System Setup and Software Installation Guide for Cisco NCS 6000 Series Routers, IOS XR Release 7.1.x

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Preface

Note This release has reached end-of-life status. For more information, see the End-of-Life and End-of-Sale Notices.

This preface contains these sections:

- Changes to This Document, on page vii
- Communications, Services, and Additional Information, on page vii

Changes to This Document

This table lists the technical changes made to this document since it was first released.

Date	Summary
January 2020	Initial release of this document

Communications, Services, and Additional Information

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.
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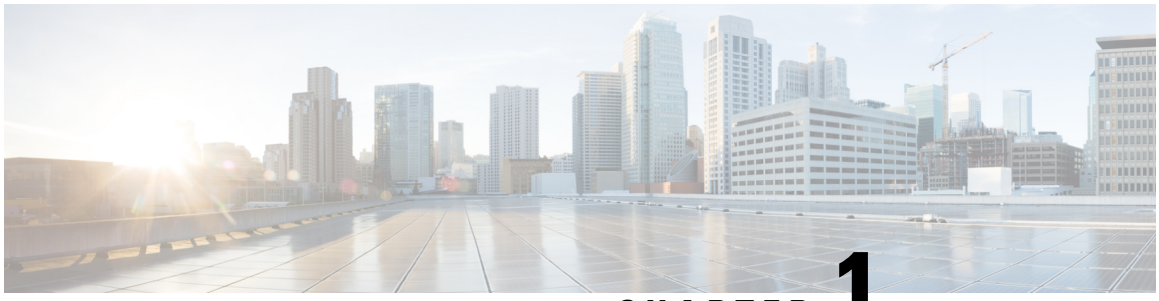
Cisco Bug Search Tool

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 1

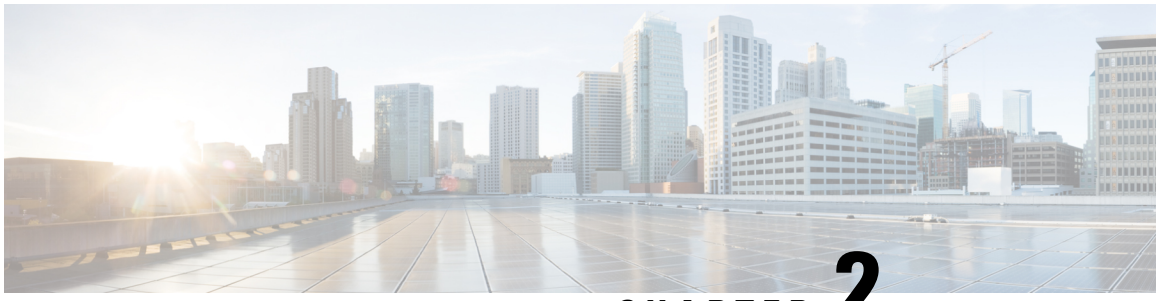
New and Changed Feature Information

This table summarizes the new and changed feature information for the *System Setup and Software Installation Guide for Cisco NCS 6000 Series Routers*.

- New and Changed System Setup Features, on page 1

New and Changed System Setup Features

Feature	Description	Changed in Release	Where Documented
None	No new features introduced	Not applicable	Not applicable



CHAPTER 2

Cisco NCS 6008 System Features

The topics covered in this chapter are:

- Cisco NCS 6008 Product Overview, on page 3
- Virtual Machine based Routing and System Administration, on page 4
- Command Modes, on page 5
- System Setup Workflow, on page 6

Cisco NCS 6008 Product Overview

Cisco Network Convergence System 6000 Series

The Cisco Network Convergence System (NCS) 6000 Series System delivers outstanding network agility, packet optical convergence, and a system scale measured in petabits per second. It also facilitates the build-out of next-generation core to:

- support elastic capacity at the lowest total ownership cost
- deliver high-bandwidth mobile, video, and cloud services

Running the Cisco IOS XR operating system, Cisco's innovative virtualized operating environment, the Cisco NCS 6000 Series advances the concept of distributed routing and virtualization. With Cisco Virtualized IOS XR, the Cisco NCS 6000 Series brings new levels of programmability and virtualization to:

- enhance application service offerings
- increase provisioning speed
- optimize network economics

The Cisco NCS 6000 Series System is engineered for environmental efficiency, with the use of adaptable power consumption. The Cisco NCS 6000 Series System is powered by the Cisco nPower Network Processor Units (NPU). These technologies aid the Cisco NCS 6000 Series the lowest carbon footprint in service provider routing.

Cisco Network Convergence System 6008 Router

The Cisco NCS 6008 router, part of the Cisco NCS 6000 Series System, is the next-generation core router that provides industry-leading 8 Tbps of full-duplex network bandwidth through eight line cards.

The Cisco NCS 6008 router runs on Cisco IOS XR software, with Linux as the underlying host operating system. A Kernel-based Virtual Machine (KVM) hypervisor provides a virtualized environment to independently run system administration and routing functions on separate virtual machines. This provision makes the new system versatile and robust, providing immense flexibility for future expansion without the need for a complete system overhaul.

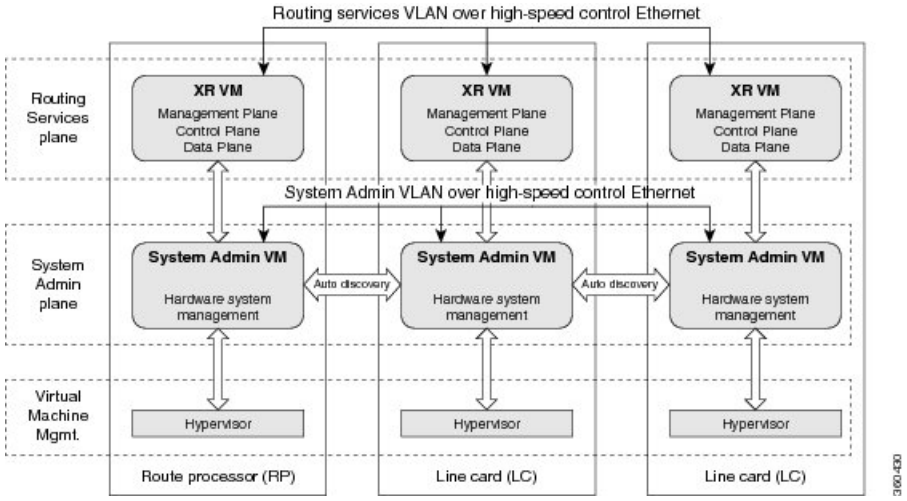
A multi-slice architecture of line cards enables the system to be configured to operate in a mixed operating mode, simultaneously supporting traffic at 10 Gbps and 100 Gbps on slice-level granularity.

Virtual Machine based Routing and System Administration

On the Cisco NCS Series router, the routing functions and the System Administration functions are run on separate virtual machines (VMs) over a Linux host operating system. The VMs simulate individual physical computing environments over a common hardware.. Available hardware resources, like processor, memory, hard disk, and so on, are virtualized and allocated to individual virtual machines by the hypervisor.

The VM topology on the Cisco NCS Series router is shown in this figure.

Figure 1: Virtualized IOS XR on Cisco NCS Series Router



Implementation of Virtualized IOS XR on Cisco NCS Series Router

- The hypervisor creates and manages individual VM environments.
- On every route processor (RP) and line card (LC) there are two VMs; one for system administration (System Admin VM) and one for managing the routing functions (XR VM).
- The two VMs on each node operate on their respective planes. On each plane, the VMs are connected to each other using a dedicated VLAN over a high-speed Control Ethernet connection.
- The System Admin VMs can detect each other's presence by auto discovery and thus maintain complete system awareness.

To access the XR VM, connect to the XR VM console port on the RP. To access the System Admin VM, in the XR VM CLI, execute the **admin** command.

Advantages of Virtualized IOS XR on the Cisco NCS Series Router

- Faster boot time—Because the System Admin functions are on a dedicated VM, the boot time is considerably reduced.
- Independent upgrades—Software packages can be independently installed on the System Admin VM and the XR VM, resulting in minimal system downtime.
- Self-starting VMs—Both the System Admin VM and the XR VM are automatically launched during router boot-up without any user intervention. They have a default set-up that is ready for use.
- System redundancy—In spite of their interconnectivity, there is also a level of isolation between the VMs. Therefore, if a particular VM experiences any issues, it does not affect the functioning of other VMs.

Command Modes

The Cisco NCS 6000 Series router runs on virtualized Cisco IOS XR software. Therefore, the CLI commands must be executed on virtual machines, namely the XR VM and the System Admin VM. This table lists the command modes for the VMs.

Command Mode	Description
XR EXEC mode (XR VM execution mode)	Run commands on the XR VM to display the operational state of the entire secure domain router (SDR). Example: `RP/0/RP0/CPU0:router#`

XR Config mode
(XR VM configuration mode)
	Perform security, routing, and other XR feature configurations on the XR VM.
	Example:
	`RP/0/RP0/CPU0:router#configure`
	`RP/0/RP0/CPU0:router(config)#`

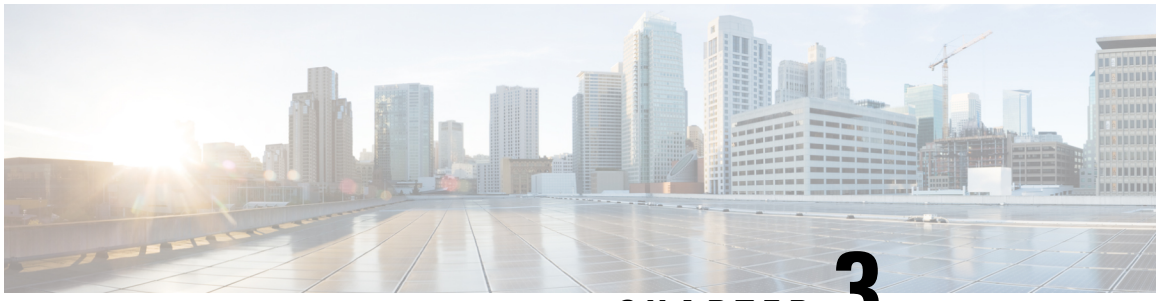
System Admin EXEC mode
(System Admin VM execution mode)
	Run commands on the System Admin VM to display and monitor the operational state of the router hardware. The chassis or individual hardware modules can be reloaded from this mode.
	Example:
	`RP/0/RP0/CPU0:router#admin`
	`sysadmin-vm:0_RP0#`

System Admin Config mode
(System Admin VM configuration mode)
	Run configuration commands on the System Admin VM to manage and operate the hardware modules of the entire chassis.
	Example:
	`RP/0/RP0/CPU0:router#admin`
	`sysadmin-vm:0_RP0#config`
	`sysadmin-vm:0_RP0(config)#`

System Setup Workflow

The system setup of the Cisco NCS 6008 Series router involves these stages:

1. Bring-up the Cisco NCS 6008 Router, on page 7—Connect to the router's console and boot-up the router. After booting is complete, specify the root username and password.
2. Perform Preliminary Checks, on page 51—Perform basic verification of the router's default setup. This ensures that, if any setup issue is detected, corrective action is taken at an early stage.
3. Create User Profiles and Assign Privileges, on page 67—Create users and assign privileges, as needed. Privileges are defined by data rules and command rules that are applied to users. Users are either permitted, or denied, the use of certain commands based on assigned privileges.
4. Perform System Upgrade and Install Feature Packages, on page 79—Upgrade the operating system, if the default is not the latest version. Also, install relevant packages to deploy additional features and software patches on the router.
5. Perform Disaster Recovery, on page 107—In the event of a router boot failure due to image corruption, boot the router using an external bootable USB drive.



CHAPTER 3

Bring-up the Cisco NCS 6008 Router

After installing the hardware, boot the Cisco NCS 6008 Series Router . Connect to the XR VM console port and power on the router. The routersystem completes the boot process using the pre-installed operating system (OS) image. If no image is available within the router, the router can be booted using an external bootable USB drive.

After booting is complete, create the root username and password, and then use it to log on to the XR VM console and get the router prompt. From the XR VM console, access the System Admin VM console to configure system administration settings.

For more information about completing the hardware installation, see Cisco Network Convergence System 6000 Series Routers Hardware Installation Guide.

The topics covered in this chapter are:

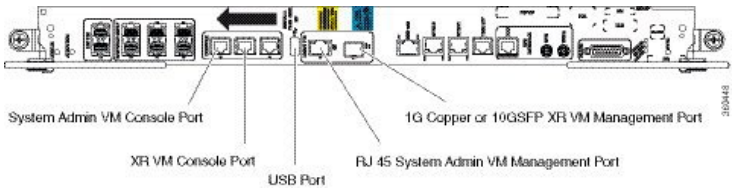
- Connect to the XR VM Console Port and Power the Router, on page 7
- Setup Root User Credentials and Login to XR VM Console, on page 8
- Configure the XR VM Management Port, on page 10
- Connecting to the XR VM Management Port, on page 12
- Provision Breakout Interfaces, on page 13
- Shut Down Unused Linecard Slices, on page 14
- Perform Clock Synchronization with NTP Server, on page 15

Connect to the XR VM Console Port and Power the Router

Use the XR VM console port on the Route Processor (RP) to connect to a new router . If required, subsequent connections can be established through the management port, after it is configured.

There are the three console ports on the RP. Console port 2 is for the XR VM.

Figure 2: XR VM console port of the RP



Step 1 Connect a terminal to the XR VM console port of the RP.

Step 2 Start the terminal emulation program on your workstation.

The console settings are 115200 bps, 8 data bits, 1 stop bit and no parity.

Step 3 Power on the router.

Press the power switch up to turn on the power shelves. As the router boots up, you will see boot process details on the console screen of the terminal emulation program.

Step 4 Press **Enter**.

When the system prompts you to enter the root-system username, it indicates that the boot process is complete. If the prompt does not appear, wait for a while to give the router more time to complete the initial boot procedure, then press **Enter**.

Important If the boot process fails, it may be because the pre-installed image on the router is corrupt. In this case, the router can be booted using an external bootable USB drive. For details see, Create Bootable USB Drive Using Shell Script, on page 113 and Boot the Router Using USB, on page 115.

What to do next

Specify the root username and password.

Setup Root User Credentials and Login to XR VM Console

When the router boots for the first time, the system prompts the user to configure root credentials (username and password). These credentials are configured as the root user on the XR VM (root-lr), the System Admin VM (root-system), and as disaster-recovery credentials. In addition to the XR VM console, the System Admin VM console and the XR VM management port can be accessed using these credentials.

Before you begin

The boot process must be complete. For details on how to initiate the boot process, see *Connect to the XR VM Console Port and Power the Router System* topic.

SUMMARY STEPS

1. **Enter root-system username:** *username*
2. **Enter secret:** *password*
3. **Enter secret again:** *password*
4. **Username:** *username*
5. **Password:** *password*
6. (Optional) **show run username**

DETAILED STEPS

Step 1 **Enter root-system username:** *username*

Example:

```
Enter root-system username: root
```

Enter the username of the root user. The character limit is 1023. In this example, the name of the root user is "root".

Important The specified username is mapped to the "root-lr" group on the XR VM. It is also mapped as the "root-system" user on the System Admin VM.

When starting the router for the first time, or after a re-image, the router does not have any user configuration. In such cases, the router prompts you to specify the "root-system username". However, if the router has been configured previously, the router prompts you to enter the "username", as described in Step 4.

Step 2 **Enter secret:** *password*

Example:

```
Enter secret:
```

Enter the password for the root user. The character limit is 253. The password you type is not displayed on the CLI for security reasons.

The root username and password must be safeguarded as it has the superuser privileges. It is used to access the complete router configuration.

Step 3 **Enter secret again:** *password*

Example:

```
Enter secret again:
```

Re-enter the password for the root user. The password is not accepted if it does not match the password entered in the previous step. The password you type is not displayed on the CLI for security reasons.

Step 4 **Username:** *username*

Example:

```
Username: root
```

Enter the root-system username to login to the XR VM console.

Step 5 **Password:** *password*

Example:

```
Password:
```

Enter the password of the root user. The correct password displays the XR VM router prompt.

```
RP/0/RP0/CPU0:router#
```

You are now logged into the XR VM console.

Step 6 (Optional) **show run username**

Example:

RP/0/RP0/CPU0:router#show run username

Displays user details.

```
username root
 group root-lr
 group cisco-support
 secret 5 $1$NBg7$fHs1inKPZVvzqxMv775UE/
!
```

What to do next

- Configure routing functions from the XR VM.
- Configure system administration settings from the System Admin prompt. The System Admin prompt is displayed on accessing the System Admin VM console. For details on how to get the System Admin prompt, see *Access the System Admin VM Console* topic.

Configure the XR VM Management Port

To use the XR VM Management port for system management and remote communication, you must configure an IP address and a subnet mask for the management ethernet interface. To communicate with devices on other networks (such as remote management stations or TFTP servers), you need to configure a default (static) route for the router .

Before you begin

- Consult your network administrator or system planner to procure IP addresses and a subnet mask for the management interface.
- Physical port Ethernet 0 on RP is the management port. Ensure that the port is connected to management network.

SUMMARY STEPS

1. **configure**
2. **interface MgmtEth** *rack/slot/***CPU0/***port*
3. **ipv4 address** *ipv4-address subnet-mask*
4. **ipv4 address** *ipv4 virtual address subnet-mask*
5. **no shutdown**
6. **exit**
7. **router static address-family ipv4 unicast** *0.0.0.0/0 default-gateway*
8. Use the **commit** or **end** command.

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters XR Config mode.

Step 2 **interface MgmtEth** *rack/slot*/**CPU0**/*port*

Example:

```
RP/0/RP0/CPU0:router(config)#interface mgmtEth 0/RP0/CPU0/0
```

Enters interface configuration mode for the management interface of the primary RP.

