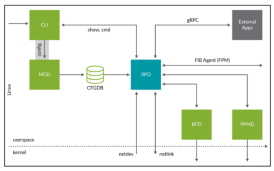
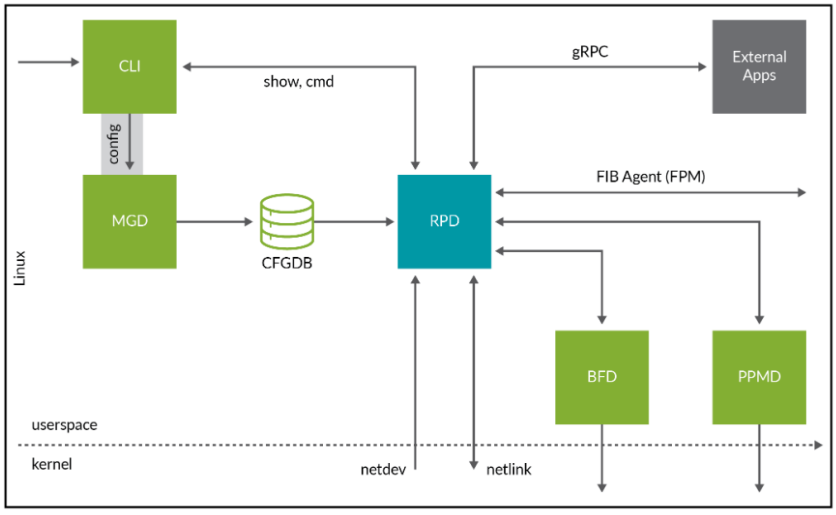


juniper cRPD Containerized Routing Protocol Daemonac User Guide

Contents

juniper cRPD Containerized Routing Protocol Daemonac



Product Information

Specifications

- **Product Name**: Junos Containerized Routing Protocol Daemon (cRPD)
- **Operating System**: Linux
- **Linux Host**: Ubuntu 18.04.1 LTS (Codename: bionic)
- **Docker Version**: 20.10.7

Product Usage Instructions

Step 1: Begin

Meet Junos cRPD
The Junos Containerized Routing Protocol Daemon (cRPD) is a software package developed by Juniper Networks. It provides containerized routing capabilities for network devices.

Get Ready
Before installing Junos cRPD, you need to ensure that Docker is installed and configured on your Linux host.

Install and Configure Docker on a Linux Host
Follow these steps to install and configure Docker on your Linux host

1. Open the terminal on your Linux host.
2. Update your existing list of packages and download the necessary tools by running the following command

   ```
   sudo apt install apt-transport-https ca-certificates curl software-properties-common
   ```

3. Add the Docker repository to Advanced Packaging Tool (APT) sources by executing the following command

   ```
   sudo apt update
   ```

4. Update the apt package index and install the latest version of Docker Engine using the following command

   ```
   sudo apt install docker-ce
   ```

5. To verify the successful installation, run the command

   ```
   docker version
   ```

Download and Install Junos cRPD Software
Once Docker is installed and running, you can proceed to download and install Junos cRPD software by following these steps

1. Visit the Juniper Networks software download page.
2. Download the Junos cRPD software package.
3. Install the downloaded software package according to the provided installation instructions.

Frequently Asked Questions (FAQ)

- **Q: Can I use Junos cRPD without a license key?**

  A: Yes, you can start using Junos cRPD without a license key by starting a free trial. Please refer to the “Start

your free trial today” section for more information.

Quick Start
Junos Containerized Routing Protocol Daemon (cRPD)

Step 1: Begin

In this guide, we walk you through how to install and configure Junos® containerized routing protocol process (cRPD) on a Linux host and access it using Junos CLI. Next, we show you how to connect and configure two Junos cRPD instances and establish an OSPF adjacency.

