEyes Enterprise Agent is 8 GB. If the device does not have enough memory or storage, we recommend that you upgrade DRAM or add an external storage such as SSD/M.2 USB. When the available resources are not sufficient to run other applications, Cisco IOx generates an error message.

Workflow to Install and Run the Cisco ThousandEyes Application

To install and run the Cisco ThousandEyes image on a device, perform these steps:

Step 1 Create a new account on the Cisco ThousandEyes portal.

Step 2 Download the Cisco ThousandEyes application package from the software downloads page and ensure that you use the agent version 4.2.2.

Step 3 Copy the image on the device.

Step 4 Install and launch the image.

Step 5 Connect the agent to the controller.

Note When you order platforms that support Cisco ThousandEyes application with Cisco IOS XE 17.8.1 software, the Cisco ThousandEyes application package is available in the bootflash of the device.

Workflow to Host the Cisco ThousandEyes Application

To install and launch the application, perform these steps:

Before you begin

Create a new account on the Cisco ThousandEyes portal and generate the token. The Cisco ThousandEyes agent application uses this token to authenticate and check into the correct Cisco ThousandEyes account. you see a message stating that your token is invalid and you want to troubleshoot the issue, see Troubleshooting the Cisco ThousandEyes Application, on page 135.

Note If you configure the correct token and Domain Name Server (DNS) information, the device is discovered automatically.

Step 1 Enable Cisco IOX application environment on the device.

- Use the following commands for non-SD-WAN (autonomous mode) images:

```
config terminal
 iox
end
write
```

- Use the following commands for SD-WAN (controller mode) images:

```
config-transaction
iox
commit
```

Step 2 If the IOx command is accepted, wait for a few seconds and check whether the IOx process is up and running by using the **show iox** command. The output must display that the show IOxman process is running.

```
Device #show iox

IOx Infrastructure Summary:
---------------------------
IOx service (CAF) 1.11.0.0     : Running
IOx service (HA)               : Not Supported
IOx service (IOxman)           : Running
IOx service (Sec storage)      : Not Supported
Libvirtd 1.3.4                 : Running
```

Step 3 Ensure that the ThousandEyes application LXC tarball is available in the device *bootflash:*.

Step 4 Create a virtual port group interface to enable the traffic path to the Cisco ThousandEyes application:

```
interface VirtualPortGroup 0
          ip address 192.168.35.1 255.255.255.0
        exit
```

Step 5 Configure the app-hosting application with the generated token:

```
app-hosting appid te
          app-vnic gateway1 virtualportgroup 0 guest-interface 0
          guest-ipaddress 192.168.35.2 netmask 255.255.255.0
          app-default-gateway 192.168.35.1 guest-interface 0
          app-resource docker
                   prepend-pkg-opts □ Required to get the default run-time options from package.yaml

                    run-opts 1 "--hostname thousandeyes"
              run-opts 2 "-e TEAGENT_ACCOUNT_TOKEN=<ThousandEyes token>"
        run-opts 3 "-e TEAGENT_PROXY_TYPE=STATIC -e TEAGENT_PROXY_LOCATION=proxy.something.other:80"

          name-server0 75.75.75.75 □ ISP's DNS server
        end

app-hosting appid te
```

```
app-resource docker
 prepend-pkg-opts
 run-opts 2 "--hostname
```

Note You can use the proxy configuration only if the Cisco ThousandEyes agent does not have an internet access without a proxy. Also, the hostname is optional. If you do not provide the hostname during the installation, the device hostname is used as the Cisco ThousandEyes agent hostname. The device hostname is displayed on the Cisco ThousandEyes portal. The DNS name server information is optional. If the Cisco ThousandEyes agent uses a private IP address, ensure that you establish a connection to the device through NAT.