Step 3 **ipv4 address** *ipv4-address subnet-mask*

Example:

```
RP/0/RP0/CPU0:router(config-if)#ipv4 address 10.1.1.1 255.0.0.0
```

Assigns an IP address and a subnet mask to the interface.

Step 4 **ipv4 address** *ipv4 virtual address subnet-mask*

Example:

```
RP/0/RP0/CPU0:router(config-if)#ipv4 address 1.70.31.160 255.255.0.0
```

Assigns a virtual IP address and a subnet mask to the interface.

Step 5 **no shutdown**

Example:

```
RP/0/RP0/CPU0:router(config-if)#no shutdown
```

Places the interface in an "up" state.

Step 6 **exit**

Example:

```
RP/0/RP0/CPU0:router(config-if)#exit
```

Exits the Management interface configuration mode.

Step 7 **router static address-family ipv4 unicast** *0.0.0.0/0 default-gateway*

Example:

```
RP/0/RP0/CPU0:router(config)#router static address-family ipv4 unicast 0.0.0.0/0 12.25.0.1
```

Specifies the IP address of the default-gateway to configure a static route; this is to be used for communications with devices on other networks.

Step 8 Use the **commit** or **end** command.

commit —Saves the configuration changes and remains within the configuration session.

end —Prompts user to take one of these actions:

- **Yes** — Saves configuration changes and exits the configuration session.
- **No** —Exits the configuration session without committing the configuration changes.
- **Cancel** —Remains in the configuration session, without committing the configuration changes.

What to do next

Connect to the management port to the ethernet network. See Connecting to the XR VM Management Port, on page 12.

Connecting to the XR VM Management Port

The XR VM management port supports 10/100G optical small form-factor pluggable (SFP) units to provide high speed network connectivity. The SFPs that can be connected to the XR VM management port are:

SFP module	Datasheet
Cisco SFP-10G-SR	http://www.cisco.com/en/US/prod/collateral/modules/ps5455/data_sheet_c78-455693.html
Cisco SFP-10G-LR	
1000BASE-SX SFP	http://www.cisco.com/en/US/prod/collateral/modules/ps5455/ps6577/product_data_sheet0900aecd8033f885.html
1000BASE-LX/LH SFP	
1000BASE-T SFP	

Before you begin

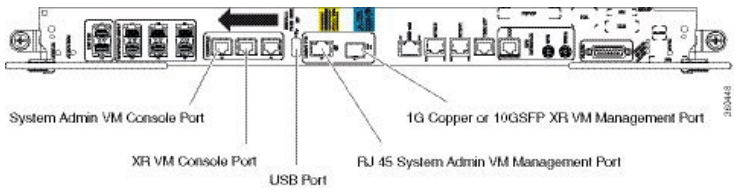
Configure the management port. See Configure the XR VM Management Port, on page 10.

Step 1 Connect the SFP module to the XR VM management port.

The XR VM management port on the RP is shown in this figure.

Note RJ-45 port is disabled by default. Do not use the RJ-45 port. Use only the 1G copper SFP port as showm in the image below.

Figure 3: XR VM console port of the RP



Step 2 Depending on the SFP module type, connect either a optical fiber or an ethernet cable to the SFP.

What to do next

With a terminal emulation program, establish a SSH or telnet connection to the management interface port using its IP address. For details on configuring the IP address of the management port, see Configure the XR VM Management Port, on page 10.

Before establishing a telnet session, use the **telnet ipv4|ipv6 server max-servers** command in the XR Config mode, to set number of allowable telnet sessions to the router.

Note Telnet supports a maximum of 100 (including both IPv4 and IPv6) sessions.

For a SSH connection, the *ncs6k-k9sec* package must be installed on the router. For details about package installation, see the Install Packages section.

Provision Breakout Interfaces

The NCS 6000 line cards have multi-slice architecture. On a 10X100G line card, each slice has two 100 GE ports that can be configured to operate at 100 GE or 10X10 GE. Breakout cables are connected to the 10X10GE interfaces. The 100G ports are mapped to each slice as:

Ports	Slice
0 and 1	0
2 and 3	1
4 and 5	2
6 and 7	3
8 and 9	4

SUMMARY STEPS

1. **configure**
2. **hw-module location** *rack/slot/CPU* **slice** *slice_number* **breakout 10G**
3. Use the **commit** or **end** command.

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters XR Config mode.

Step 2 **hw-module location** *rack/slot/CPU* **slice** *slice_number* **breakout 10G**

Example:

```
RP/0/RP0/CPU0:router(config)#hw-module location 0/1/CPU0 slice 1 breakout 10G
```

Provisions the interfaces on the specified slice in the 10G breakout mode.

Step 3 Use the **commit** or **end** command.

commit —Saves the configuration changes and remains within the configuration session.

end —Prompts user to take one of these actions:

- **Yes** — Saves configuration changes and exits the configuration session.
- **No** —Exits the configuration session without committing the configuration changes.
- **Cancel** —Remains in the configuration session, without committing the configuration changes.

What to do next

Run the **show ipv4 interface brief** command in the XR EXEC mode to view breakout interfaces. Each 10 GE interface is represented as **TenGigE**<*rack_num*>/<*slot_id*>/<*card_instance*>/<*port_num*>/<*breakout_num*>.

Verify that ten TenGigE interfaces are created for every HundredGigE interface of the slice on which the breakout is configured.

```
RP/0/RP0/CPU0:router(config)#show ipv4 interface brief
Interface                      IP-Address      Status          Protocol Vrf-Name
Bundle-Ether1                  199.1.1.1       Up               Up       default
Loopback0                      100.100.100.100 Up               Up       default
Loopback10                     unassigned      Up               Up       default
Loopback11                     unassigned      Up               Up       default
Loopback12                     unassigned      Up               Up       default
Loopback13                     unassigned      Up               Up       default
....
MgmtEth0/RP1/CPU0/0            4.15.10.145     Up               Up       default
HundredGigE0/0/0/0             unassigned      Up               Up       default
HundredGigE0/0/0/1             unassigned      Up               Up       default
HundredGigE0/0/0/2             unassigned      Up               Up       default
HundredGigE0/0/0/3             unassigned      Up               Up       default
HundredGigE0/0/0/4             10.0.4.1        Up               Up       default
....
TenGigE0/1/0/0                 10.1.0.1        Up               Up       default
TenGigE0/1/0/1                 10.1.1.1        Up               Up       default
TenGigE0/1/0/2                 10.1.2.1        Up               Up       default
TenGigE0/1/0/3                 10.1.3.1        Up               Up       default
TenGigE0/1/0/4                 10.1.4.1        Up               Up       default
....
```

Shut Down Unused Linecard Slices

The NCS 6000 linecards, namely, NCS 6000 10x100G Multi-Service CPAK, NCS 6000 10x100G Multi-Service CXP, and NCS 6000 60x10GE PAT, have multi-slice architecture. The 10X100G line cards has 5 slices, whereas the 60X10G line cards has 4 slices. Each slice can be individually shut down:

- To save power- Shutting down a slice will power down the slice. This will reduce the power consumption of that line card. The mode of operating line cards with one or more slices shut is called the green mode.

Note Shutting down a slice will also delete the Virtual Output Queue (VOQ) and this drops the ingress-traffic.

- For troubleshooting - If a slice is malfunctioning, shutting it down isolates the slice from the system, thus reducing its impact on the router. Also, troubleshooting can be done within the domain of the slice.

SUMMARY STEPS

1. **configure**
2. **hw-module location** *rack/slot/CPU* **slice** *slice_number* **shutdown**
3. Use the **commit** or **end** command.

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters XR Config mode.

Step 2 **hw-module location** *rack/slot/CPU* **slice** *slice_number* **shutdown**

Example:

```
RP/0/RP0/CPU0:router(config)#hw-module location 0/1/CPU0 slice 3 shutdown
```

Shuts down the specified slice. The interfaces belonging to the slice that is shut down are deleted from the system and are not visible in the output of the **show interfaces brief** command.

Step 3 Use the **commit** or **end** command.

commit —Saves the configuration changes and remains within the configuration session.

end —Prompts user to take one of these actions:

- **Yes** — Saves configuration changes and exits the configuration session.
- **No** —Exits the configuration session without committing the configuration changes.
- **Cancel** —Remains in the configuration session, without committing the configuration changes.

What to do next

To make a shutdown slice operational, use the **no hw-module location** *rack/slot/CPU* **slice** *slice_number* **shutdown** command.

Verify the slice shut down using **show platform** in XR VM or **show platform slices** in System Admin VM.

Perform Clock Synchronization with NTP Server

There are independent system clocks for the XR VM and the System Admin VM. To ensure that these clocks do not deviate from true time, they need to be synchronized with the clock of a NTP server. In this task you

will configure a NTP server for the XR VM. After the XR VM clock is synchronized, the System Admin VM clock will automatically synchronize with the XR VM clock.

Before you begin

Configure and connect to the XR VM management port.

SUMMARY STEPS

1. **configure**
2. **ntp server** *server_address*
3. **commit**
4. **exit**
5. **sh run ntp**

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:router# configure
```

Enters XR Config mode.

Step 2 **ntp server** *server_address*

Example:

The XR VM clock is configured to be synchronized with the specified sever.

```
RP/0/RP0/CPU0:router#ntp server 64.90.182.55
```

The System Admin VM clock is configured to be synchronized with the specified sever.

```
sysadmin-vm:0_RP0#ntp server 64.90.182.55
```

Step 3 **commit**

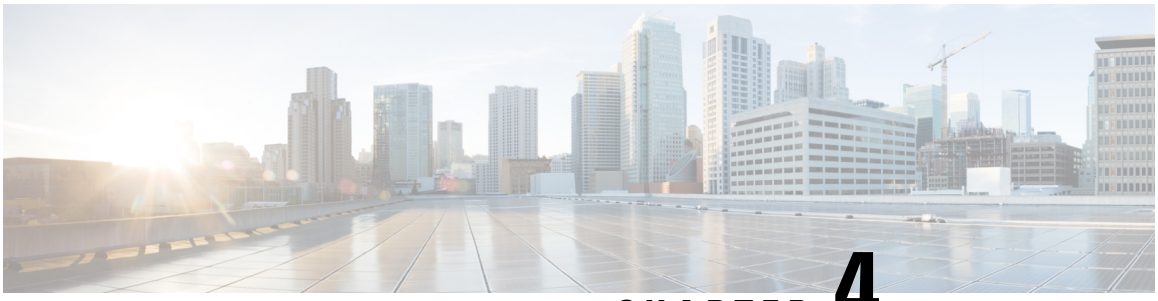
Step 4 **exit**

Step 5 **sh run ntp**

Example:

```
RP/0/RP0/CPU0:router#sh run ntp

ntp
server 202.153.144.25
!
```



CHAPTER 4

Setup Multi-chassis Configuration

Multiple Network Convergence System (NCS) 6008 single chassis can be connected using NCS 6000 fabric card chassis to form a multi-chassis system. This provides high scale of interfaces with single admin and control plane.

The multi-chassis system consists of two types of chassis:

- Line card chassis (LCC)
- Fabric card chassis (FCC)

Multi-chassis system is built with one or more LCC connected to FCCs, with a maximum hardware configuration of 16 LCC and a set of 4 FCC. The LCC has 8 line card slots and 6 fabric card slots, each fabric slot representing a logical fabric plane. The system provides 8 Tbps of full-duplex network bandwidth through eight line cards. The FCC hosts the agnostic fabric cards (FC). Each FCC can have 12 FC slots. The fabric cards used in a single chassis setup is different from the fabric cards used in the multi-chassis system. All the LCCs are connected to the FCC, and traffic flows from one LCC to another LCC through the FCC.

To form a multi-chassis system, two types of connectivity must be established:

- Control ethernet connectivity: The racks are interconnected to form a network. The shelf controller (SC) cards and route processor (RP) cards have two control ethernet ports - port 0 and port 1. These ports are connected to two switches that are in-turn connected using 40G trunk ports.
- Fabric connectivity: The FCC and LCC are connected to form a fabric plane.

After the hardware components are installed, and connectivity is established between the racks, you can setup a multi-chassis system.

The workflow for setting up a multi-chassis system is represented in this flow chart:

Note This workflow image has clickable links that are enabled only in the HTML format (and not in the PDF format) of this document.

Figure 4: Multi-chassis Configuration Interactive Workflow

• Assign Rack Number to Chassis, on page 19
• Associate Fabric Card in Fabric Card Chassis to Fabric Plane, on page 22

Assign Rack Number to Chassis

In a multi-chassis system, each chassis must have a unique rack number. This rack number is used to identify a chassis in the system.

Complete this task to identify the chassis and its connections and to establish a multi-chassis network:

Before you begin

- Install the hardware components of the multi-chassis system. In Line card chassis (LCC), line cards, fabric cards, and route processors are installed, and in Fabric card chassis (FCC), fabric cards (FC), shelf-controller switch cards (SC-SW) and shelf controllers (SC) are installed.
- Connect the chassis in the multi-chassis system using control ethernet cables. The control ethernet network provides inter-connectivity between chassis, and a two-way management ethernet path from System Admin and XR VM console. For more information see Cabling the Ethernet Control Plane Network section in the Cisco Network Convergence System 6000 Fabric Card Chassis Hardware Installation Guide.
- The fabric cards on the LCC and FCC are connected using fabric cables. This is used for data traffic. For more information see Cabling the Fabric section in the Cisco Network Convergence System 6000 Fabric Card Chassis Hardware Installation Guide.

SUMMARY STEPS

1. **admin**
2. **show chassis**
3. **config**
4. **chassis serial <chassis serial number>**
5. **rack <rack number>**
6. Repeat step 3 to 5 for all the chassis in the multi-chassis system.
7. Use the **commit** or **end** command.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**admin** **Example:** `RP/0/RP0/CPU0:router# admin`	Enters System Admin EXEC mode.

Step 2	**show chassis**
	Example:
	The following example shows a 2 + 2 (2 LCC and 2 FCC) configuration:
	`sysadmin-vm:0_RP0#show chassis`
	`Wed Jun 4 17:18:22.498 UTC`
		Shows the chassis details including the chassis serial number.
		Identify the serial numbers for which rack numbers are to be assigned.

	Command or Action	Purpose

	`Serial Num  Rack Num  Rack Type  Rack State  Data Plane  Ctrl Plane`
	`FMP12020050  0  LCC  UP  CONN  CONN`
	`FMP12260408  F1  FCC  UP  CONN  CONN`
	`FMP16320213  1  LCC  UP  CONN  CONN`
	`FMP17260334  F0  FCC  UP  CONN  CONN`
	The following example shows a 4 + 2 (4 LCC and 2 FCC)configuration:
	`sysadmin-vm:0_RP0#show chassis`
	`Wed Jun 4 17:18:22.498 UTC`
	`Serial Num  Rack Num  Rack Type  Rack State  Data Plane  Ctrl Plane`
	`FLM17326A2K  0  LCC  OPERATIONAL  CONN  CONN`
	`FLM17326A2J  1  LCC  OPERATIONAL  CONN  CONN`
	`FLM17386E28  2  LCC  OPERATIONAL  CONN  CONN`
	`FLM17075XWM  3  LCC  OPERATIONAL  CONN  CONN`
	`FMP17210228  F0  FCC  OPERATIONAL  CONN  CONN`
	`FMP17380420  F1  FCC  OPERATIONAL  CONN  CONN`	

Step 3	**config** **Example:** `sysadmin-vm:0_RP0#config`	Enters the configuration mode.
Step 4	**chassis serial <chassis serial number>** **Example:** `sysadmin-vm:0_RP0(config)# chassis serial FMP12020050`	Enters the configuration mode for the chassis serial number.
Step 5	**rack <rack number>** **Example:** `sysadmin-vm:0_RP0(config-serial-FMP12020050)# rack 0`	Type a rack number to associate the rack number to the chassis.
Step 6	Repeat step 3 to 5 for all the chassis in the multi-chassis system.	
Step 7	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session.

	Command or Action	Purpose
		• **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

What to do next

Perform preliminary checks to verify that the chassis is configured correctly:

- After configuring the chassis serial number, verify that a unique rack number is assigned for each chassis serial number using the **show running-config chassis serial** command in System Admin EXEC mode.

  The following example shows a 2+2 configuration:

```
sysadmin-vm:0_RP0# show running-config chassis serial
chassis serial FMP12020050
 rack 0
!
chassis serial FMP12260408
 rack F1
!
chassis serial FMP16320213
 rack 1
!
chassis serial FMP17260334
 rack F0
```

  The following example shows a 4+2 configuration:

```
sysadmin-vm:0_RP0# show running-config chassis serial
chassis serial FLM17326A2K
 rack 0
!
chassis serial FLM17326A2J
 rack 1
!
chassis serial FLM17386E28
 rack 2
!
chassis serial FLM17075XWM
 rack 3
!
chassis serial FMP17210228
 rack F0
!
chassis serial FMP17380420
 rack F1
```

- After the rack numbers are assigned to the chassis serial number, verify that all the cards are operational, and XR VM is running on all the cards. For details, see Verify SDR Information, on page 62.
- If the XR VM is not running, no output is shown for that location in the result. In this case, verify the state of secure domain router (SDR) on the node using the **show sdr** command in System Admin EXEC mode. For details, see Verify SDR Information, on page 62.
- After the system has booted, all available interfaces must be discovered by the system. View the number of discovered interfaces using the **show interfaces summary** command. For details, see Verify Interface Status, on page 60

After verifying that the cards in LCC are operational, configure the fabric cards in FCC.

Associate Fabric Card in Fabric Card Chassis to Fabric Plane

The fabric cards in the fabric card chassis (FCC) must be associated to a fabric plane in the multi-chassis system. The system fabric is divided into six fabric planes that are used to evenly distribute traffic across the fabric. The location of each fabric card in the fabric plane is identified by an instance number. The instance number starts from 0 and are sequential.

For information on multi-chassis configurations and cabling, see Cabling a Multi-Chassis Configuration in the Cisco Network Convergence System 6000 Fabric Card Chassis Hardware Installation Guide.

SUMMARY STEPS

1. **admin**
2. **config**
3. **controller fabric plane <plane number>**
4. **instance <instance-number>**
5. **location <fabric-chassis-number/fabric-card-number>**
6. Repeat step 3 to step 5 to associate all fabric cards to an instance in the fabric plane.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**admin** **Example:** `RP/0/RP0/CPU0:router# admin`	Enters System Admin EXEC mode.
Step 2	**config** **Example:** `sysadmin-vm:0_RP0#config`	Enter System Admin Config mode.
Step 3	**controller fabric plane <plane number>** **Example:** `sysadmin-vm:0_RP0(config)# controller fabric plane 4`	Enter configuration mode for the specified fabric plane.
Step 4	**instance <instance-number>** **Example:** `sysadmin-vm:0_RP0(config-plane-4)# instance 0`	Specify the instance number to which the fabric card is to be mapped.
Step 5	**location <fabric-chassis-number/fabric-card-number>** **Example:** `sysadmin-vm:0_RP0(config-instance-0)# location F0/FC8`	Associate the location of the fabric card in FCC with an instance in a fabric plane.

	Command or Action	Purpose
Step 6	Repeat step 3 to step 5 to associate all fabric cards to an instance in the fabric plane.	

What to do next

Perform preliminary checks to verify that the fabric card chassis is configured correctly:

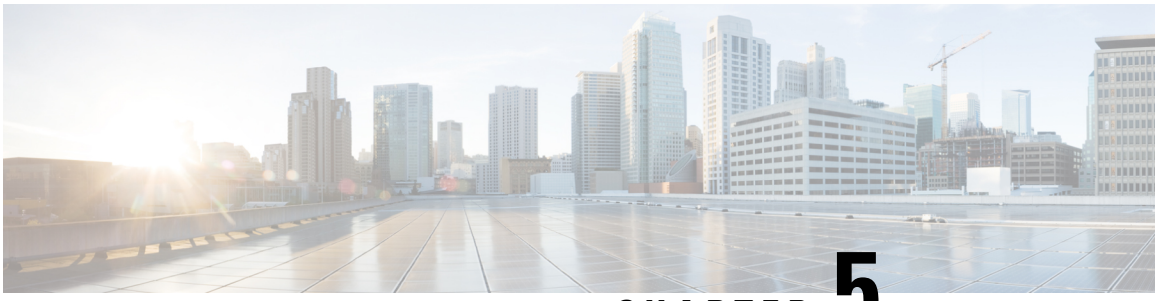
- After associating the fabric card in FCC to a fabric plane, verify the mapping of fabric plane to an instance. The following is an example of a topology with two instances:

```
sysadmin-vm:0_RP0# show running-config controller fabric

controller fabric plane 0
  instance 0
    location F0/FC0
  instance 1
    location F1/FC0
  !
!
controller fabric plane 1
   instance 0
      location F0/FC1
   instance 1
      location F1/FC1
   !
!
controller fabric plane 2
  instance 0
    location F0/FC2
  instance 1
    location F1/FC2
  !
!
controller fabric plane 3
   instance 0
      location F0/FC3
   instance 1
      location F1/FC3
   !
!
controller fabric plane 4
  instance 0
    location F0/FC4
  instance 1
    location F1/FC4
  !
!
controller fabric plane 5
   instance 0
      location F0/FC5
   instance 1
      location F1/FC5
   !
!
```

- After all the fabric cards are mapped to an instance in the plane, verify that all the fabric planes are up. For details, see Verify Fabric Plane, on page 61.
- Verify the switch summary. For details, see Verify Control Ethernet Connections, on page 63

The multi-chassis system is setup.

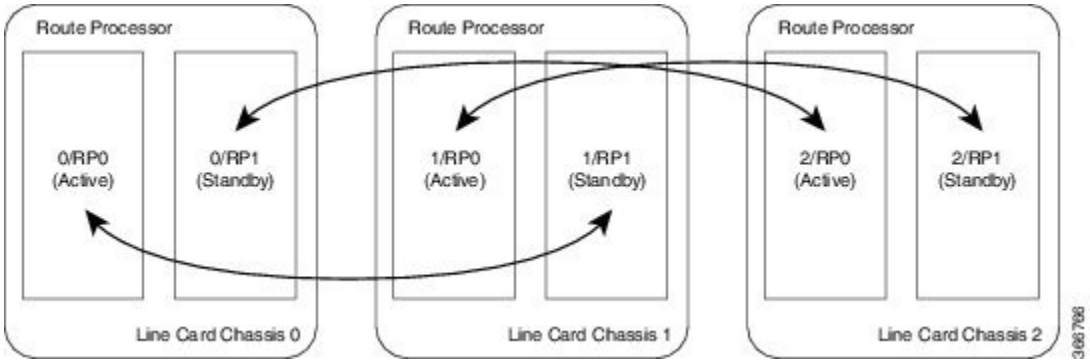


CHAPTER 5

Enable Cross-rack Pairing

Cross-rack (or inter-rack) pairing allows pairing route processors (RP) between racks to provide high availability (HA) against rack failures. The RP of one rack is paired with the RP on the next rack. The pairing is determined by the SDR manager through a daisy chain algorithm. The XR process manager breaks or creates a new pair based on the pairing algorithm decided by the SDR manager. The algorithm is executed only on the discovered set of nodes. The pairing remains consistent as long as the set of nodes that were discovered is constant.

Figure 5: Inter-rack pairing using daisy chain algorithm



Only the racks with dual RPs (an RP on both slots of rack) are considered for inter-rack pairing.

The pairing algorithm is triggered automatically when:

- a rack is inserted
- a change in chassis configuration is committed
- RP card is inserted
- re-pair command is manually executed
- change in configuration between inter-rack to intra-rack pairing, and vice versa

Cross rack pairing is not supported on racks when:

- inserted into the system with only one RP
- transitions to a state of single RP, and a change in cross-rack pairing is triggered either manually or automatically. An example of automatic and manual trigger are:
    - a re-pair is automatically initiated when a rack or an RP is added or deleted from the configuration

- user can trigger a re-pair after online insertion or removal (OIR) of an RP

For more information about scenarios that initiate automatic and manual re-pair of RPs, see Use Cases for Re-pairing RP, on page 32.

- Verify System Readiness, on page 26
- Enable Inter-rack Pairing Mode, on page 28
- Enable Inter-rack Pairing in Multi-SDR Configuration, on page 29
- Manually Initiate Re-pair, on page 32
- Use Cases for Re-pairing RP, on page 32
- Process Placement after a Pairing Change, on page 49

Verify System Readiness

The system must be ready before and after enabling inter-rack pairing. Run these commands to improve debuggability and compare their output to expected behavior. This ensures that the system is ready, and any changes in System Admin are reflected in XR VMs.

Description	Commands
Verify that all nodes are in OPERATIONAL state, a standby RP is available and in READY state.	**SysAdmin VM:** show sdr default-sdr pairing show platform show platform slice show vm show version show inventory show log show install log show run dir harddisk: **XR-VM:** show redundancy show redundancy summary show platform vm show placement program all show health gsp show health sysdb show platform show log show install log show run show placement reoptimize cfs check dir harddisk:
Verify the fabric health and system environment. Ensure all fabric planes are UP, and fan speed is not zero. **Note** A power module in FAILED state may not indicate a problem. A power module that is inserted and powered Off will appear as failed.	**SysAdmin VM:** show controller fabric health show controller fabric plane all show alarms detail show environment power show environment fan show environment temp

Description	Commands
Verify the current packages installed on the device.	**SysAdmin (Calvados) VM:** show install active show install committed show install inactive show install repository **XR-VM:** show install active show install committed show install inactive show install repository

Enable Inter-rack Pairing Mode

The pairing mode is a SDR configurable option. The default mode is intra-rack, and the pairing algorithm is run when inter-rack (also known as cross-rack) pairing mode is enabled.

Note Traffic loss may occur when moving between inter-rack and intra-rack pairing modes. All cross-rack related triggers must be done in a maintenance window. For more information about scenarios that initiate automatic and manual re-pair of RPs, see Use Cases for Re-pairing RP, on page 32.

Before you begin

Verify the status of the system. For more information, see Verify System Readiness, on page 26.

SUMMARY STEPS

1. **conf**
2. **sdr default-sdr pairing-mode inter-rack**
3. **end**
4. **show sdr default-sdr pairing**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**conf** **Example:** `sysadmin-vm:0_RP0#conf`	Enter System Admin Config mode.

	Command or Action	Purpose
Step 2	**sdr default-sdr pairing-mode inter-rack** **Example:** `sysadmin-vm:0_RP0(config)# sdr default-sdr pairing-mode inter-rack`	Enable inter-rack pairing mode.

Step 3	**end**
	Example:
	`Uncommitted changes found, commit them? [yes/no/CANCEL] yes`
	`Commit complete.`
		Commit the changes.

Step 4	**show sdr default-sdr pairing**
	Example:
	`sysadmin-vm:0_RP0# show sdr default-sdr pairing`
	` Pairing Mode  INTER-RACK`
	` SDR Lead`
	`  Node 0 0/RP0`
	`  Node 1 1/RP1`
	` Pairs`
	`  Pair Name Pair0`
	`  Node 0  0/RP0`
	`  Node 1  1/RP1`
	` Pairs`
	`  Pair Name Pair1`
	`  Node 0  1/RP0`
	`  Node 1  2/RP1`
	` Pairs`
	`  Pair Name Pair2`
	`  Node 0  2/RP0`
	`  Node 1  0/RP1`
		Verify that the pairing is inter-rack and the partner nodes are on different racks.

Enable Inter-rack Pairing in Multi-SDR Configuration

This task shows how to enable inter-rack pairing mode in a multi-SDR configuration.

SUMMARY STEPS

1. **show running-config sdr**
2. **show sdr default-sdr pairing**
3. **conf**
4. **no sdr default-sdr**
5. **sdr <sdr-name>**
6. **show running-config sdr**
7. **show sdr <sdr-name> pairing**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show running-config sdr**
	Example:
	`sysadmin-vm:0_RP0# show running-config sdr`
	`sdr default-sdr`
	` pairing-mode intra-rack`
	` location all`
	` !`
	`!`
		Show the running configuration for the SDR.

Step 2	**show sdr default-sdr pairing**
	Example:
	`sysadmin-vm:0_RP0# show sdr default-sdr pairing`
	` Pairing Mode  INTRA-RACK`
	` SDR Lead`
	`  Node 0 0/RP0`
	`  Node 1 0/RP1`
	` Pairs`
	`  Pair Name Pair0`
	`  Node 0  0/RP0`
	`  Node 1  0/RP1`
	` Pairs`
	`  Pair Name Pair1`
	`  Node 0  1/RP0`
	`  Node 1  1/RP1`
	` Pairs`
	`  Pair Name Pair2`
	`  Node 0  3/RP0`
	`  Node 1  3/RP1`
		Display the default pairing in the SDR.

Step 3	**conf**
	Example:
	`sysadmin-vm:0_RP0# conf`
	`Entering configuration mode terminal`
		Enter the configuration mode.

Step 4	**no sdr default-sdr**
	Example:
	`sysadmin-vm:0_RP0(config)# no sdr default-sdr`
	`sysadmin-vm:0_RP0(config)# commit`
	`Commit complete.`
		Remove the default SDR.

Step 5	**sdr <sdr-name>**
	Example:
	`sysadmin-vm:0_RP0(config)# sdr abc`
	`sysadmin-vm:0_RP0(config-sdr-abc)# pairing-mode inter-rack`
	`sysadmin-vm:0_RP0(config-sdr-abc)# location 0/RP0`
	
	`sysadmin-vm:0_RP0(config-location-0/RP0)# location 0/RP1`
	`sysadmin-vm:0_RP0(config-location-0/RP1)# location 1/RP0`
	`sysadmin-vm:0_RP0(config-location-1/RP0)# location`
		Configure two new SDRs with pairing set to inter-rack mode.

	Command or Action	Purpose
	1/RP1 sysadmin-vm:0_RP0(config-location-1/RP1)# sdr xyz sysadmin-vm:0_RP0(config-sdr-xyz)# pairing-mode inter-rack sysadmin-vm:0_RP0(config-sdr-xyz)# location 0/RP0 sysadmin-vm:0_RP0(config-location-0/RP0)# location 0/RP1 sysadmin-vm:0_RP0(config-location-0/RP1)# commit Commit complete.	
Step 6	**show running-config sdr** **Example:** sysadmin-vm:0_RP0# show running-config sdr sdr abc pairing-mode inter-rack location 0/RP0 ! location 0/RP1 ! location 1/RP0 ! location 1/RP1 ! ! sdr xyz pairing-mode inter-rack location 0/RP0 ! location 0/RP1 ! !	Verify that the new SDRs are included in the multi-SDR configuration.
Step 7	**show sdr <sdr-name> pairing** **Example:** sysadmin-vm:0_RP0# show sdr abc pairing Pairing Mode INTER-RACK SDR Lead Node 0 0/RP0 Node 1 1/RP1 Pairs Pair Name Pair0 Node 0 0/RP0 Node 1 1/RP1 Pairs Pair Name Pair1 Node 0 1/RP0 Node 1 0/RP1 sysadmin-vm:0_RP0# show sdr xyz pairing Pairing Mode INTER-RACK SDR Lead Node 0 0/RP0 Node 1 0/RP1 Pairs Pair Name Pair0	Verify that the new SDRs are paired in the inter-rack pairing mode.

	Command or Action	Purpose
	Node 0 0/RP0 Node 1 0/RP1	

Manually Initiate Re-pair

The user can manually initiate a re-calculation of the inter-rack pairing algorithm. This task changes the pairing based on the current state of the card inventory.

SUMMARY STEPS

1. **sdr default-sdr re_pair**
2. **show sdr default-sdr pairing**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**sdr default-sdr re_pair**
	Example:
	`sysadmin-vm:0_RP1# sdr default-sdr re_pair`
	`Current Configuration`
	`0/RP0 1/RP1`
	`1/RP0 2/RP1`
	`2/RP0 0/RP1`
	`Re_Paired Configuration`
	`0/RP0 1/RP1`
	`1/RP0 0/RP1`
	`Would you like to proceed ? [yes/no]: yes`
	`Proceeding with action`
		Display the prediction of change in the re-pair configuration. Observe that rack 2 is down, and the re_pair command optimizes the pairing based on this change.
		Note Proceeding with the re-pair action even when the `re_pair` command does not predict any changes does not affect the system.

Step 2	**show sdr default-sdr pairing**
	Example:
	`sysadmin-vm:0_RP0#show sdr default-sdr pairing`
	`Pairing Mode INTER-RACK`
	`SDR Lead`
	`Node 0 0/RP0`
	`Node 1 1/RP1`
	`Pairs`
	`Pair Name Pair0`
	`Node 0 0/RP0`
	`Node 1 1/RP1`
	`Pairs`
	`Pair Name Pair1`
	`Node 0 1/RP0`
	`Node 1 0/RP1`
		Verify that the pairing shows the updated configuration.

Use Cases for Re-pairing RP

In this section, certain use cases with automatic and manual re-pairing of RPs are described.

Use Case: Automatic Re-pairing Algorithm

Insert a Rack Online

This task shows the automatic recalculation of pairing algorithm when a rack is inserted online. For more information about installing RP cards, see Cisco ASR 9000 Series Aggregation Services Router Hardware Installation Guide.

SUMMARY STEPS

1. **show chassis**
2. **show redundancy summary**
3. **show sdr default-sdr pairing**
4. **show running-config chassis**
5. **conf**
6. **chassis serial <serial-number> rack 1**
7. **commit**
8. Insert the rack.
9. **show chassis**
10. **show sdr default-sdr pairing**
11. **show redundancy summary**
12. **show running-config chassis**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show chassis**
	Example:
	`sysadmin-vm:F1_SC0# show chassis`
	`Serial Num  Rack Num  Rack Type  Rack State`
	`  Data Plane  Ctrl Plane`
	`---------------------------------------------------------------`
	`FLM171662RX  0  LCC  UP`
	`  CONN  CONN`
	`FMP17260280  F1  FCC  UP`
	`  CONN  CONN`
		Shows the chassis details including the chassis serial number. In the example, observe that rack 1 has not been associated with the chassis configuration.

Step 2	**show redundancy summary**
	Example:
	`Router#show redundancy summary`
	`  Active Node  Standby Node`
	`  ----------  ------------`
	`  0/RP0/CPU0  0/RP1/CPU0 (Node Ready, NSR:Ready)`
		View the redundancy summary of the node.

Step 3	**show sdr default-sdr pairing**
	Example:
	`sysadmin-vm:3_RP1# show sdr default-sdr pairing`
	`Pairing Mode  INTER-RACK`
		View the current pairing information.

	Command or Action	Purpose
	SDR Lead Node 0 0/RP0 Node 1 0/RP1 Pairs Pair Name Pair0 Node 0 0/RP0 Node 1 0/RP1	
Step 4	**show running-config chassis** **Example:** sysadmin-vm:F1_SC0# show running-config chassis chassis serial FLM171662RX rack 0 ! chassis serial FMP17260280 rack F1 !	Check the current chassis configuration.
Step 5	**conf** **Example:** sysadmin-vm:F1_SC0# conf	Enter the System Admin Config mode.
Step 6	**chassis serial <serial-number> rack 1** **Example:** sysadmin-vm:F1_SC0(config)# chassis serial FLM171762WW rack 1	Enter the configuration mode for the chassis with the rack number associated to the chassis.
Step 7	**commit** **Example:** sysadmin-vm:F1_SC0(config)# commit Commit complete.	Commit the changes.
Step 8	Insert the rack.	
Step 9	**show chassis** **Example:** sysadmin-vm:F1_SC0# show chassis Serial Num Rack Num Rack Type Rack State Data Plane Ctrl Plane --- FLM171662RX 0 LCC UP CONN CONN FLM171762WW 1 LCC UP CONN CONN FMP17260280 F1 FCC UP CONN CONN	Verify that rack 1 is visible.
Step 10	**show sdr default-sdr pairing** **Example:** sysadmin-vm:3_RP1# show sdr default-sdr pairing Pairing Mode INTER-RACK SDR Lead	Verify that rack1 is included in the pairing that was automatically updated after inserting the rack.

	Command or Action	Purpose
	Node 0 0/RP0 Node 1 1/RP1 Pairs Pair Name Pair0 Node 0 0/RP0 Node 1 1/RP1 Pairs Pair Name Pair1 Node 0 1/RP0 Node 1 0/RP1	
Step 11	**show redundancy summary** **Example:** Router#show redundancy summary Active Node Standby Node 0/RP0/CPU0 1/RP1/CPU0 (Node Ready, NSR:Ready) 1/RP0/CPU0 0/RP1/CPU0 (Node Ready, NSR:Ready)	
Step 12	**show running-config chassis** **Example:** sysadmin-vm:F1_SC0# show running-config chassis chassis serial FLM171662RX rack 0 ! chassis serial FLM171762WW rack 1 ! chassis serial FMP17260280 rack F1 !	Verify the chassis configuration.

Remove a Rack from System

This task shows the automatic recalculation of pairing algorithm when a rack is deleted from the configuration.

SUMMARY STEPS

1. **show running-config chassis**
2. **show chassis**
3. **show sdr default-sdr pairing**
4. **show redundancy summary**
5. Remove a rack from the system.
6. **show chassis**
7. **show sdr default-sdr pairing**
8. **show redundancy summary**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show running-config chassis**
	Example:
	`sysadmin-vm:F1_SC0# show running-config chassis`
	`chassis serial FLM171662RX`
	` rack 0`
	`!`
	`chassis serial FLM171762WW`
	` rack 1`
	`!`
	`chassis serial FLM171763M4`
	` rack 2`
	`!`
	`chassis serial FMP12020039`
	` rack 3`
	`!`
	`chassis serial FMP17260280`
	` rack F1`
		Display the current configuration of the chassis.

Step 2	**show chassis**
	Example:
	`sysadmin-vm:F1_SC0# show chassis`
	`Serial Num Rack Num Rack Type Rack State`
	`Data Plane Ctrl Plane`
	`---`
	`FLM171662RX 0 LCC UP`
	`CONN CONN`
	`FLM171762WW 1 LCC UP`
	`CONN CONN`
	`FLM171763M4 2 LCC UP`
	`CONN CONN`
	`FMP12020039 3 LCC UP`
	`CONN CONN`
	`FMP17260280 F1 FCC UP`
	`CONN CONN`
		Display the racks and their states.

Step 3	**show sdr default-sdr pairing**
	Example:
	`sysadmin-vm:2_RP0# show sdr default-sdr pairing`
	`Pairing Mode INTER-RACK`
	` SDR Lead`
	`Node 0 0/RP0`
	`Node 1 1/RP1`
	` Pairs`
	`Pair Name Pair0`
	`Node 0 0/RP0`
	`Node 1 1/RP1`
	` Pairs`
	`Pair Name Pair1`
	`Node 0 1/RP0`
	`Node 1 2/RP1`
	` Pairs`
	`Pair Name Pair2`
	`Node 0 2/RP0`
	`Node 1 3/RP1`
		View the current active and standby pairing of RPs.

	Command or Action	Purpose
	Pairs Pair Name Pair3 Node 0 3/RP0 Node 1 0/RP1	

Step 4	**show redundancy summary**
	Example:
	`Router#show redundancy summary`
	`Active Node Standby Node`
	`1/RP0/CPU0 2/RP1/CPU0 (Node Ready, NSR:Ready)`
	`2/RP0/CPU0 3/RP1/CPU0 (Node Ready, NSR:Ready)`
	`3/RP0/CPU0 0/RP1/CPU0 (Node Ready, NSR:Ready)`
	`0/RP0/CPU0 1/RP1/CPU0 (Node Ready, NSR:Ready)`
		Verify node status and pairing.

Step 5	Remove a rack from the system.	

Step 6	**show chassis**
	Example:
	`sysadmin-vm:F1_SC0# show chassis`
	`Serial Num Rack Num Rack Type Rack State Data Plane Ctrl Plane`
	`FLM171662RX 0 LCC UP CONN CONN`
	`FLM171763M4 2 LCC UP CONN CONN`
	`FMP12020039 3 LCC UP CONN CONN`
	`FMP17260280 F1 FCC UP CONN CONN`
		Show the chassis configuration. Observe that rack 1 is deleted from the configuration.

Step 7	**show sdr default-sdr pairing**
	Example:
	`sysadmin-vm:2_RP0# show sdr default-sdr pairing`
	`Pairing Mode INTER-RACK`
	`SDR Lead`
	`Node 0 0/RP0`
	`Node 1 2/RP1`
	`Pairs`
	`Pair Name Pair0`
	`Node 0 0/RP0`
	`Node 1 2/RP1`
	`Pairs`
	`Pair Name Pair2`
	`Node 0 2/RP0`
	`Node 1 3/RP1`
	`Pairs`
	`Pair Name Pair3`
	`Node 0 3/RP0`
	`Node 1 0/RP1`
		Display the recalculated pairing configuration. Observe that the deleted rack is not included in the new pairing. The XR VMs must reflect the SDR pairing of the RPs.

	Command or Action	Purpose

Step 8	**show redundancy summary**
	Example:
	`Router#show redundancy summary`
	`    Active Node    Standby Node`
	`    -----------    ------------`
	`     2/RP0/CPU0      3/RP1/CPU0 (Node Ready, NSR:Ready)`
	`     3/RP0/CPU0      0/RP1/CPU0 (Node Ready, NSR:Ready)`
	`     0/RP0/CPU0      2/RP1/CPU0 (Node Ready, NSR:Ready)`
		Verify the node status and pairing.

Insert an RP Online to Create Dual RP

When an RP is inserted to a rack to create a chassis with dual RP, the re-pairing of RPs is automatically recalculated. The dual RP can be created using one of these methods.

Insert an RP

This task shows the automatic recalculation of pairing algorithm when an RP is added online to create a dual RP.

SUMMARY STEPS

1. **show redundancy summary**
2. Insert an RP. Consider that 2/RP0 is inserted.
3. **show sdr default-sdr pairing**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show redundancy summary**
	Example:
	`    Active Node    Standby Node`
	`    -----------    ------------`
	`     0/RP0/CPU0      1/RP1/CPU0 (Node Ready, NSR:Ready)`
	`     1/RP0/CPU0      0/RP1/CPU0 (Node Ready, NSR:Ready)`
	`     2/RP1/CPU0      N/A`
		Verify node status and pairing. In the example, the standby RP 0/RP1 reloads to pair with 1/RP0.

Step 2	Insert an RP. Consider that 2/RP0 is inserted.	

Step 3	**show sdr default-sdr pairing**
	Example:
	`sysadmin-vm:2_RP0# show sdr default-sdr pairing`
	` Pairing Mode  INTER-RACK`
	` SDR Lead`
	`   Node 0 0/RP0`
	`   Node 1 1/RP1`
	` Pairs`
		Pairing is automatically recalculated to include rack 2. In the example, observe that 2/RP1 reloads to become the standby RP, and a third pair is created.

	Command or Action	Purpose

	<pre> Pair Name Pair0
	    Node 0 0/RP0
	    Node 1 1/RP1
	 Pairs
	   Pair Name Pair2
	    Node 0 1/RP0
	    Node 1 2/RP1
	 Pairs
	   Pair Name Pair3
	    Node 0 2/RP0
	    Node 1 0/RP1
	
	RP/0/RP0/CPU0:ios#show redundancy summary
	    Active Node Standby Node
	    ----------- ------------
	     0/RP0/CPU0 1/RP1/CPU0 (Node Ready,
	NSR:Ready)
	     1/RP0/CPU0 2/RP1/CPU0 (Node Ready,
	NSR:Ready)
	     2/RP0/CPU0 0/RP1/CPU0 (Node Ready,
	NSR:Ready)</pre>	

Add an RP to a Named SDR

This task shows the automatic recalculation of pairing algorithm when an RP is added to a named SDR.

SUMMARY STEPS

1. **show running-config sdr**
2. **show sdr newsdra pairing**
3. **conf**
4. **sdr newsdra location 1/RP1**
5. **show running-config sdr**
6. **show sdr newsdra pairing**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show running-config sdr**
	Example:
	<pre>sysadmin-vm:F1_SC0# show running-config sdr
	newsdra
	pairing-mode inter-rack
	 location 0/RP0
	 !
	 location 0/RP1
	 !
	 location 1/RP0
	 !
	 location 2/RP1
	 !
	!</pre>
		Display the current configuration of the named SDR.

	Command or Action	Purpose

Step 2	**show sdr newsdra pairing**
	Example:
	`sysadmin-vm:2_RP0# show sdr newsdra pairing`
	` Pairing Mode  INTER-RACK`
	` SDR Lead`
	`  Node 0 0/RP0`
	`  Node 1 0/RP1`
	` Pairs`
	`  Pair Name Pair0`
	`  Node 0  0/RP0`
	`  Node 1  0/RP1`
	` Pairs`
	`  Pair Name Pair2`
	`  Node 0  1/RP0`
	`  Node 1  NONE`
	` Pairs`
	`  Pair Name Pair3`
	`  Node 0  2/RP1`
	`  Node 1  NONE`
		Observe that rack 1 and rack 2 are not included in pairing because both the racks have a single RP. Inter-rack pairing does not support racks with single RP.

Step 3	**conf**
	Example:
	`sysadmin-vm:F1_SC0# conf`
	`Entering configuration mode terminal`
		Enter the configuration mode.

Step 4	**sdr newsdra location 1/RP1**
	Example:
	`sysadmin-vm:F1_SC0(config)# sdr newsdra location 1/RP1`
	`sysadmin-vm:F1_SC0(config-location-1/RP1)# commit`
	`Commit complete.`
		Add `1/RP1` to the SDR configuration, and commit the configuration.

Step 5	**show running-config sdr**
	Example:
	`sysadmin-vm:F1_SC0# show running-config sdr`
	`sdr newsdra`
	`pairing-mode inter-rack`
	` location 0/RP0`
	` !`
	` location 0/RP1`
	` !`
	` location 1/RP0`
	` !`
	` location 1/RP1`
	` !`
	` location 2/RP1`
	` !`
	`!`
		View the updated rack details in the SDR configuration.

Step 6	**show sdr newsdra pairing**
	Example:
	`sysadmin-vm:2_RP0# show sdr newsdra pairing`
	` Pairing Mode  INTER-RACK`
	` SDR Lead`
		Verify the re-paired algorithm. The algorithm has automatically recaluculated to include rack 1 in the pairing.

	Command or Action	Purpose
	Node 0 0/RP0 Node 1 1/RP1 Pairs Pair Name Pair0 Node 0 0/RP0 Node 1 1/RP1 Pairs Pair Name Pair2 Node 0 1/RP0 Node 1 0/RP1 Pairs Pair Name Pair3 Node 0 2/RP1 Node 1 NONE	

Use Case: Manual Re-pairing Algorithm

Rack Failure

A re-pair of the RPs can be initiated manually when a rack is not functional. This will re-establish rack level high availability (HA). A rack failure may occur during one or more of these circumstances:

- simultaneous hardware or software failure on both RPs in the rack
- simultaneous loss of ethernet connectivity from rest of the system on both RPs in the rack
- isolation of rack due to fiber cuts
- power failure

HA can be re-established by triggering re-calculation of pairing within a maintenance window. This can be done by:

- removing the affected rack from the system by deleting it from the chassis configuration using **no chassis serial <chassis-serial-number>** command
- shutting down the rack and running re-pair manually

This section shows the steps for shutting down the rack and running the re-pair manually:

SUMMARY STEPS

1. **show chassis**
2. **show running-config chassis**
3. **show sdr default-sdr pairing**
4. **sdr default-sdr re_pair**
5. **show chassis**
6. **show running-config chassis**
7. **show sdr default-sdr pairing**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show chassis**
	Example:
	`sysadmin-vm:F1_SC0# show chassis`
	`Serial Num  Rack Num  Rack Type  Rack State  Data Plane  Ctrl Plane`
	`FLM171662RX  0  LCC  UP  CONN  CONN`
	`FLM171762WW  1  LCC  DOWN  CONN  CONN`
	`FLM171763M4  2  LCC  UP  CONN  CONN`
		Show the current chassis configuration. Note that rack 1 has failed and is in DOWN state.

Step 2	**show running-config chassis**
	Example:
	`sysadmin-vm:2_RP0# show running-config chassis`
	`chassis serial FLM171662RX`
	`rack 0`
	`!`
	`chassis serial FLM171762WW`
	`rack 1`
	`!`
	`chassis serial FLM171763M4`
	`rack 2`
		Display the current running configuration of the chassis.

Step 3	**show sdr default-sdr pairing**
	Example:
	`sysadmin-vm:2_RP0# show sdr default-sdr pairing`
	`Pairing Mode  INTER-RACK`
	`SDR Lead`
	`Node 0 0/RP0`
	`Node 1 1/RP1`
	`Pairs`
	`Pair Name Pair0`
	`Node 0 0/RP0`
	`Node 1 1/RP1`
	`Pairs`
	`Pair Name Pair1`
	`Node 0 1/RP0`
	`Node 1 2/RP1`
	`Pairs`
	`Pair Name Pair2`
	`Node 0 2/RP0`
	`Node 1 0/RP1`
		Display the current pairing algorithm of RPs.

Step 4	**sdr default-sdr re_pair**
	Example:
	`sysadmin-vm:0_RP0# sdr default-sdr re_pair`
	`Current Configuration`
	`Lead Pair: 0/RP0 1/RP1`
	`1/RP0 2/RP1`
	`2/RP0 0/RP1`
	`Re_Paired Configuration`
	`Lead Pair: 0/RP0 2/RP1`
		Remove rack 1 from the configuration.

	Command or Action	Purpose
	2/RP0 0/RP1 Would you like to proceed ? [yes/no]: yes Proceeding with action	
Step 5	**show chassis** **Example:** sysadmin-vm:F1_SC0# show chassis Serial Num Rack Num Rack Type Rack State Data Plane Ctrl Plane FLM171662RX 0 LCC UP CONN CONN FLM171762WW 1 LCC DOWN CONN CONN FLM171763M4 2 LCC UP CONN CONN	Display the chassis configuration details.
Step 6	**show running-config chassis** **Example:** sysadmin-vm:2_RP0# show running-config chassis chassis serial FLM171662RX rack 0 ! chassis serial FLM171762WW rack 1 ! chassis serial FLM171763M4 rack 2	Show the current running configuration of the chassis. Observe that the chassis configuration is unchanged.
Step 7	**show sdr default-sdr pairing** **Example:** sysadmin-vm:2_RP0# show sdr default-sdr pairing Pairing Mode INTER-RACK SDR Lead Node 0 0/RP0 Node 1 2/RP1 Pairs Pair Name Pair0 Node 0 0/RP0 Node 1 2/RP1 Pairs Pair Name Pair1 Node 0 2/RP0 Node 1 0/RP1	Display the SDR pairing algorithm. The SDR configuration is updated to exclude rack 1.

Remove RP

This task shows manually intitiating the recalculation of pairing algorithm when an RP is removed using online insertion and removal (OIR).

SUMMARY STEPS

1. **show sdr default-sdr pairing**
2. **show redundancy summary**

3. Remove an RP using OIR. For example, consider 0/RP0 is removed from the chassis.
4. **show redundancy summary** and **show sdr default-sdr pairing**
5. **sdr default-sdr re_pair**
6. **show sdr default-sdr pairing**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show sdr default-sdr pairing**
	Example:
	`sysadmin-vm:3_RP1# show sdr default-sdr pairing`
	` Pairing Mode  INTER-RACK`
	` SDR Lead`
	`  Node 0 0/RP0`
	`  Node 1 0/RP1`
	` Pairs`
	`  Pair Name Pair0`
	`  Node 0  0/RP0`
	`  Node 1  1/RP1`
	` Pairs`
	`  Pair Name Pair1`
	`  Node 0  1/RP0`
	`  Node 1  0/RP1`
		Display the pairing of RPs in the SDR configuration.

Step 2	**show redundancy summary**
	Example:
	`Router#show redundancy summary`
	`  Active Node  Standby Node`
	`  ----------  ------------`
	`  0/RP0/CPU0  1/RP1/CPU0`
	`  1/RP0/CPU0  0/RP1/CPU0 (Node Ready, NSR:Ready)`	

Step 3	Remove an RP using OIR. For example, consider 0/RP0 is removed from the chassis.	

Step 4	**show redundancy summary** and **show sdr default-sdr pairing**
	Example:
	`Router#show redundancy summary`
	`  Active Node  Standby Node`
	`  ----------  ------------`
	`  1/RP1/CPU0  N/A`
	`  1/RP0/CPU0  0/RP1/CPU0 (Node Ready, NSR:Ready)`
	
	`sysadmin-vm:3_RP1# show sdr default-sdr pairing`
	` Pairing Mode  INTER-RACK`
	` SDR Lead`
	`  Node 0 0/RP0`
	`  Node 1 1/RP1`
	` Pairs`
	`  Pair Name Pair0`
	`  Node 0  0/RP0`
	`  Node 1  1/RP1`
	` Pairs`
		Observe the mismatch between the SDR configuration and the actual state of the nodes.

	Command or Action	Purpose
	Pair Name Pair1 Node 0 1/RP0 Node 1 0/RP1	
Step 5	**sdr default-sdr re_pair** **Example:** sysadmin-vm:2_RP0# sdr default-sdr re_pair Current Configuration Lead Pair: 0/RP0 1/RP1 1/RP0 0/RP1 Re_Paired Configuration Lead Pair: 1/RP1 N/A 0/RP0 0/RP1 Would you like to proceed ? [yes/no]: yes Proceeding with action	Use the re-pair command to solve the mismatch between SDR configuration and state of the nodes.
Step 6	**show sdr default-sdr pairing** **Example:** sysadmin-vm:2_RP0# show sdr default-sdr pairing Pairing Mode INTER-RACK SDR Lead Node 0 1/RP1 Node 1 N/A Pairs Pair Name Pair0 Node 0 1/RP1 Node 1 N/A Pairs Pair Name Pair1 Node 0 0/RP0 Node 1 0/RP1	Verify that the SDR configuration shows the correct pairing on RPs.

Remove RP from SDR Configuration

This task shows manually initiating the recalculation of pairing algorithm when an RP is removed from SDR configuration.

SUMMARY STEPS

1. **show running-config sdr abc**
2. **sh sdr**
3. **show sdr abc pairing**
4. **show redundancy summary**
5. **conf**
6. **sdr abc**
7. **no location 1/RP1**
8. **show running-config sdr abc**
9. **show sdr abc pairing**
10. **sdr abc re_pair**
11. **show sdr abc pairing**
12. **show sdr abc reboot-history**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**show running-config sdr abc**
	Example:
	`sysadmin-vm:0_RP0# show running-config sdr abc`
	`sdr abc`
	` pairing-mode inter-rack`
	` location 0/RP0`
	` !`
	` location 0/RP1`
	` !`
	` location 1/RP0`
	` !`
	` location 1/RP1`
	` !`
	`!`
		Display current SDR configuration.

Step 2	**sh sdr**
	Example:
	`sysadmin-vm:0_RP0# sh sdr`
	`SDR: abc`
	`Location IP Address Status Boot Count Time Started`
	`0/RP0/VM1 192.3.0.4 RUNNING 1 06/26/2017 21:02:23`
	`0/RP1/VM1 192.3.4.4 RUNNING 1 06/26/2017 21:03:09`
	`1/RP0/VM1 192.2.0.4 RUNNING 1 06/26/2017 21:03:26`
	`1/RP1/VM1 192.2.4.4 RUNNING 1 06/26/2017 21:03:36`
	`SDR: abcabc`
	`Location IP Address Status Boot Count Time Started`
	`1/RP0/VM2 192.2.0.6 RUNNING 1 06/26/2017 21:14:29`
	`1/RP1/VM2 192.2.4.6 RUNNING 1 06/26/2017 21:14:37`
	`3/RP0/VM1 192.1.0.4 RUNNING 1 06/26/2017 21:14:01`
	`3/RP1/VM1 192.1.4.4 RUNNING 1 06/26/2017 21:15:31`
	`SDR: xyz`
	`Location IP Address Status Boot Count Time Started`
	`0/RP0/VM2 192.3.0.6 RUNNING 1 06/26/2017 21:04:15`
	`0/RP1/VM2 192.3.4.6 RUNNING 1 06/26/2017 21:04:38`
		Display SDR configuration details.

Step 3	**show sdr abc pairing** **Example:**	Verify that inter-rack mode is enabled in the SDR, and the pairing is displayed.

	Command or Action	Purpose

	`sysadmin-vm:0_RP0# show sdr abc pairing`
	` Pairing Mode  INTER-RACK`
	` SDR Lead`
	`   Node 0 0/RP0`
	`   Node 1 1/RP1`
	` Pairs`
	`   Pair Name Pair0`
	`    Node 0   0/RP0`
	`    Node 1   1/RP1`
	` Pairs`
	`   Pair Name Pair1`
	`    Node 0   1/RP0`
	`    Node 1   0/RP1`	

Step 4	**show redundancy summary**
	Example:
	`RP/0/RP0/CPU1:ios#show redundancy summary`
	`    Active Node    Standby Node`
	`    -----------    ------------`
	`     0/RP1/CPU1      1/RP0/CPU1 (Node Ready, NSR:Not Configured)`
	`     0/RP0/CPU1      1/RP1/CPU1 (Node Ready, NSR:Not Configured)`
		Disolay summary of the nodes states.

Step 5	**conf**
	Example:
	`sysadmin-vm:0_RP0# conf`
	`Entering configuration mode terminal`
		Enter configuration mode.

Step 6	**sdr abc** **Example:** `sysadmin-vm:0_RP0(config)# sdr abc`	Enter SDR configuration mode.

Step 7	**no location 1/RP1**
	Example:
	`sysadmin-vm:0_RP0(config-sdr-abc)# no location 1/RP1`
	`sysadmin-vm:0_RP0(config-sdr-abc)# end`
	`Mon Jun  26 21:18:32.448 UTC`
	`Uncommitted changes found, commit them? [yes/no/CANCEL] yes`
	`Commit complete.`
		Remove the RP and commit the changes. In this example, the RP 1/RP1 is removed from the `abc` SDR configuration.

Step 8	**show running-config sdr abc**
	Example:
	`sysadmin-vm:0_RP0# show running-config sdr abc`
	`sdr abc`
	` pairing-mode inter-rack`
	` location 0/RP0`
	` !`
	` location 0/RP1`
	` !`
	` location 1/RP0`
	` !`
	`!`
		Verify that the SDR inventory has changed.

	Command or Action	Purpose

Step 9	**show sdr abc pairing**
	Example:
	`sysadmin-vm:0_RP0# show sdr abc pairing`
	` Pairing Mode  INTER-RACK`
	` SDR Lead`
	`   Node 0 0/RP0`
	`   Node 1 1/RP1`
	` Pairs`
	`   Pair Name Pair0`
	`    Node 0   0/RP0`
	`    Node 1   1/RP1`
	` Pairs`
	`   Pair Name Pair1`
	`    Node 0   1/RP0`
	`    Node 1   0/RP1`
		View the SDR pairing information after the RP is removed. Observe that pairing is unchanged with the removed RP available in the pairing algorithm. Note that the output of **show running-config sdr** command in step 8 is different from the output in step 9.

Step 10	**sdr abc re_pair**
	Example:
	`sysadmin-vm:0_RP0# sdr abc re_pair`
	`Current Configuration`
	`Lead Pair: 0/RP0 1/RP1`
	`1/RP0 0/RP1`
	
	`Re_Paired Configuration`
	`Lead Pair: 0/RP0 0/RP1`
	`1/RP0`
	`Would you like to proceed ? [yes/no]: yes`
	`Proceeding with action`
		Manually initiate the recalculation of the pairing algorithm.

Step 11	**show sdr abc pairing**
	Example:
	`sysadmin-vm:0_RP0# show sdr abc pairing`
	` Pairing Mode  INTER-RACK`
	` SDR Lead`
	`   Node 0 0/RP0`
	`   Node 1 0/RP1`
	` Pairs`
	`   Pair Name Pair0`
	`    Node 0   0/RP0`
	`    Node 1   0/RP1`
	` Pairs`
	`   Pair Name Pair1`
	`    Node 0   1/RP0`
	`    Node 1   NONE`
		Verify that the pairing is updated to exclude the details of the RP that was removed. Also, run the **show redundancy summary** command to verify that the XR VMs reflect the changes.

Step 12	**show sdr abc reboot-history**
	Example:
	`sysadmin-vm:0_RP0# show sdr abc reboot-history`
	`Reboots Since`
	`Location  Created  Reason`
	`0/RP0/VM1  1  06/26/2017 21:02:23`
	`FIRST_BOOT`
	`0/RP1/VM1  2  6/26/2017 21:25:23`
	`VM_REQUESTED_GRACEFUL_RELOAD: Src: node0_RP0_CPU1,`
	` Partner change from`
		Verify the reboot history of the SDR nodes. The history reflects the changes made to the configuration.

	Command or Action	Purpose
	node1_RP1_CPU1 to node0_RP1_CPU1 06/26/2017 21:03:09 FIRST_BOOT 1/RP0/VM1 1 06/26/2017 21:03:26 FIRST_BOOT	

Process Placement after a Pairing Change

You must check the placement reoptimization of configuration before and after a change in pairing algorithm. This maintains HA for configurable processes.This includes moving to inter-rack or intra-rack pairing, running a manual re-pair, or triggering an automatic re_pair scenario. This feature provides the flexibility to decide a change in service placements based on the prediction from process placement.

SUMMARY STEPS

1. **show redundancy summary**
2. **show placement reoptimize**
3. **placement reoptimize**
4. **show placement reoptimize**

DETAILED STEPS

	Command or Action	Purpose

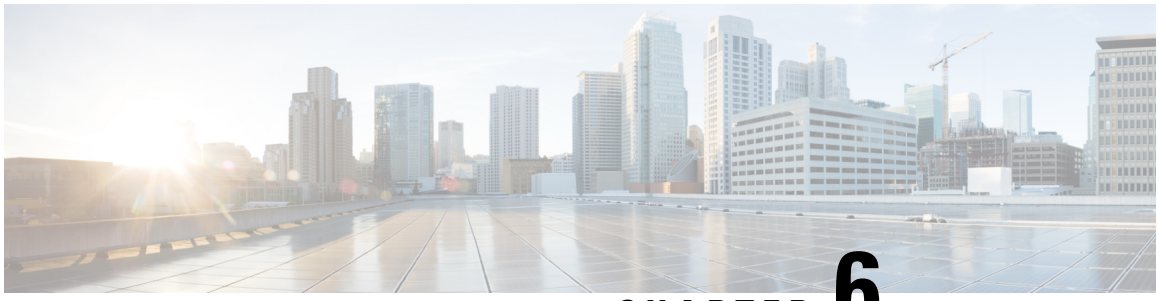
Step 1	**show redundancy summary**
	Example:
	`RP/0/RP0/CPU1:ios#show redundancy summary`
	`Active Node Standby Node`
	`----------- ------------`
	`1/RP0/CPU1 N/A`
	`0/RP0/CPU1 0/RP1/CPU1 (Node Ready, NSR:Configured)`
		Display the summary of nodes on the configuration.

Step 2	**show placement reoptimize**
	Example:
	`Router#show placement reoptimize`
	`Group-Name Current-Placement`
	`Reoptimized-Placement`
	`central-services 0/RP0/CPU1(0/RP1/CPU1)`
	`0/RP0/CPU1(0/RP1/CPU1)`
	`v4-routing 1/RP0/CPU1(NONE)`
	`0/RP0/CPU1(0/RP1/CPU1)`
	`netmgmt 1/RP0/CPU1(NONE)`
	`0/RP0/CPU1(0/RP1/CPU1)`
	`mcast-routing 0/RP0/CPU1(0/RP1/CPU1)`
	`0/RP0/CPU1(0/RP1/CPU1)`
	`v6-routing 1/RP0/CPU1(NONE)`
	`0/RP0/CPU1(0/RP1/CPU1)`
	`Group_0_1 0/RP0/CPU1(0/RP1/CPU1)`
	`0/RP0/CPU1(0/RP1/CPU1)`
		Show current placements and reoptimized placements of services.

	Command or Action	Purpose
	`Group_0_0 1/RP0/CPU1(NONE) 0/RP0/CPU1(0/RP1/CPU1)`	

Step 3	**placement reoptimize**
	Example:
	`RP/0/RP0/CPU1:ios#placement reoptimize`
	`Group-Name Current-Placement Reoptimized-Placement`
	`central-services 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`v4-routing 1/RP0/CPU1(NONE) 0/RP0/CPU1(0/RP1/CPU1)`
	`netmgmt 1/RP0/CPU1(NONE) 0/RP0/CPU1(0/RP1/CPU1)`
	`mcast-routing 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`v6-routing 1/RP0/CPU1(NONE) 0/RP0/CPU1(0/RP1/CPU1)`
	`Group_0_1 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`Group_0_0 1/RP0/CPU1(NONE) 0/RP0/CPU1(0/RP1/CPU1)`
	`Do you want to proceed with the reoptimization[y/n]y`
	`Triggering reoptimize`
	`Migration running in the background`
	`Please don't trigger one more migration`
		Display the placement reoptimize details.

Step 4	**show placement reoptimize**
	Example:
	`Router#show placement reoptimize`
	`Group-Name Current-Placement Reoptimized-Placement`
	`central-services 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`v4-routing 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`netmgmt 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`mcast-routing 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`v6-routing 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`Group_0_1 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`Group_0_0 0/RP0/CPU1(0/RP1/CPU1) 0/RP0/CPU1(0/RP1/CPU1)`
	`No changes predicted.`
		Verify re-optimized placement matches the current placement and no more changes are predicted.



CHAPTER 6

Perform Preliminary Checks

After successfully logging into the XR VM console, you must perform some preliminary checks to verify the default setup. If any setup issue is detected when these checks are performed, take corrective action before making further configurations. These preliminary checks are:

- Verify Active VMs, on page 51
- Verify Status of Hardware Modules, on page 54
- Verify Node Status, on page 55
- Verify Software Version, on page 58
- Verify Firmware Version, on page 58
- Verify Interface Status, on page 60
- Verify Fabric Plane, on page 61
- Verify SDR Information, on page 62
- Verify Control Ethernet Connections, on page 63
- Monitor Craft Panel Interface , on page 65

Verify Active VMs

On the router both the XR VM and the System Admin VM must be operational. Instances of both VMs should be running on every RP and LC . Complete this task to verify the VMs are active.

SUMMARY STEPS

1. **admin**
2. **show vm**

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **show vm**

Example:

```
sysadmin-vm:0_RP0#show vm
sysadmin-vm:0_RP1# sh vm

Location: 0/0
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.64.1       NA/NA
default-sdr         running       192.0.64.3       1528/1528

Location: 0/1
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.68.1       NA/NA
default-sdr         running       192.0.68.3       1528/1528

Location: 0/2
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.72.1       NA/NA
default-sdr         running       192.0.72.3       1528/1528

Location: 0/3
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.76.1       NA/NA
default-sdr         running       192.0.76.3       1528/1528

Location: 0/4
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.80.1       NA/NA
default-sdr         running       192.0.80.3       1528/1528

Location: 0/5
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.84.1       NA/NA
default-sdr         running       192.0.84.3       1529/1529

Location: 0/6
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.88.1       NA/NA
default-sdr         running       192.0.88.3       1531/1531

Location: 0/7
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.92.1       NA/NA
default-sdr         running       192.0.92.3       1531/1531

Location: 0/RP0
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.0.1        NA/NA
default-sdr         running       192.0.0.4        29736/29736

Location: 0/RP1
Id                  Status        IP Address       HB Sent/Recv
--------------------------------------------------------------
sysadmin            running       192.0.4.1        NA/NA
default-sdr         running       192.0.4.4        30534/30534
```

Displays the status of the VMs running on various nodes.

```
------ VMs found at location 0/3 ------
  Id     : sysadmin
  Status : running
  IP Addr: 192.0.76.1
  HB Interval : 0s 0ns
  Last HB Sent: 2026
  Last HB Rec : 2026
  -------
  Id     : default-sdr
  Status : running
  IP Addr: 192.0.76.3
  HB Interval : 10s 0ns
  Last HB Sent: 2026
  Last HB Rec : 2026
  -------
------ VMs found at location 0/RP0 ------
  Id     : sysadmin
  Status : running
  IP Addr: 192.0.0.1
  HB Interval : 0s 0ns
  Last HB Sent: 40660
  Last HB Rec : 40659
  -------
  Id     : default-sdr
  Status : running
  IP Addr: 192.0.0.4
  HB Interval : 0s 500000000ns
  Last HB Sent: 40708
  Last HB Rec : 40707
  -------
------ VMs found at location 0/RP1 ------
  Id     : sysadmin
  Status : running
  IP Addr: 192.0.4.1
  HB Interval : 0s 0ns
  Last HB Sent: 40708
  Last HB Rec : 40708
  -------
  Id     : default-sdr
  Status : running
  IP Addr: 192.0.4.4
  HB Interval : 0s 500000000ns
  Last HB Sent: 40708
  Last HB Rec : 40708
  -------
```

In the above result:

- Id—Name of the VM. "sysadmin" represents System Admin VM; "default-sdr" represents XR VM
- Status—Status of the VM
- IP Addr—Internal IP address of the VM

If a VM is not running on a node, in the output of the **show vm** command, no output is shown for that node.

What to do next

If the XR VM is not running on a node, try reloading the node. To do so, use the **hw-module location** *node-id* **reload** command in the System Admin EXEC mode. Also, use the **show sdr** command in the System Admin EXEC mode to verify that the SDR is running on the node.

Verify Status of Hardware Modules

Hardware modules include RPs, LCs, fan trays, fabric cards, and so on. On the router, multiple hardware modules are installed. Perform this task to verify that all hardware modules are installed correctly and are operational.

Before you begin

Ensure that all required hardware modules have been installed on the router. For installation details, see Cisco Network Convergence System 6000 Series Routers Hardware Installation Guide.

SUMMARY STEPS

1. **admin**
2. **show hw-module** *fpd location*

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **show hw-module** *fpd location*

Displays the list of hardware modules detected on the router.