Meet Junos cRPD

- Junos cRPD is a cloud-native, containerized routing engine that supports simple deployment throughout the cloud infrastructure. Junos cRPD decouples the RPD from Junos OS and packages the RPD as a Docker container that runs on any Linux-based system, including servers and whitebox routers. Docker is an open source software platform that makes it simple to create and manage a virtual container.
- Junos cRPD supports multiple protocols such as OSPF, IS-IS, BGP, MP-BGP, and so on. Junos cRPD shares the same management functionality as Junos OS and Junos OS Evolved to deliver a consistent configuration and management experience in routers, servers, or any Linux-based device.

Get Ready

Before you begin deployment

- Familiarize yourself with your Junos cRPD license agreement. See Flex Software License for cRPD and Managing cRPD Licenses.
- Set up a Docker hub account. You’ll need an account to download Docker Engine. See Docker ID accounts for details.

Install and Configure Docker on a Linux Host

1. Verify that your host meets these system requirements.
    - **Linux OS support** – Ubuntu 18.04
    - **Linux Kernel** – 4.15
    - **Docker Engine**– 18.09.1 or later versions
    - **CPUs**– 2 CPU core
    - **Memory** – 4 GB
    - **Disk space** – 10 GB
    - **Host processor type** – x86_64 multicore CPU
    - **Network Interface** – Ethernet

      root-user@linux-host:~# uname -a
      Linux ix-crpd-03 4.15.0-147-generic #151-Ubuntu SMP Fri Jun 18 19:21:19 UTC 2021 x86_64 x86_64 x86_64 GNU/Linux
      root-user@linux-host:lsb_release -a
      No LSB modules are available.

Distributor ID: Ubuntu

Description: Ubuntu 18.04.1 LTS

Release: 18.04

Codename: bionic

2. Download the Docker software.
   - Update your existing list of packages and download the necessary tools.

     rootuser@linux-host:**~# apt install apt-transport-https ca-certificates curl software-properties-common**

     [sudo] password for lab

     Reading package lists… Done

     Building dependency tree

     Reading state information… Done

     Note, selecting 'apt' instead of 'apt-transport-https'

     The following additional packages will be installed:……
   - Add the Docker repository to Advanced Packaging Tool (APT) sources.

     rootuser@linux-host:~# add-apt-repository "deb [arch=amd64]

     https://download.docker.com/linux/ubuntu bionic stable"

     Get:1 **https://download.docker.com/linux/ubuntu** bionic InRelease [64.4 kB] **Get**:2

     https://download.docker.com/linux/ubuntu bionic/stable amd64 Packages [18.8 kB] **Hit**:3

     http://archive.ubuntu.com/ubuntu bionic InRelease

     Get:4 **http://archive.ubuntu.com/ubuntu** bionic-security InRelease [88.7 kB] **Get**:5

     http://archive.ubuntu.com/ubuntu bionic-updates InRelease [88.7 kB] **Get**:6

     http://archive.ubuntu.com/ubuntu bionic/main Translation-en [516 kB] **Get**:7

     http://archive.ubuntu.com/ubuntu bionic-security/main Translation-en [329 kB] **Get**:8

     http://archive.ubuntu.com/ubuntu bionic-updates/main Translation-en [422 kB] Fetched 1,528 kB in 8s (185 kB/s)

     Reading package lists… Done
   - Update the database with the Docker packages.

     rootuser@linux- host:~# apt update

     Hit:1 **https://download.docker.com/linux/ubuntu** bionic In Release

     Hit:2 **http://archive.ubuntu.com/ubuntu** bionic In Release

     Hit:3 **http://archive.ubuntu.com/ubuntu** bionic-security In Release

     Hit:4 **http://archive.ubuntu.com/ubuntu** bionic-updates In Release Reading package lists… Done

     Building dependency tree

     Reading state information… Done
   - Update the apt package index, and install the latest version of Docker Engine.

     rootuser@linux-host:~# apt install docker-ce Reading package lists… Done

     Building dependency tree

     Reading state information… Done

     The following additional packages will be installed containerd.io docker-ce-cli docker-ce-rootless-extras docker-scan-plugin libltdl7 libseccomp2

     Suggested packages

     aufs-tools cgroupfs-mount | cgroup-lite Recommended packages

pigz slirp4netns

…….