Step 6 Configure the **start** command to run the application automatically when the application is installed on the device using the **install** command:

```
app-hosting appid te
         start
```

Step 7 Install the ThousandEyes application:

```
app-hosting install appid <appid> package [bootflash: | harddisk: | https:]
```

Select a location to install the ThousandEyes application from these options:

```
Device# app-hosting install appid te package ?
           bootflash:  Package path □ ISR4K case if image is locally available in bootflash:
           harddisk:   Package path □ Cat8K case if image is locally available in M.2 USB
           https:      Package path □ Download over the internet if image is not locally present in
 router. URL to ThousandEyes site hosting agent image to be provided here
```

Step 8 Check if the application is up and running:

```
Device#show app-hosting list
 App id                                   State
---------------------------------------------------------
  te                                       RUNNING
```

Note If any of these steps fail, use the **show logging** command and check the IOx error message. If the error message is about insufficient disk space, clean the storage media (bootflash or hard disk) to free up the space. Use the **show app-hosting resource** command to check the CPU and disk memory.

Downloading and Copying the Image to the Device

To download and copy the image to bootflash, perform these steps:

Step 1 Check if the Cisco ThousandEyes image is precopied to *bootflash:/<directory name>*.

Step 2 If the image is not available in the device directory, perform these steps:

a) If the device has a direct access to internet, use the *https:*. option in the **application install** command. This option downloads the image from the Cisco ThousandEyes software downloads page into *bootflash:/apps* and installs the application.

```
Device# app-hosting install appid <appid string> package [bootflash: | flash | http | https://
| ftp | ] URL to image location hosted on ThousandEyes portal
```

```
Device# app-hosting install appid te1000 package
https://downloads.thousandeyes.com/enterprise-agent/thousandeyes-enterprise-agent-4.0.2.cisco.tar

Installing package
'https://downloads.thousandeyes.com/enterprise-agent/thousandeyes-enterprise-agent-4.0.2.cisco.tar'
 for 'te1000'.

Use 'show app-hosting list' for progress.
*Jun 29 23:43:29.244: %IOSXE-6-PLATFORM: R0/0: IOx:  App verification successful
*Jun 29 23:45:00.449: %IM-6-INSTALL_MSG: R0/0: ioxman: app-hosting: Install succeeded: te1000
installed successfully Current state is DEPLOYED
*Jun 29 23:45:01.801: %IOSXE-6-PLATFORM: R0/0: IOx:  App verification successful
*Jun 29 23:45:51.054: %IM-6-START_MSG: R0/0: ioxman: app-hosting: Start succeeded: te1000 started
 successfully Current state is RUNNING

Device#show app-hosting detail appid te1000  ( Details of Application)
App id                 : te1000
Owner                  : iox
State                  : RUNNING
Application
  Type                 : docker
  Name                 : ThousandEyes Enterprise Agent
  Version              : 4.0
  Author               : ThousandEyes <support@thousandeyes.com>
  Path                 : bootflash:thousandeyes-enterprise-agent-4.0-22.cisco.tar
Resource reservation
  Memory               : 500 MB
  Disk                 : 1 MB
  CPU                  : 1500 units
  CPU-percent          : 70 %
```

b) If the device has a proxy server, copy the image manually to *bootflash:/apps*.

c) Download the Cisco ThousandEyes application package from the software downloads page and ensure that you use the agent version 4.0.2.

d) Create an application directory in the *bootflash:* to copy the image:

```
Device# mkdir bootflash:apps
Create directory filename [apps]?
Created dir bootflash:/apps
```

e) Copy the Cisco ThousandEyes image to the *bootflash:apps* directory.

f) Validate the image using the **verify** command:

```
verify /md5 bootflash:apps/<file name>
```

Connecting the Cisco ThousandEyes Agent with the Controller

Before you begin

Ensure that you have an Internet connection before you connect the agent with the controller.

After the Cisco ThousandEyes application is up and running, the agent (ThousandEyes-agent) process connects to the controller that is running on the cloud environment.

Note If you have issues related to connectivity, the application logs the relevant error messages in the application-specific logs (*/var/logs*).

Modifying the Agent Parameters

To modify the agent parameters, perform these actions:

Step 1 Stop the application using the **app-hosting stop appid appid** command.
Step 2 Deactivate the application using the **app-hosting deactivate appid appid** command.
Step 3 Make the required changes to app-hosting configuration.
Step 4 Activate the application using the **app-hosting activate appid appid** command.
Step 5 Start the application using the **app-hosting start appid appid** command.