```
LOCATION  SHOW
----------------
0/RP0     -
0/RP1     -
0/FC0     -
0/FT0     -
0/FT1     -
0/3       -
0/PT1     -
```

From the result, verify that all the hardware modules installed on the chassis are listed. If a module is not listed, it indicates either that module is malfunctioning, or it is not properly installed. Remove and reinstall the hardware module.

Verify Node Status

Each card on the router represents a node. The operational status of the node is verified using the **show platform** command. This command is to be executed independently from both XR VM and System Admin VM CLIs.

For the multi-chassis system, run the command from one chassis. The verification commands will list information for all chassis.

SUMMARY STEPS

1. **sh platform**
2. **admin**
3. **show platform**

DETAILED STEPS

Step 1 **sh platform**

Example:

```
RP/0/RP0/CPU0:router#sh platform
```

The **show platform** command when executed from the XR EXEC mode displays the status of XR VM running on various RPs and LCs.

This is an example for single-chassis system:

```
RP/0/RP1/CPU0:#sh platform
Mon Feb 13 15:07:03.729 UTC
Node               Type                       State             Config state
--------------------------------------------------------------------------------
0/0/CPU0           NC6-10X100G-M-K            IOS XR RUN        NSHUT
0/0/NPU0           Slice                      UP
0/0/NPU1           Slice                      UP
0/0/NPU2           Slice                      UP
0/0/NPU3           Slice                      UP
0/0/NPU4           Slice                      UP
0/1/CPU0           NC6-60X10GE-L-S            IOS XR RUN        NSHUT
0/1/NPU0           Slice                      UP
0/1/NPU1           Slice                      UP
0/1/NPU2           Slice                      UP
0/1/NPU3           Slice                      UP
0/2/CPU0           NC6-10X100G-M-K            IOS XR RUN        NSHUT
0/2/NPU0           Slice                      UP
0/2/NPU1           Slice                      UP
0/2/NPU2           Slice                      UP
0/2/NPU3           Slice                      UP
0/2/NPU4           Slice                      UP
0/3/CPU0           NC6-10X100G-M-K            IOS XR RUN        NSHUT
0/3/NPU0           Slice                      UP
0/3/NPU1           Slice                      UP
0/3/NPU2           Slice                      UP
0/3/NPU3           Slice                      UP
0/3/NPU4           Slice                      UP
0/4/CPU0           NC6-2/10X100G-L-K          IOS XR RUN        NSHUT
```

```
0/4/NPU0          Slice                     UP
0/4/NPU1          Slice                     UP
0/4/NPU2          Slice                     UP
0/4/NPU3          Slice                     UP
0/4/NPU4          Slice                     UP
0/5/CPU0          NC6-10X100G-M-K           IOS XR RUN        NSHUT
0/5/NPU0          Slice                     UP
0/5/NPU1          Slice                     UP
0/5/NPU2          Slice                     UP
0/5/NPU3          Slice                     UP
```

This is an example for multi-chassis system:

```
Node            Type            PLIM            State           Config State
--------------------------------------------------------------------------------
1/RP1/CPU0      RP(Standby)     N/A             IOS XR RUN      PWR,NSHUT,MON
1/7/CPU0        LC              GE              IOS XR RUN      PWR,NSHUT,MON
0/RP1/CPU0      RP(Standby)     N/A             IOS XR RUN      PWR,NSHUT,MON
0/RP0/CPU0      RP(Active)      N/A             IOS XR RUN      PWR,NSHUT,MON
0/0/CPU0        LC              GE              IOS XR RUN      PWR,NSHUT,MON
1/0/CPU0        LC              GE              IOS XR RUN      PWR,NSHUT,MON
0/7/CPU0        LC              GE              IOS XR RUN      PWR,NSHUT,MON
1/RP0/CPU0      RP(Active)      N/A             IOS XR RUN      PWR,NSHUT,MON
RP/0/RP0/CPU0:MCDT3#
```

Verify that all RPs and LCs are listed and their state is "IOS XR RUN". This indicates that the XR VM is operational on the cards.

If the XR VM is not running, no output is shown for that location in the result. In this case, verify the state of SDR on the node using the **show sdr** command in the System Admin EXEC mode. For details, see Verify SDR Information, on page 62. Also, verify that the node state is "OPERATIONAL" in the result of **show platform** command in the System Admin EXEC mode, as described in Step 3.

Step 2 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 3 **show platform**

Example:

```
sysadmin-vm:0_RP0#show platform
```

The **show platform** command when executed from the System Admin EXEC mode displays the status of all hardware units like cards (RPs, LCs, and FCs), and hardware modules (fan trays) on the router.

This is an example for single-chassis system:

```
Location  Card Type                HW State      SW State      Config State
--------------------------------------------------------------------------------
0/RP0     NC6-RP                   OPERATIONAL   OPERATIONAL   NSHUT
0/RP1     NC6-RP                   OPERATIONAL   OPERATIONAL   NSHUT
0/FC0     NC6-FC                   OPERATIONAL   N/A           NSHUT
0/FT0     P-L-FANTRAY              OPERATIONAL   N/A           NSHUT
0/FT1     P-L-FANTRAY              OPERATIONAL   N/A           NSHUT
```

```
0/3       NC6-10X100G-M           OPERATIONAL   OPERATIONAL   NSHUT
0/7       NC6-10X100G-M           FAILED        FAILED        NSHUT
0/PT1     PWR-2KW-DC-V2 1.0       OPERATIONAL   N/A           NSHUT
```

This is an example for multi-chassis system:

```
Wed Jun  4  15:08:09.495 UTC
Location  Card Type               HW State      SW State      Config State
--------------------------------------------------------------------------------
0/3       NC6-10X100G-M-P         OPERATIONAL   OPERATIONAL   NSHUT
0/6       NC6-10X100G-M-P         OPERATIONAL   OPERATIONAL   NSHUT
0/RP0     NC6-RP                  OPERATIONAL   OPERATIONAL   NSHUT
0/RP1     P-L-RP                  OPERATIONAL   OPERATIONAL   NSHUT
0/FC2     NC6-FC-MC               OPERATIONAL   N/A           NSHUT
0/FC3     NC6-FC-MC               OPERATIONAL   N/A           NSHUT
0/FC4     NC6-FC-MC               OPERATIONAL   N/A           NSHUT
0/FC5     NC6-FC-MC               OPERATIONAL   N/A           NSHUT
0/FT0     NC6-FANTRAY             OPERATIONAL   N/A           NSHUT
0/FT1     NC6-FANTRAY             OPERATIONAL   N/A           NSHUT
0/PT1     PROTO-AC-PWRTRAY        OPERATIONAL   N/A           NSHUT
1/FC2     NC6-FC-MC               OPERATIONAL   N/A           NSHUT
1/FC3     NC6-FC-MC               OPERATIONAL   N/A           NSHUT
1/FC4     NC6-FC-MC               OPERATIONAL   N/A           NSHUT
1/FC5     NC6-FC-MC               OPERATIONAL   N/A           NSHUT
1/CI0     NCS-CRFT                OPERATIONAL   N/A           NSHUT
1/FT0     NC6-FANTRAY             OPERATIONAL   N/A           NSHUT
1/FT1     NC6-FANTRAY             OPERATIONAL   N/A           NSHUT
1/PT0     NCS-AC-PWRTRAY          OPERATIONAL   N/A           NSHUT
1/PT1     NCS-AC-PWRTRAY          OPERATIONAL   N/A           NSHUT
F0/SC0    P-F-SCSW                OPERATIONAL   OPERATIONAL   NSHUT
F0/SC1    P-F-SC                  OPERATIONAL   OPERATIONAL   NSHUT
F0/FT0    NCS-FCC-FANTRAY         OPERATIONAL   N/A           NSHUT
F0/FT1    NCS-FCC-FANTRAY         OPERATIONAL   N/A           NSHUT
F1/PT1    P-F-AC-PWRTRAY          OPERATIONAL   N/A           NSHUT
F1/SW0    NCS-F-SCSW (SW)         OPERATIONAL   N/A           NSHUT
```

Verify that all cards installed on the router are displayed in the result. The software state of LCs and RPs and the hardware state of FC and FTs should be "OPERATIONAL". Various hardware and software states are listed here.

Hardware states:

- OPERATIONAL—Card is operating normally and is fully functional
- POWERED_ON—Power is on and the card is booting up
- FAILED—Card is powered on but has experienced some internal failure
- PRESENT—Card is in the shutdown state
- OFFLINE—User has changed the card state to OFFLINE. The card is accessible for diagnostics

Software states:

- DIAG_MODE—User has changed the card state to OFFLINE for diagnosis
- OPERATIONAL—Software is operating normally and is fully functional
- SW_INACTIVE—Software is not completely operational
- FAILED—Software is operational but the card has experienced some internal failure

Note In the result, the RPs are not highlighted as active and standby. This is because, at all times, the System Admin VM is operational on both RPs. If one RP fails, the System Admin VM running on the other RP continues to manage all the System Admin functions of the router.

Verify Software Version

The Cisco NCS 6008 router is shipped with the Cisco IOS XR software pre-installed. Verify that the latest version of the software is installed. If a newer version is available, perform a system upgrade. This will install the newer version of the software and provide the latest feature set on the router.

Perform this task to verify the version of Cisco IOS XR software running on the router.

SUMMARY STEPS

1. **show version**

DETAILED STEPS

show version

Example:

```
RP/0/RP0/CPU0:router# show version
```

Displays the version of the various software components installed on the router. The result includes the version of Cisco IOS XR software, its various components, and BIOS information.

Only that portion of the output where the Cisco IOS XR software version is displayed is shown here:

What to do next

Verify the result to ascertain whether a system upgrade or additional package installation is required. If that is required, refer to the tasks in the chapter Perform System Upgrade and Install Feature Packages, on page 79.

Verify Firmware Version

The firmware on various hardware components of the router must be compatible with the Cisco IOS XR image installed. Incompatibility might cause the router to malfunction. Complete this task to verify the firmware version.

SUMMARY STEPS

1. **admin**
2. **show hw-module fpd**

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **show hw-module fpd**

Example:

```
sysadmin-vm:0_RP0#show hw-module fpd
```

Displays the firmware information for various hardware components of the router.

```
RP/0/RP1/CPU0:#show hw-module fpd

                                                                  FPD Versions
                                                                  ================
Location   Card type        HWver FPD device       ATR Status   Running Programd
-------------------------------------------------------------------------------
0/0        NC6-10X100G-M-K   2.0   Backup-BIOS      BSP CURRENT           14.00
0/0        NC6-10X100G-M-K   2.0   Backup-CCC-PwrOn BSP CURRENT            1.36
0/0        NC6-10X100G-M-K   2.0   Backup-EthSwitch BSP CURRENT            1.33
0/0        NC6-10X100G-M-K   2.0   BAO-DB-FPGA          CURRENT    1.06    1.06
0/0        NC6-10X100G-M-K   2.0   BAO-MB-FPGA          CURRENT    1.06    1.06
0/0        NC6-10X100G-M-K   2.0   CCC-Bootloader   BSP CURRENT            2.09
0/0        NC6-10X100G-M-K   2.0   CCC-FPGA          S  CURRENT    2.11    2.11
0/0        NC6-10X100G-M-K   2.0   CCC-Power-On      S  CURRENT    1.41    1.41
0/0        NC6-10X100G-M-K         CPAK-bay-0-FPD       NOT READY
0/0        NC6-10X100G-M-K         CPAK-bay-1-FPD       NOT READY
0/0        NC6-10X100G-M-K         CPAK-bay-2-FPD       NOT READY
0/0        NC6-10X100G-M-K         CPAK-bay-3-FPD       NOT READY
0/0        NC6-10X100G-M-K         CPAK-bay-4-FPD       NOT READY
0/0        NC6-10X100G-M-K         CPAK-bay-5-FPD       NOT READY
0/0        NC6-10X100G-M-K   2.0   CPAK-bay-6-SR10      CURRENT    2.03    2.03
0/0        NC6-10X100G-M-K   2.0   CPAK-bay-7-SR10      CURRENT    2.03    2.03
0/0        NC6-10X100G-M-K   2.0   CPAK-bay-8-LR10      CURRENT    2.03    2.03
0/0        NC6-10X100G-M-K   2.0   CPAK-bay-9-SR10      CURRENT    2.03    2.03
0/0        NC6-10X100G-M-K   2.0   Ethernet-Switch   S  CURRENT    1.33    1.33
0/0        NC6-10X100G-M-K   2.0   PLX-8748             CURRENT
```

In the result, the "RUN" column displays the current version of the firmware running on the FPD.

The "ATR Status" column displays the upgrade status of the firmware. It can display these states:

- READY—The firmware of the FPD is ready for an upgrade.
- NOT READY—The firmware of the FPD is not ready for an upgrade.
- NEED UPGD—A newer firmware version is available in the installed image. It is recommended that an upgrade be performed.
- UPGD DONE—The firmware upgrade is successful.
- UPGD FAIL—The firmware upgrade has failed.
- BACK IMG—The firmware is corrupted. Reinstall the firmware.

- UPGD SKIP—The upgrade has been skipped because the installed firmware version is higher than the one available in the image.

What to do next

- Upgrade the required firmware by using the **upgrade hw-module location all fpd** command in the System Admin EXEC mode. For the FPD upgrade to take effect, the router needs a power cycle.
- If required, turn on the auto fpd upgrade function. To do so, use the **fpd auto-upgrade enable** command in the System Admin Config mode. After it is enabled, if there are new FPD binaries present in the image being installed on the router, FPDs are automatically upgraded during the system upgrade operation.

Verify Interface Status

After the router has booted, all available interfaces must be discovered by the system. If interfaces are not discovered, it might indicate a malfunction in the unit. Complete this task to view the number of discovered interfaces.

For the multi-chassis system, run the command from one chassis. The verification commands will list information for all chassis.

SUMMARY STEPS

1. **show ipv4 interface summary**

DETAILED STEPS

show ipv4 interface summary

Example:

```
RP/0/RP0/CPU0:router#show ipv4 interface summary
```

When a router is turned on for the first time, all interfaces are in the 'unassigned' state. Verify that the total number of interfaces displayed in the result matches with the actual number of interfaces present on the router.

```
IP address      State   State           State           State
config          up,up   up,down         down,down       shutdown,down
--------------------------------------------------------------------
Assigned        0       0               0               0
Unnumbered      0       0               0               0
Unassigned      0       0               0               4
```

In the above result:

- Assigned— An IP address is assigned to the interface.
- Unnumbered— Interface which has borrowed an IP address already configured on one of the other interfaces of the router.
- Unassigned—No IP address is assigned to the interface.

You can also use the **show interfaces brief** and **show interfaces summary** commands in the XR EXEC mode to verify the interface status.

Verify Fabric Plane

The packets traverse from the ingress to the egress interfaces over the fabric plane. There can be a maximum of six fabric planes. The Cisco NCS routing system fabric is implemented through multiple redundant fabric cards (FCs) installed in the line card chassis.

For the multi-chassis system, run the command from one chassis. The verification commands will list information for all chassis.

Complete this task to verify the status of the fabric planes.

Before you begin

Install all required fabric cards on the router.

SUMMARY STEPS

1. **admin**
2. **show controller fabric plane all**

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **show controller fabric plane all**

Example:

```
sysadmin-vm:0_RP0#show controller fabric plane all
```

Displays the status of the switch fabric plane.

Verify that the Admin State and Plane State for all operational planes is "UP". Each fabric card represents one plane. If the Plane State is "DN", it indicates that traffic is not able to reach any destination using the plane. If the Plane State is "MCAST_DN", it indicates that some destinations are not reachable using the plane. This indicates that one fabric card in the line card chassis (LCC) is not operational. Reinstall the fabric card and verify that its state is "OPERATIONAL" in the result of **show platform** command in the System Admin EXEC mode.

Verify SDR Information

Secure domain routers (SDRs) divide a single physical system into multiple logically-separated routers. SDRs are also known as logical routers (LRs). On the Cisco NCS 6008 router, only one SDR is supported. This SDR is termed the default-sdr. Every router is shipped with the default-sdr, which owns all RPs and LCs installed in the routing system. An instance of this SDR runs on all nodes. Complete this task to verify the details of the SDR instances.

For the multi-chassis system, run the command from one chassis. The verification commands will list information for all chassis.

SUMMARY STEPS

1. **admin**
2. **sh sdr**

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **sh sdr**

Example:

```
sysadmin-vm:0_RP0# sh sdr
```

Displays the SDR information for every node.