- Check to see if the installation is successful.

  rootuser@linux-host:~# docker versio

  Client: Docker Engine – Community

  Version:20.10.7

  API version:1.41

  Go version:go1.13.15

  Git commit:f0df350

  Built: Wed Jun 2 11:56:40 2021

  OS/Arch: linux/amd64

  Context: default

  Experimental :true

  Server: Docker Engine – Community

  Engine

  Version:20.10.7

  API version:1.41 (minimum version 1.12)

  Go version:go1.13.15

  Git commit: b0f5bc3

  Built: Wed Jun 2 11:54:48 2021

  OS/Arch: linux/amd64

  Experimental: false

  containerd

  Version: 1.4.6

  GitCommit: d71fcd7d8303cbf684402823e425e9dd2e99285d

  runc

  Version: 1.0.0-rc95

  GitCommit: b9ee9c6314599f1b4a7f497e1f1f856fe433d3b7

  docker-init

  Version: 0.19.0

  GitCommit: de40ad0

TIP: Use these commands to install the components you need for the Python environment and packages

- apt-add-repository universe
- apt-get update
- apt-get install python-pip
- python -m pip install grpcio
- python -m pip install grpcio-tools

Download and Install Junos cRPD Software

Now that you've installed Docker on the Linux host and confirmed that the Docker Engine is running, let's download the
Junos cRPD software from the Juniper Networks software download page.

NOTE: To download, install, and start using Junos cRPD without a license key, see Start your free trial today.

NOTE: You can open an Admin Case with Customer Care for privileges to download the software.

1. Navigate to the Juniper Networks Support page for Junos cRPD: **https://support.juniper.net/support/downloads/?** p=crpd and click the latest version.
2. Enter your user ID and password and accept the Juniper end-user license agreement. You'll be guided to the software image download page.
3. Download the image directly on your host. Copy and paste the generated string as instructed on the screen.
   rootuser@linux-host:~# wget -O junos-routing-crpd-docker-21.2R1.10.tgz
   https://cdn.juniper.net/software/
   crpd/21.2R1.10/junos-routing-crpd-docker-21.2R1.10.tgz?
   SM_USER=user1&__gda__=1626246704_4cd5cfea47ebec7c1226d07e671d0186
   Resolving cdn.juniper.net (cdn.juniper.net)… 23.203.176.210
   Connecting to cdn.juniper.net (cdn.juniper.net)|23.203.176.210|:443… connected.
   HTTP request sent, awaiting response… 200 OK
   Length: 127066581 (121M) [application/octet-stream] **Saving to**: âjunos-routing-crpd-docker-21.2R1.10.tgzâ
   junos-routing-crpd-docker-21.2R1.10.tgz 100%
   [==========>
   121.18M 4.08MB/
   s in 34s
   2021-07-14 07:02:44 (3.57 MB/s) – âjunos-routing-crpd-docker-21.2R1.10.tgzâ saved [127066581/127066581]
4. Load the Junos cRPD software image to Docker.
   rootuser@linux-host:~# docker load -i junos-routing-crpd-docker-21.2R1.10.tgz
   6effd95c47f2: Loading layer [==========>]
   65.61MB/65.61MB
   ……
   Loaded image: crpd:21.2R1.10
   rootuser@linux-host:~# docker images
   REPOSITORY TAG IMAGE ID CREATED SIZE
   crpd 21.2R1.10 f9b634369718 3 weeks ago 374MB
5. Create a data volume for configuration and var logs.
   rootuser@linux-host:~# docker volume create crpd01-config
   crpd01-config
   rootuser@linux-host:~# docker volume create crpd01-varlog
   crpd01-varlog
6. Create a Junos cRPD instance. In this example, you'll name it crpd01.
   rootuser@linux-host:~# docker run –rm –detach –name crpd01 -h crpd01 –net=bridge –privileged -v crpd01-
   config:/config -v crpd01-varlog:/var/log -it crpd:21.2R1.10
   e39177e2a41b5fc2147115092d10e12a27c77976c88387a694faa5cbc5857f1e
   Alternatively, you can allocate the amount of memory to the Junos cRPD instance while creating the instance.
   rootuser@linux-host:~# docker run –rm –detach –name crpd-01 -h crpd-01 –privileged -v crpd01-config:/
   config -v crpd01-varlog:/var/log -m 2048MB –memory-swap=2048MB -it crpd:21.2R1.10
   WARNING: Your kernel does not support swap limit capabilities or the cgroup is not mounted. Memory limited

without swap.