Uninstalling the Application

To uninstall the application, perform these steps:

Step 1 Stop the application using the **app-hosting stop appid te** command.
Step 2 Check if the application is in active state using the **show app-hosting list** command.
Step 3 Deactivate the application using the **app-hosting deactivate appid te** command.
Step 4 Ensure that the application is not in active state. Use the **show app-hosting list** command to check status of the application.
Step 5 Uninstall the application using the **app-hosting uninstall appid te** command.
Step 6 After the uninstallation process is complete, use the **show app-hosting list** command to check if the application is uninstalled successfully.

Troubleshooting the Cisco ThousandEyes Application

To troubleshoot the Cisco ThousandEyes application, perform these steps:

1. Connect to Cisco ThousandEyes agent application using the **app-hosting connect appid appid session /bin/bash** command.
2. Verify the configuration applied to the application at the following path */etc/te-agent.cfg*.
3. View the logs at the following path */var/log/agent/te-agent.log*. You can use these logs to troubleshoot the configuration.

Checking the ThousandEyes Application Status

When the Cisco ThousandEyes application is in running state, it is registered on the ThousandEyes portal. If the application does not show up in a few minutes after the agent is in running state, check the following using the **app-hosting connect appid thousandeyes_enterprise_agent session** command:

```
Device#app-hosting connect appid thousandeyes_enterprise_agent session
Device# cat /var/log/agent/te-agent.log
2021-02-04 08:59:29.642 DEBUG [e4736a40] [te.agent.AptPackageInterface] {} Initialized APT
 package interface
2021-02-04 08:59:29.642 INFO  [e4736a40] [te.agent.main] {} Agent version 1.103.0 starting.
  Max core size is 0 and max open files is 1024
2021-02-04 08:59:29.642 DEBUG [e4736a40] [te.agent.db] {} Vacuuming database
2021-02-04 08:59:29.643 INFO  [e4736a40] [te.agent.db] {} Found version 0, expected version
 50
2021-02-04 08:59:29.672 INFO  [e4708700] [te.probe.ServerTaskExecutor] {} ProbeTaskExecutor
 started with 2 threads.
2021-02-04 08:59:29.673 INFO  [e2f05700] [te.probe.ProbeTaskExecutor.bandwidth] {}
ProbeTaskExecutor started with 1 threads.
2021-02-04 08:59:29.673 INFO  [e2704700] [te.probe.ProbeTaskExecutor.realtime] {}
ProbeTaskExecutor started with 1 threads.
2021-02-04 08:59:29.673 INFO  [e1f03700] [te.probe.ProbeTaskExecutor.throughput] {}
ProbeTaskExecutor started with 1 threads.
2021-02-04 08:59:29.674 DEBUG [e4736a40] [te.agent.DnssecTaskProceessor] {} Agent is not
running bind
2021-02-04 08:59:29.674 DEBUG [e4736a40] [te.snmp.RequestDispatcher] {} Initialised SNMP++
 session
2021-02-04 08:59:29.674 DEBUG [e4736a40] [te.snmp.RequestDispatcher] {} Initialised SNMP++
 session
2021-02-04 08:59:29.674 DEBUG [e4736a40] [te.snmp.RequestDispatcher] {} Initialised SNMP++
 session
2021-02-04 08:59:29.674 INFO  [e4736a40] [te.agent.main] {} Agent starting up
2021-02-04 08:59:29.675 INFO  [e4736a40] [te.agent.main] {} No agent id found, attempting
to obtain one
2021-02-04 08:59:29.675 INFO  [e4736a40] [te.agent.ClusterMasterAdapter] {} Attempting to
get agent id from sc1.thousandeyes.com
2021-02-04 08:59:29.679 ERROR [e4736a40] [te.agent.main] {} Error calling create_agent:
Curl error - Couldn't resolve host name
2021-02-04 08:59:29.680 INFO  [e4736a40] [te.agent.main] {} Sleeping for 30 seconds
Note :
```

Note Check the DNS server connection. If the Cisco ThousandEyes agent is assigned to a private IP address, check the NAT configuration.