1125e62c9c639fc6fca87121d8c1a014713495b5e763f4a34972f5a28999b56c

Check **cRPD Resource Requirements** for the details.

7. Verify the newly created container details.

   rootuser@linux-host:~# docker ps

   CONTAINER ID IMAGE COMMAND CREATED STATUS

   PORTS NAMES

   e39177e2a41b crpd:21.2R1.10 “/sbin/runit-init.sh” About a minute ago Up About a minute 22/tcp, 179/

   tcp, 830/tcp, 3784/tcp, 4784/tcp, 6784/tcp, 7784/tcp, 50051/tcp crpd01

   rootuser@linux-host:~# docker stats

   CONTAINER ID NAME CPU % MEM USAGE / LIMIT MEM % NET I/O BLOCK I/O PIDS

   e39177e2a41b crpd01 0.00% 147.1MiB / 3.853GiB 3.73% 1.24kB / 826B 4.1kB / 35MB 58

   CONTAINER ID NAME CPU % MEM USAGE / LIMIT MEM % NET I/O BLOCK I/O PIDS

   e39177e2a41b crpd01 0.00% 147.1MiB / 3.853GiB 3.73% 1.24kB / 826B 4.1kB / 35MB 58

   CONTAINER ID NAME CPU % MEM USAGE / LIMIT MEM % NET I/O BLOCK I/O PIDS

   e39177e2a41b crpd01 0.05% 147.1MiB / 3.853GiB 3.73% 1.24kB / 826B 4.1kB / 35MB 58

Step 2: Up and Running

Access the CLI

You configure Junos cRPD using Junos CLI commands for routing services. Here’s how to access the Junos CLI:

1. Log in to the Junos cRPD container.

   rootuser@linux-host:~# docker exec -it crpd01 cli

2. Check the Junos OS version.

   rootuser@crpd01> show version

   root@crpd01> show version

   Hostname: crpd01

   Model: cRPD

   Junos: 21.2R1.10

   cRPD package version : 21.2R1.10 built by builder on 2021-06-21 14:13:43 UTC

3. Enter configuration mode.

   rootuser@crpd01> configure

   Entering configuration mode

4. Add a password to the root administration user account. Enter a plain text password.

   [edit] **rootuser@crpd01# set system root-authentication plain-text-password**

   New password

   Retype new password:

5. Commit the configuration.

   [edit] **rootuser@crpd01# commit**

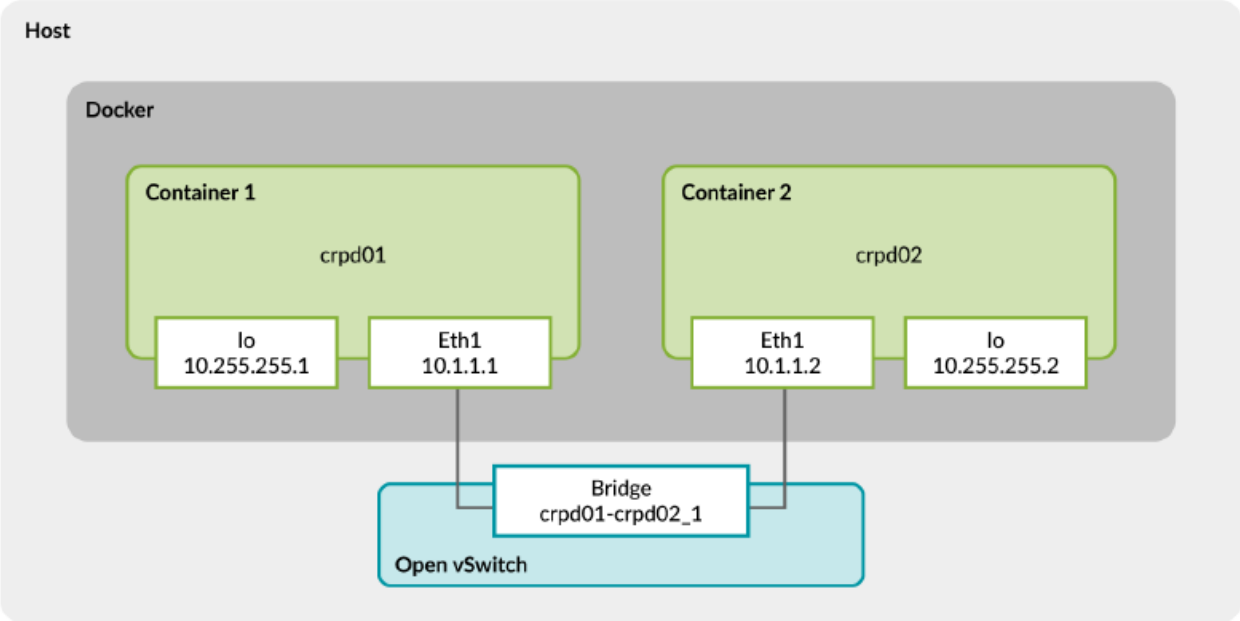
   commit complete

6. Log in to the Junos cRPD instance with the CLI and continue customizing the configuration.

Interconnect cRPD Instances

Now let's learn how to build point-to-point links between two Junos cRPD containers.

In this example, we use two containers, crpd01 and crpd02, and connect them using eth1 interfaces that are connected to an OpenVswitch (OVS) bridge on the host. We're using an OVS bridge for Docker networking because it supports multiple host networking and provides secure communication. Refer to the following illustration:



1. Install the OVS switch utility.

   rootuser@linux-host:~# apt-get install openvswitch-switch

   sudo] password for lab:

   Reading package lists… Done

   Building dependency tree

   Reading state information… Done

   The following additional packages will be installed:

   libpython-stdlib libpython2.7-minimal libpython2.7-stdlib openvswitch-common python python-minimal pythonsix python2.7 python2.7-minimal

2. Navigate to the usr/bin directory path and use the wget command to download and to install the OVS docker.

   rootuser@linux-host:~# cd /usr/bin

   rootuser@linux-host:~# wget "**https://raw.githubusercontent.com/openvswitch/ovs/master/utilities/ovs-docker**"

   –2021-07-14 07:55:17– **https://raw.githubusercontent.com/openvswitch/ovs/master/utilities/ovs-docker**

   Resolving raw.githubusercontent.com (**raw.githubusercontent.com**)… 185.199.109.133, 185.199.111.133, 185.199.110.133, …

   Connecting to raw.githubusercontent.com (**raw.githubusercontent.com**)|185.199.109.133|:443… connected.

   HTTP request sent, awaiting response… 200 OK

   Length: 8064 (7.9K) [text/plain] **Saving to**: âovs-docker.1â

   ovs-docker.1 100%

   [===>

   7.88K –.-KB/

   s in 0s

   2021-07-14 07:55:17 (115 MB/s) – âovs-docker.1â saved [8064/8064]

3. Change the permissions on the OVS bridge.
   rootuser@linux-host:/usr/bin chmod a+rwx ovs-docker
4. Create another Junos cRPD container called crpd02.
   rootuser@linux-host:~# docker run –rm –detach –name crpd02 -h crpd02 –net=bridge –privileged -v crpd02-
   config:/config -v crpd02-varlog:/var/log -it crpd:21.2R1.10
   e18aec5bfcb8567ab09b3db3ed5794271edefe553a4c27a3d124975b116aa02
5. Create a bridge called my-net. This step creates eth1 interfaces on crpd01 and crdp02.
   rootuser@linux-host:~# docker network create –internal my-net
   37ddf7fd93a724100df023d23e98a86a4eb4ba2cbf3eda0cd811744936a84116
6. Create an OVS bridge and add crpd01 and crpd02 containers with eth1 interfaces.
   rootuser@linux-host:~# ovs-vsctl add-br crpd01-crpd02_1
   rootuser@linux-host:~# ovs-docker add-port crpd01-crpd02_1 eth1 crpd01
   rootuser@linux-host:~# ovs-docker add-port crpd01-crpd02_1 eth1 crpd02
7. Add IP addresses to the eth1 interfaces and to the loopback interfaces.
   rootuser@linux-host:~# docker exec -d crpd01 ifconfig eth1 10.1.1.1/24
   rootuser@linux-host:~# docker exec -d crpd02 ifconfig eth1 10.1.1.2/24
   rootuser@linux-host:~# docker exec -d crpd01 ifconfig lo0 10.255.255.1 netmask 255.255.255.255
   rootuser@linux-host:~# docker exec -d crpd02 ifconfig lo0 10.255.255.2 netmask 255.255.255.255
8. Log in to the crpd01 container and verify the interface configuration.
   rootuser@linux-host:~# docker exec -it crpd01 bash
   rootuser@crpd01:/# ifconfig
   …..
   eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
   inet 10.1.1.1 netmask 255.255.255.0 broadcast 10.1.1.255
   inet6 fe80::42:acff:fe12:2 prefixlen 64 scopeid 0x20<link>
   ether 02:42:ac:12:00:02 txqueuelen 0 (Ethernet)
   RX packets 24 bytes 2128 (2.1 KB)
   RX errors 0 dropped 0 overruns 0 frame 0
   TX packets 8 bytes 788 (788.0 B)
   TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
   ……..
9. Send a ping to the crpd02 container to confirm connectivity between the two containers. Use the IP address of eth1 of crpd02 (10.1.1.2) to ping the container.
   ping 10.1.1.2 -c 2
   PING 10.1.1.2 (10.1.1.2) 56(84) bytes of data.
   64 bytes from 10.1.1.2: icmp_seq=1 ttl=64 time=0.323 ms
   64 bytes from 10.1.1.2: icmp_seq=2 ttl=64 time=0.042 ms
   — 10.1.1.2 ping statistics —
   2 packets transmitted, 2 received, 0% packet loss, time 1018ms
   rtt min/avg/max/mdev = 0.042/0.182/0.323/0.141 ms
   The output confirms that the two containers can communicate with each other.

Configure Open Shortest Path First (OSPF)

Now you have two containers, crpd01 and crpd02, that are connected and communicating. The next step is to establish
neighbor adjacencies for the two containers. OSPF-enabled routers must form adjacencies with their neighbor before
they can share information with that neighbor.

1. Configure OSPF on the crpd01 container.

   [edit] **rootuser@crpd01# show policy-options**

   policy-statement adv {

   term 1 {

   from {

   route-filter 10.10.10.0/24 exact

   }

   then accept

   }

   }

   [edit] rootuser@crpd01# show protocols

   ospf {

   area 0.0.0.0 {

   interface eth1;

   interface lo0.0

   }

   export adv

   }

   [edit] rootuser@crpd01# show routing-options

   router-id 10.255.255.1;

   static {

   route 10.10.10.0/24 reject

   }

2. Commit the configuration.

   [edit] **rootuser@crpd01# commit**

   commit complete

3. Repeat steps 1 and 2 to configure OSPF on the crpd02 container.

   rootuser@crpd02# show policy-options

   policy-statement adv {

   term 1 {

   from {

   route-filter 10.20.20.0/24 exact;

   }

   then accept;

   }

   }

   [edit] rootuser@crpd02# show routing-options

   router-id 10.255.255.2

static {

route 10.20.20.0/24 reject

}

[edit] rootuser@crpd02# show protocols ospf

area 0.0.0.0 {

interface eth1;

interface lo0.0

}

export adv;

4. Use show commands to verify OSPF neighbors that have an immediate adjacency.

   rootuser@crpd01> show ospf neighbor

   Address Interface State ID Pri Dead

   10.1.1.2 eth1 Full 10.255.255.2 128 38

   rootuser@crpd01> show ospf route

   Topology default Route Table:

   Prefix Path Route NH Metric NextHop Nexthop

   Type Type Type Interface Address/LSP

   10.255.255.2 Intra AS BR IP 1 eth1 10.1.1.2

   10.1.1.0/24 Intra Network IP 1 eth1

   10.20.20.0/24 Ext2 Network IP 0 eth1 10.1.1.2

   10.255.255.1/32 Intra Network IP 0 lo0.0

   10.255.255.2/32 Intra Network IP 1 eth1 10.1.1.2

The output shows the container's own loopback address and the loopback addresses of any containers which it is immediately adjacent to. The output confirms that the Junos cRPD has established an OSPF neighbor relationship and has learned their addresses and interfaces.

View Junos cRPD Core Files

When a core file is generated, you can find the output in the /var/crash folder. The generated core files are stored on the system that is hosting the Docker containers.

1. Change to the directory where crash files are stored.

   rootuser@linux-host:~# cd /var/crash

2. List the crash files.

   rootuser@linux-host:/var/crash# ls -l

   total 32

   -rw-r—– 1 root root 29304 Jul 14 15:14 _usr_bin_unattended-upgrade.0.crash

3. Identify the location of the core files.

   rootuser@linux-host:/var/crash# sysctl kernel.core_pattern

   kernel.core_pattern = |/bin/bash -c "$@" — eval /bin/gzip > /var/crash/%h.%e.core.%t-%p-%u.gz

Step 3: Keep Going

Congratulations! You've now completed the initial configuration for Junos cRPD!

What's Next?

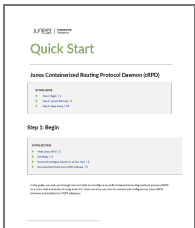
Now that you've configured Junos cRPD containers and established communication between two containers, here are some things you might want to configure next.

If you want to	Then
Download, activate, and manage your software licenses to unlock additional features for your Junos cRPD	See **Flex Software License for cRPD** and **Managing cRPD Licenses**
Find more in-depth information about installing and configuring Junos cRPD	See **Day One: Cloud Native Routing with cRPD**
Check out blog posts about Junos cRPD with Docker Desktop.	See **Juniper cRPD 20.4 on Docker Desktop**
Configure routing and network protocols	See **Routing and Network Protocols**
Learn about Juniper Networks cloud-native routing solution	Watch the video **Cloud-Native Routing Overview**

General Information
Here are some excellent resources that will help you take your Junos cRPD knowledge to the next level

If you want to	Then
Find in-depth product documentation for Junos cRPD	See **cRPD Documentation**
Explore all documentation available for Junos OS	Visit **Junos OS Documentation**
Stay up to date on new and changed features and known See the Junos OS Release Notes and resolved issues	Check out **Junos OS Release Notes**

Documents / Resources

	juniper cRPD Containerized Routing Protocol Daemonac [pdf] User Guide cRPD Containerized Routing Protocol Daemonac, cRPD, Containerized Routing Protocol Daemonac, Routing Protocol Daemonac, Protocol Daemonac

References

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- containerd – An industry-standard container runtime with an emphasis on simplicity, robustness and portability
- GitHub: Let’s build from here · GitHub
- Support 403 | Juniper Networks US
- Elevate Community | Juniper Networks
- raw.githubusercontent.com/openvswitch/ovs/master/utilities/ovs-docker
- Downloads
- Downloads
- Contact - Support - Juniper Networks
- Junos OS Documentation | Juniper Networks
- cRPD Documentation | Juniper Networks
- cRPD Documentation | Juniper Networks
- cRPD Resource Requirements | cRPD | Juniper Networks
- Activate Your Licenses | Licensing | Juniper Networks
- Juniper Licensing User Guide | Licensing | Juniper Networks
- cRPD Free Trial | Juniper Networks US
- User Manual