```
SDR: default-sdr
Location     IP Address      Status           Boot Count  Time Started
------------------------------------------------------------------------------
0/RP0/VM1    192.0.0.4       RUNNING          1           02/13/2017 10:06:01
0/RP1/VM1    192.0.4.4       RUNNING          2           02/13/2017 07:27:25
0/0/VM1      192.0.64.3      RUNNING          1           02/10/2017 12:44:02
0/1/VM1      192.0.68.3      RUNNING          1           02/10/2017 12:44:02
0/2/VM1      192.0.72.3      RUNNING          1           02/10/2017 12:44:01
0/3/VM1      192.0.76.3      RUNNING          1           02/10/2017 12:44:01
0/4/VM1      192.0.80.3      RUNNING          1           02/10/2017 12:55:10
0/5/VM1      192.0.84.3      RUNNING          1           02/10/2017 12:44:02
0/6/VM1      192.0.88.3      RUNNING          1           02/10/2017 12:44:04
0/7/VM1      192.0.92.3      RUNNING          1           02/10/2017 12:44:01
1/RP0/VM1    192.1.0.4       RUNNING          1           02/13/2017 10:06:14
1/RP1/VM1    192.1.4.4       RUNNING          1           02/13/2017 07:28:54
1/0/VM1      192.1.64.3      RUNNING          1           02/13/2017 04:31:21
1/1/VM1      192.1.68.3      RUNNING          1           02/13/2017 04:31:22
1/2/VM1      192.1.72.3      RUNNING          1           02/13/2017 04:31:22
1/3/VM1      192.1.76.3      RUNNING          1           02/13/2017 05:19:19
1/4/VM1      192.1.80.3      RUNNING          1           02/13/2017 04:31:20
1/5/VM1      192.1.84.3      RUNNING          1           02/13/2017 04:31:22
```

```
1/6/VM1      192.1.88.3      RUNNING          1           02/13/2017 04:40:26
1/7/VM1      192.1.92.3      RUNNING          1           02/13/2017 04:31:22
```

For a functional SDR, the VM State is "RUNNING". If the SDR is not running on a node, no output is shown in the result, for that location. At times the node performs a core dump. During such times the VM State is "Paused & Core Dump in Progress".

What to do next

If you find SDR is not running on a node, try reloading the node. To do that, use the **hw-module location** *node-id* **reload** command in the System Admin EXEC mode.

Verify Control Ethernet Connections

The control ethernet connections connect the chassis within the multi-chassis system. A control ethernet failure disconnects one or more chassis from rest of the system. If the chassis is disconnected, the connectivity with the fabric cards chassis is impaired. The disconnect can be due to fiber cut, hardware failure or software failure.

For the multi-chassis system, run the command from one chassis. The verification commands will list information for all chassis.

Complete this task to verify the status of the control ethernet connections.

SUMMARY STEPS

1. **admin**
2. **show controller switch summary**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**admin** **Example:** `RP/0/RP0/CPU0:router# admin`	Enters System Admin EXEC mode.

Step 2	**show controller switch summary**
	Example:
	`sysadmin-vm:0_RP0#show controller switch summary`
		Displays the summary of the switch.
		`Wed Jun  4  17:23:19.752 UTC`
		`Rack  Card  Switch  Rack Serial Number`
		`----------------------------------------`
		`0     RP0   RP-SW   FMP12020050`
		`Port  Phys State  Admin State  Port Speed  Protocol State  Forward State  Connects To`
		`0     Down   Up     10-Gbps  Down      -  LC7`
		`2     Up     Up     10-Gbps  Standby   Forwarding  LC6`

	Command or Action	Purpose
		4 Down Up 1-Gbps Down - FC0 5 Down Up 1-Gbps Down - FC1 6 Down Up 10-Gbps Down - LC5 8 Down Up 10-Gbps Down - LC4 10 Up Up 1-Gbps Standby Forwarding FC2 16 Down Up 10-Gbps Down - LC0 18 Down Up 10-Gbps Down - LC1 20 Up Up 1-Gbps Standby Forwarding FC5 21 Up Up 1-Gbps Standby Forwarding FC4 22 Down Up 10-Gbps Down - LC2 24 Up Up 10-Gbps Standby Forwarding LC3 26 Up Up 1-Gbps Standby Forwarding FC3 32 Up Up 10-Gbps Standby Forwarding RP1 Card (RP0 Ctrl) 34 Up Up 10-Gbps - Forwarding RP1 Card (RP1 Ctrl) 36 Up Up 1-Gbps - Forwarding Mgmt Eth0 37 Up Up 1-Gbps - Forwarding CCC (RP1 Ctrl) 38 Up Up 1-Gbps Standby Forwarding CCC (RP0 Ctrl) 40 Up Up 10-Gbps - Forwarding RP0 CPU (0) 48 Down Up 10-Gbps - - I/F Shelf Eth4 49 Down Up 10-Gbps - - I/F Shelf Eth5 50 Down Up 10-Gbps - - I/F Shelf Eth2 51 Down Up 10-Gbps - - I/F Shelf Eth3 54 Up Up 1-Gbps - Forwarding Mgmt Eth1 56 Down Up 10-Gbps - - I/F Shelf Eth0 57 Down Up 10-Gbps - - I/F Shelf Eth1 58 Up Up 10-Gbps Active Forwarding Exp Eth0 59 Up Up 10-Gbps Standby Blocking Exp Eth1 Verify the state of Exp Eth 0 and Exp Eth 1 ports. One port must be in Active (Forwarding) state, and one port in Standby (Blocking) state. The state of the ethernet port is decided by the system. Verify that the connected ports are

	Command or Action	Purpose
		up, active and in forwarding state. If the states are not displayed correctly, check the control ethernet cabling.

Monitor Craft Panel Interface

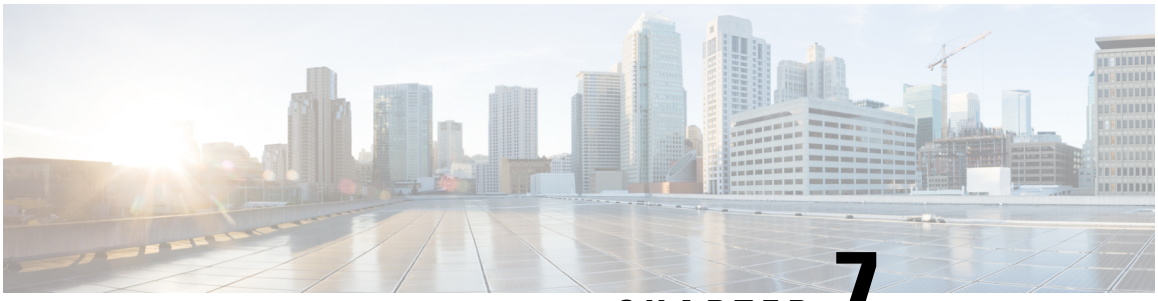
Network Convergence System (NCS) 6000 system has a craft panel interface on the front of fabric card chassis (FCC). The craft panel interface assists the field operator in monitoring and troubleshooting the router. It consists of a touch screen LCD display and three LEDs. The LEDs indicate minor, major and critical alarms.

For more information about completing the hardware installation, see Cisco Network Convergence System 6000 Series Routers Hardware Installation Guide.

On powering up, the main screen is displayed on the craft panel LCD. The craft panel has a settings screen to adjust the brightness, volume of audio alarms and inactivity timer for the LCD. You can turn off the LCD display with the help of the sleep button. There is a help option on every screen. This option displays information (in text) for each button. Refresh and back buttons (available on each screen) enable the user to refresh and go back to the previous screen, respectively.

Craft panel interface is used to fetch the following information from the chassis:

- Chassis power configuration and consumption. This is similar to the output of the **show environment power** command.
- Power Entry Module (PEM) status information of the chassis. This is similar to the output of the **show environment power** command.
- Fan operation speed and current status. This is similar to the output of the **show environment fan** command.
- Alarms in the chassis. This is similar to the output of the **show alarms** command.
- Chassis temperature information for the route processors and shelf controllers.
- Hardware and software state of all cards in the chassis.
- Router name and rack-id of chassis (on each screen).
- Uptime of the route processors.
- Messages for the craft operator from the administrator sent from a remote location.



CHAPTER 7

Create User Profiles and Assign Privileges

To provide controlled access to the System Admin configurations on the Cisco NCS 6008 router, user profiles are created with assigned privileges. The privileges are specified using command rules and data rules. The authentication, authorization, and accounting (aaa) commands are used in the System Admin Config mode for the creation of users, groups, command rules, and data rules. The "aaa" commands are also used for changing the disaster-recovery password.

Note You cannot configure the external AAA server and services from the System Admin VM. It can be configured only from the XR VM.

Note If any user on XR is deleted, the local database checks whether there is a first user on System Admin VM.

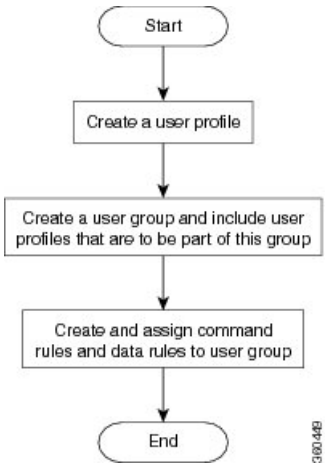
- If there is a first user, no syncing occurs.
- If there is no first user, then the first user on XR (based on the order of creation) is synced to System Admin VM.

For more information on AAA services, see Configuring AAA Services chapter in System Security Configuration Guide for Cisco NCS 6000 Series Routers

Users are authenticated using username and password. Authenticated users are entitled to execute commands and access data elements based on the command rules and data rules that are created and applied to user groups. All users who are part of a user group have such access privileges to the system as defined in the command rules and data rules for that user group.

The workflow for creating user profile is represented in this flow chart:

Figure 6: Workflow for Creating User Profiles



Note The root-lr user, created for the XR VM during initial router start-up, is mapped to the root-system user for the System Admin VM. The root-system user has superuser permissions for the System Admin VM and therefore has no access restrictions.

Use the **show run aaa** command in the System Admin Config mode to view existing aaa configurations.

The topics covered in this chapter are:

- Create a User Profile, on page 68
- Create a User Group, on page 70
- Create Command Rules, on page 72
- Create Data Rules, on page 74
- Change Disaster-recovery Username and Password, on page 77
- Recover Password using PXE Boot, on page 78

Create a User Profile

Create new users for the System Admin VM. Users are included in a user group and assigned certain privileges. The users have restricted access to the commands and configurations in the System Admin VM console, based on assigned privileges.

The router supports a maximum of 1024 user profiles.

Note Users created in the System Admin VM are different from the ones created in XR VM. As a result, the username and password of a System Admin VM user cannot be used to access the XR VM, and vice versa.

The root-lr user of XR VM can access the System Admin VM by entering **Admin** command in the XR EXEC mode. The router does not prompt you to enter any username and password. The XR VM root-lr user is provided full access to the System Admin VM.

If you access the System Admin VM by directly connecting to the System Admin VM console port or System Admin VM management port, you will be prompted to enter the System Admin username and password that is created in this task.

SUMMARY STEPS

1. **admin**
2. **config**
3. **aaa authentication users user** *user_name*
4. **password** *password*
5. **uid** *user_id_value*
6. **gid** *group_id_value*
7. **ssh_keydir** *ssh_keydir*
8. **homedir** *homedir*
9. Use the **commit** or **end** command.

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **config**

Example:

```
sysadmin-vm:0_RP0#config
```

Enters System Admin Config mode.

Step 3 **aaa authentication users user** *user_name*

Example:

```
sysadmin-vm:0_RP0(config)#aaa authentication users user us1
```

Creates a new user and enters user configuration mode. In the example, the user "us1" is created.

Step 4 **password** *password*

Example:

```
sysadmin-vm:0_RP0(config-user-us1)#password pwd1
```

Enter the password that will be used for user authentication at the time of login into System Admin VM.

Step 5 **uid** *user_id_value*

Example:

```
sysadmin-vm:0_RP0(config-user-us1)#uid 100
```

Specify a numeric value. You can enter any 32 bit integer.

Step 6 **gid** *group_id_value*

Example:

```
sysadmin-vm:0_RP0(config-user-us1)#gid 50
```

Specify a numeric value. You can enter any 32 bit integer.

Step 7 **ssh_keydir** *ssh_keydir*

Example:

```
sysadmin-vm:0_RP0(config-user-us1)#ssh_keydir dir1
```

Specify any alphanumeric value.

Step 8 **homedir** *homedir*

Example:

```
sysadmin-vm:0_RP0(config-user-us1)#homedir dir2
```

Specify any alphanumeric value.

Step 9 Use the **commit** or **end** command.

commit —Saves the configuration changes and remains within the configuration session.

end —Prompts user to take one of these actions:

- **Yes** — Saves configuration changes and exits the configuration session.
- **No** —Exits the configuration session without committing the configuration changes.
- **Cancel** —Remains in the configuration session, without committing the configuration changes.

What to do next

- Create user group that includes the user created in this task. See Create a User Group, on page 70.
- Create command rules that apply to the user group. See Create Command Rules, on page 72.
- Create data rules that apply to the user group. See Create Data Rules, on page 74.

Create a User Group

Create a new user group to associate command rules and data rules with it. The command rules and data rules are enforced on all users that are part of the user group.

The router supports a maximum of 32 user groups.

Before you begin

Create a user profile. See Create a User Profile, on page 68.

SUMMARY STEPS

1. **admin**
2. **config**

3. **aaa authentication groups group** *group_name*
4. **users** *user_name*
5. **gid** *group_id_value*
6. Use the **commit** or **end** command.

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **config**

Example:

```
sysadmin-vm:0_RP0#config
```

Enters System Admin Config mode.

Step 3 **aaa authentication groups group** *group_name*

Example:

```
sysadmin-vm:0_RP0(config)#aaa authentication groups group gr1
```

Creates a new user group (if it is not already present) and enters the group configuration mode. In this example, the user group "gr1" is created.

Note By default, the user group "root-system" is created by the system at the time of root user creation. The root user is part of this user group. Users added to this group will get root user permissions.

Step 4 **users** *user_name*

Example:

```
sysadmin-vm:0_RP0(config-group-gr1)#users us1
```

Specify the name of the user that should be part of the user group.

You can specify multiple user names enclosed withing double quotes. For example, **users** "*user1 user2 ...*".

Step 5 **gid** *group_id_value*

Example:

```
sysadmin-vm:0_RP0(config-group-gr1)#gid 50
```

Specify a numeric value. You can enter any 32 bit integer.

Step 6 Use the **commit** or **end** command.

commit —Saves the configuration changes and remains within the configuration session.

end —Prompts user to take one of these actions:

- **Yes** — Saves configuration changes and exits the configuration session.
- **No** —Exits the configuration session without committing the configuration changes.

- **Cancel** —Remains in the configuration session, without committing the configuration changes.

What to do next

- Create command rules. See Create Command Rules, on page 72.
- Create data rules. See Create Data Rules, on page 74.

Create Command Rules

Command rules are rules based on which users of a user group are either permitted or denied the use of certain commands. Command rules are associated to a user group and get applied to all users who are part of the user group.

A command rule is created by specifying whether an operation is permitted, or denied, on a command. This table lists possible operation and permission combinations:

Operation	**Accept Permission**	**Reject Permission**
Read (R)	Command is displayed on the CLI when "?" is used.	Command is not displayed on the CLI when "?" is used.
Execute (X)	Command can be executed from the CLI.	Command cannot be executed from the CLI.
Read and execute (RX)	Command is visible on the CLI and can be executed.	Command is neither visible nor executable from the CLI.

By default, all permissions are set to **Reject**.

Each command rule is identified by a number associated with it. When multiple command rules are applied to a user group, the command rule with a lower number takes precedence. For example, cmdrule 5 permits read access, while cmdrule10 rejects read access. When both these command rules are applied to the same user group, the user in this group gets read access because cmdrule 5 takes precedence.

As an example, in this task, the command rule is created to deny read and execute permissions for the "show platform" command.

Before you begin

Create an user group. See Create a User Group, on page 70.

SUMMARY STEPS

1. **admin**
2. **config**
3. **aaa authorization cmdrules cmdrule** *command_rule_number*
4. **command** *command_name*
5. **ops {r** | **x** | **rx}**
6. **action** {**accept** | **accept_log** | **reject**}
7. **group** *user_group_name*

8. **context** *connection_type*
9. Use the **commit** or **end** command.

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **config**

Example:

```
sysadmin-vm:0_RP0#config
```

Enters System Admin Config mode.

Step 3 **aaa authorization cmdrules cmdrule** *command_rule_number*

Example:

```
sysadmin-vm:0_RP0(config)#aaa authorization cmdrules cmdrule 1100
```

Specify a numeric value as the command rule number. You can enter a 32 bit integer.

Important Do no use numbers between 1 to 1000 because they are reserved by Cisco.

This command creates a new command rule (if it is not already present) and enters the command rule configuration mode. In the example, command rule "1100" is created.

Note By default "cmdrule 1" is created by the system when the root-system user is created. This command rule provides "accept" permission to "read" and "execute" operations for all commands. Therefore, the root user has no restrictions imposed on it, unless "cmdrule 1" is modified.

Step 4 **command** *command_name*

Example:

```
sysadmin-vm:0_RP0(config-cmdrule-1100)#command "show platform"
```

Specify the command for which permission is to be controlled.

If you enter an asterisk '*****' for **command**, it indicates that the command rule is applicable to all commands.

Step 5 **ops {r | x | rx}**

Example:

```
sysadmin-vm:0_RP0(config-cmdrule-1100)#ops rx
```

Specify the operation for which permission has to be specified:

- **r** — Read
- **x** — Execute
- **rx** — Read and execute

Step 6 **action** {**accept** | **accept_log** | **reject**}

Example:

```
sysadmin-vm:0_RP0(config-cmdrule-1100)#action reject
```

Specify whether users are permitted or denied the use of the operation.

- **accept** — users are permitted to perform the operation
- **accept_log**— users are permitted to perform the operation and every access attempt is logged.
- **reject**— users are restricted from performing the operation.

Step 7 **group** *user_group_name*

Example:

```
sysadmin-vm:0_RP0(config-cmdrule-1100)#group gr1
```

Specify the user group on which the command rule is applied.

Step 8 **context** *connection_type*

Example:

```
sysadmin-vm:0_RP0(config-cmdrule-1100)#context *
```

Specify the type of connection to which this rule applies. The connection type can be *netconf* (Network Configuration Protocol), *cli* (Command Line Interface), or *xml* (Extensible Markup Language). It is recommended that you enter an asterisk '*'; this indicates that the command rule applies to all connection types.

Step 9 Use the **commit** or **end** command.

commit —Saves the configuration changes and remains within the configuration session.

end —Prompts user to take one of these actions:

- **Yes** — Saves configuration changes and exits the configuration session.
- **No** —Exits the configuration session without committing the configuration changes.
- **Cancel** —Remains in the configuration session, without committing the configuration changes.

What to do next

Create data rules. See Create Data Rules, on page 74.

Create Data Rules

Data rules are rules based on which users of the user group are either permitted, or denied, accessing and modifying configuration data elements. The data rules are associated to a user group. The data rules get applied to all users who are part of the user group.

Each data rule is identified by a number associated to it. When multiple data rules are applied to a user group, the data rule with a lower number takes precedence.

Before you begin

Create an user group. See Create a User Group, on page 70.

SUMMARY STEPS

1. **admin**
2. **config**
3. **aaa authorization datarules datarule** *data_rule_number*
4. **keypath** *keypath*
5. **ops** *operation*
6. **action** {**accept** | **accept_log** | **reject**}
7. **group** *user_group_name*
8. **context** *connection type*
9. **namespace** *namespace*
10. Use the **commit** or **end** command.

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **config**

Example:

```
sysadmin-vm:0_RP0#config
```

Enters System Admin Config mode.

Step 3 **aaa authorization datarules datarule** *data_rule_number*

Example:

```
sysadmin-vm:0_RP0(config)#aaa authorization datarules datarule 1100
```

Specify a numeric value as the data rule number. You can enter a 32 bit integer.

Important Do no use numbers between 1 to 1000 because they are reserved by Cisco.

This command creates a new data rule (if it is not already present) and enters the data rule configuration mode. In the example, data rule "1100" is created.

Note By default "datarule 1" is created by the system when the root-system user is created. This data rule provides "accept" permission to "read", "write", and "execute" operations for all configuration data. Therefore, the root user has no restrictions imposed on it, unless "datarule 1" is modified.

Step 4 **keypath** *keypath*

Example:

```
sysadmin-vm:0_RP0(config-datarule-1100)#keypath  /aaa/disaster-recovery
```

Specify the keypath of the data element. The keypath is an expression defining the location of the data element. If you enter an asterisk '*' for **keypath** , it indicates that the command rule is applicable to all configuration data.

Step 5 **ops** *operation*

Example:

```
sysadmin-vm:0_RP0(config-datarule-1100)#ops rw
```

Specify the operation for which permission has to be specified. Various operations are identified by these letters:

- c—Create
- d—Delete
- u—Update
- w— Write (a combination of create, update, and delete)
- r—Read
- x—Execute

Step 6 **action** {**accept** | **accept_log** | **reject**}

Example:

```
sysadmin-vm:0_RP0(config-datarule-1100)#action reject
```

Specify whether users are permitted or denied the operation.

- **accept** — users are permitted to perform the operation
- **accept_log**— users are permitted to perform the operation and every access attempt is logged
- **reject**— users are restricted from performing the operation

Step 7 **group** *user_group_name*

Example:

```
sysadmin-vm:0_RP0(config-datarule-1100)#group gr1
```

Specify the user group on which the data rule is applied. Multiple group names can also be specified.

Step 8 **context** *connection type*

Example:

```
sysadmin-vm:0_RP0(config-datarule-1100)#context *
```

Specify the type of connection to which this rule applies. The connection type can be *netconf* (Network Configuration Protocol), *cli* (Command Line Interface), or *xml* (Extensible Markup Language). It is recommended that you enter an asterisk '*', which indicates that the command applies to all connection types.

Step 9 **namespace** *namespace*

Example:

```
sysadmin-vm:0_RP0(config-datarule-1100)#namespace *
```

Enter asterisk '*' to indicate that the data rule is applicable for all namespace values.

Step 10 Use the **commit** or **end** command.

commit —Saves the configuration changes and remains within the configuration session.

end —Prompts user to take one of these actions:

- **Yes** — Saves configuration changes and exits the configuration session.
- **No** —Exits the configuration session without committing the configuration changes.
- **Cancel** —Remains in the configuration session, without committing the configuration changes.

Change Disaster-recovery Username and Password

When you define the root-system username and password initially after starting the router, the same username and password gets mapped as the disaster-recovery username and password for the System Admin VM. However, it can be changed.

The disaster-recovery username and password is useful in these scenarios:

- Access the system when the AAA database, which is the default source for authentication in System Admin VM, is corrupted.
- Access the system through the management port, when, for some reason, the System Admin VM console is not working.
- Create new users by accessing the System Admin VM using the disaster-recovery username and password, when the regular username and password is forgotten.

Note On the router, you can configure only one disaster-recovery username and password at a time.

Before you begin

Complete the user creation. For details, see Create a User Profile, on page 68.

SUMMARY STEPS

1. **admin**
2. **config**
3. **aaa disaster-recovery username** *username* **password** *password*
4. Use the **commit** or **end** command.

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0/CPU0:router# admin
```

Enters System Admin EXEC mode.

Step 2 **config**

Example:

```
sysadmin-vm:0_RP0#config
```

Enters System Admin Config mode.

Step 3 **aaa disaster-recovery username** *username* **password** *password*

Example:

```
sysadmin-vm:0_RP0(config)#aaa disaster-recovery username us1 password pwd1
```

Specify the disaster-recovery username and the password. You have to select an existing user as the disaster-recovery user. In the example, 'us1' is selected as the disaster-recovery user and assigned the password as 'pwd1'. The password can be entered as a plain text or md5 digest string.

When you need to make use of the disaster recovery username, you need to enter it as *username***@localhost**.

Step 4 Use the **commit** or **end** command.

commit —Saves the configuration changes and remains within the configuration session.

end —Prompts user to take one of these actions:

- **Yes** — Saves configuration changes and exits the configuration session.
- **No** —Exits the configuration session without committing the configuration changes.
- **Cancel** —Remains in the configuration session, without committing the configuration changes.

Recover Password using PXE Boot

If you are unable to login or lost your XR and System administration passwords, use the following steps to create new password. A lost password cannot be recovered, instead a new username and password must be created with a non-graceful PXE boot.

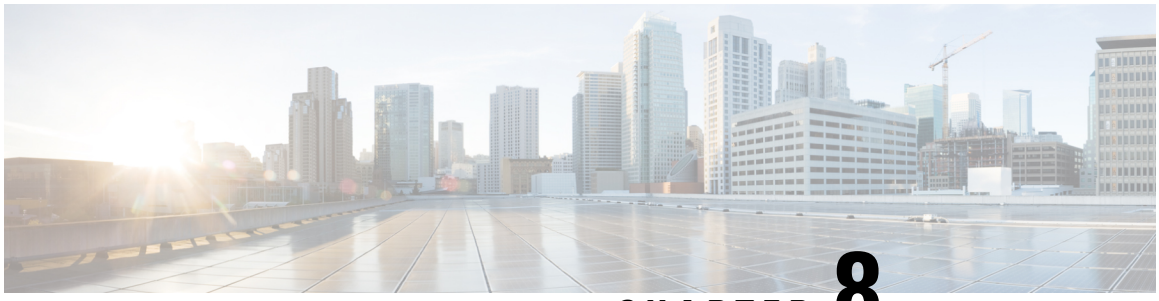
Step 1 To recover XR password, add or remove the SDR from System admin configuration.

After the SDR is added or removed, verify the configuration. See Verify SDR Information, on page 62.

Step 2 To recover the System admin password, PXE boot the router.

Note PXE boot is fully intrusive. The router state, configuration and image is reset.

Step 3 Reset the password.



CHAPTER 8

Perform System Upgrade and Install Feature Packages

On Cisco NCS 6008 routers, system upgrade and package installation processes are executed using **install** commands. The processes involve adding and activating the iso images (*.iso*), feature packages (*.pkg*), and software maintenance upgrade files (*.smu*) on the router. These files are accessed from a network server and then activated on the router. If the installed package or SMU causes any issue on the router, it can be uninstalled.

The topics covered in this chapter are:

- Upgrading the OS and Features, on page 79
- Upgrading Features, on page 80
- Workflow for Install Process, on page 80

Upgrading the OS and Features

You can upgrade the version of Cisco IOS XR on a router, from the XR VM. However, during system upgrade, the version of IOS XR that runs on both the XR VM and the System Admin VM is upgraded.

From Release 6.3.1 onwards, NCS 6000 supports the use of a composite RPM file for upgrading each, the XR VM and the System Admin VM. RPM is a Linux open standard packaging format that simplifies the dependency management of upgrade components, such as SMUs and packages. The RPM metadata and version helps to manage the SMUs. By using Linux-based RPM format for packages, you can enable asynchronous upgrade of packages and off-box development of tools.

For more information about the install process, see Workflow for Install Process, on page 80.

Upgrading Features

Installing a package on the router installs specific features that are part of that package. Each package contains components that perform a specific set of router functions, such as routing, security, and so on. Some of the standard XR VM packages are:

- `ncs6k-k9sec-1.0.0.0-r63113I.x86_64.rpm`
- `ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm`
- `ncs6k-mgbl-1.0.0.0-r63113I.x86_64.rpm`
- `ncs6k-mpls-1.0.0.0-r63113I.x86_64.rpm`

For more information about the install process, see Workflow for Install Process, on page 80.

Caution Do not perform any install operations when the router is reloading.

Do not reload the router during an upgrade operation.

Related Topics

Install Prepared Packages, on page 93
install prepare

Upgrading Features

Installing a package on the router installs specific features that are part of that package. Each package contains components that perform a specific set of router functions, such as routing, security, and so on. Some of the standard XR VM packages are:

- `ncs6k-k9sec-1.0.0.0-r63113I.x86_64.rpm`
- `ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm`
- `ncs6k-mgbl-1.0.0.0-r63113I.x86_64.rpm`
- `ncs6k-mpls-1.0.0.0-r63113I.x86_64.rpm`

For more information about the install process, see Workflow for Install Process, on page 80.

Workflow for Install Process

The workflow for installation and uninstallation processes is depicted in this flowchart.

For installing a package, see Install Packages, on page 80. For uninstalling a package, see Uninstall Packages, on page 88.

Install Packages

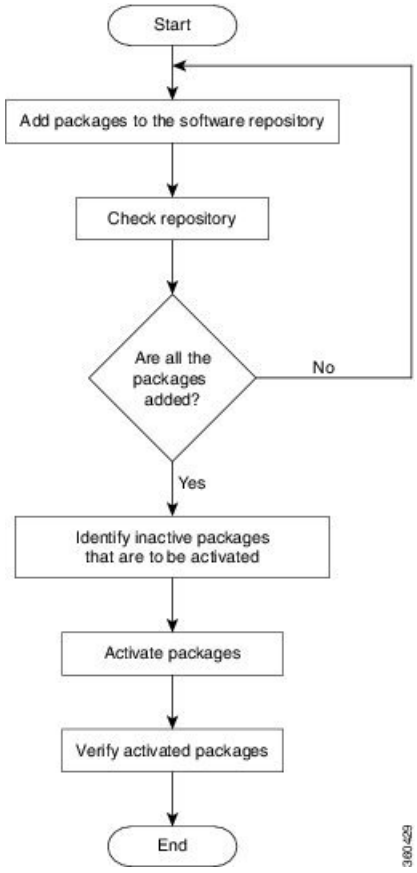
Complete this task to upgrade the system or install a patch. The system upgrade is done using an ISO image file, while the patch installation is done using packages and SMUs. This task is also used to install *.tar* files. The *.tar* file contains multiple packages and SMUs that are merged into a single file. A single *.tar* file can contain up to 64 individual files.

Note

- Depending on whether you are installing a System Admin package or a XR package, execute the **install** commands in the System Admin EXEC mode or XR EXEC mode respectively. All **install** commands are applicable in both these modes.
- Install operation over IPv6 is not supported.

The workflow for installing a package is shown in this flowchart.

Figure 7: Installing Packages Workflow



SUMMARY STEPS

1. Execute one of these:
   - **install add source** *<tftp transfer protocol>/package_path/ filename1 filename2 ...*
   - **install add source** *<ftp or sftp transfer protocol>//user@server:/package_path/ filename1 filename2 ...*
2. **show install request**
3. **show install repository**
4. **show install inactive**
5. Execute one of these:
   - **install activate** *package_name*
   - **install activate id** *operation_id*
6. **install commit**
7. **show install active**

DETAILED STEPS

Step 1 Execute one of these:

- **install add source** *<tftp transfer protocol>/package_path/ filename1 filename2 ...*
- **install add source** *<ftp or sftp transfer protocol>//user@server:/package_path/ filename1 filename2 ...*

Example:

```
RP/0/RP0/CPU0:router# install add source /harddisk:/ ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm
ncs6k-mpls-1.0.0.0-r63113I.x86_64.rpm
```

or

```
RP/0/RP0/CPU0:router# install add source sftp://root@8.33.5.15:/auto/ncs/package/
ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm ncs6k-mpls-1.0.0.0-r63113I.x86_64.rpm
```

or

```
RP/0/RP0/CPU0:router# install add source tftp://223.255.254.254/auto/ncs/package/ ncs6k-mini-x.iso
ncs6k-full-x.iso
```

The software files are unpacked from the package and added to the software repository. This operation might take time depending on the size of the files being added. The operation is performed in asynchronous mode. The **install add** command runs in the background, and the EXEC prompt is returned as soon as possible.

You can use ftp, tftp, or sftp protocols to transfer files from the network server to the router. Ftp and sftp protocols are supported from Release 5.0.1. In case of ftp and sftp protocols, you need to enter password within 60 seconds to continue with the **install add** operation. Otherwise, the operation is terminated. To use ftp and sftp protocols on the XR VM, it is mandatory that the `ncs6k-k9sec-1.0.0.0-r63113I.x86_64.rpm` package has been installed on the router.

Note The repositories for the XR VM and the System Admin VM are different. The system automatically adds a routing package to the XR VM repository and a system administration package to the System Admin VM repository.

Step 2 **show install request**

Example:

```
RP/0/RP0/CPU0:router#show install request
```

(Optional) Displays the operation ID of the add operation and its status. The percentage of installation in progress is displayed. The operation ID can be later used to execute the **activate** command.

```
Install operation 8 is still in progress
```

For system administration packages, the remaining steps must be performed from the System Admin EXEC mode. Use the **admin** command to enter the System Admin EXEC mode.

Step 3 **show install repository**

Example:

```
RP/0/RP0/CPU0:router#show install repository
```

Displays packages that are added to the repository. Packages are displayed only after the `install add` operation is complete.

```
1 package(s) in XR repository:
```

```
    ncs6k-iosxr-os-1.0.0.1-r63113I.CSCxr11111.x86_64
```

Step 4 **show install inactive**

Example:

From the XR VM:

```
RP/0/RP0/CPU0:router# show install active

2 inactive package(s) found:
ncs6k-mpls-1.0.0.0-r63113I.x86_64
ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm
```

From the SystemAdmin VM:

```
sysadmin-vm:0_RP0# show install inactive

Node 0/RP0 [RP]
     Inactive Packages:
        ncs6k-xr-6.3.1.13I
        ncs6k-mini-x-6.3.1.13I


Node 1/RP0 [RP]
    Inactive Packages:
         ncs6k-xr-6.3.1.13I
        ncs6k-mini-x-6.3.1.13I
```

Displays inactive packages that are present in the repository. Only inactive packages can be activated.

Step 5 Execute one of these:

- **install activate** *package_name*
- **install activate id** *operation_id*

Example:

```
RP/0/RP0/CPU0:router# install activate ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm
ncs6k-mpls-1.0.0.0-r63113I.x86_64.rpm
```

or

```
RP/0/RP0/CPU0:router#install activate id 8
```

The package configurations are made active on the router. As a result, new features and software fixes take effect. This operation is performed in asynchronous mode. The **install activate** command runs in the background, and the EXEC prompt is returned as soon as possible.

If you use the operation ID, all packages that were added in the specified operation are activated together. For example, if 5 packages are added in operation 8, by executing **install activate id 8**, all 5 packages are activated together. You do not have to activate the packages individually.

Activation of some SMUs require a manual reloading of the router. When such SMUs are activated, a warning message is displayed to perform reload. The components of the SMU get activated only after the reload is complete. Perform router reload immediately after executing the **install activate** command. If the SMU has dependency on both XR VM and System Admin VM, perform the reload after activating the SMU in both VMs so that they take effect simultaneously. To reload the router, use the **hw-module location all reload** command from the System Admin EXEC mode.

Step 6 **install commit**

Example:

```
RP/0/RP0/CPU0:router#install commit
```

Commits the newly active software.

Step 7 **show install active**

Example:

```
RP/0/RP0/CPU0:router#show install active
```

Displays packages that are active.

```
Node 0/RP0/CPU0 [RP]
  Boot Partition: xr_lv0
  Active Packages: 7
        ncs6k-xr-6.3.1.13I version=6.3.1.13I [Boot image]
        ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm
        ncs6k-mpls-1.0.0.0-r63113I
        ncs6k-iosxr-os-1.0.0.1-r63113I.CSCxr11111

Node 0/RP1/CPU0 [RP]
  Boot Partition: xr_lv0
  Active Packages: 7
        ncs6k-xr-6.3.1.13I version=6.3.1.13I [Boot image]
        ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm
        ncs6k-mpls-1.0.0.0-r63113I
        ncs6k-iosxr-os-1.0.0.1-r63113I.CSCxr11111

Node 0/3/CPU0 [LC]
  Boot Partition: xr_lv0
  Active Packages: 7
        ncs6k-xr-6.3.1.13I version=6.3.1.13I [Boot image]
        ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm
        ncs6k-mpls-1.0.0.0-r63113I
        ncs6k-iosxr-os-1.0.0.1-r63113I.CSCxr11111
```

From the result, verify that the same image and package versions are active on all RPs and LCs.

Installing Packages: Related Commands

Related Commands	Purpose
show install log	Displays the log information for the install process; this can be used for troubleshooting in case of install failure.
show install package	Displays the details of the packages that have been added to the repository. Use this command to identify individual components of a package.
install prepare	Makes pre-activation checks on an inactive package, to prepare it for activation.
show install prepare	Displays the list of package that have been prepared and are ready for activation.

What to do next

- After performing a system upgrade, upgrade FPD by using the **upgrade hw-module location all fpd all** command from the System Admin EXEC mode. The progress of FPD upgrade process can be monitored using the **show hw-module fpd** command in the System Admin EXEC mode. Reload the router after the FPD upgrade is completed.
- Verify the installation using the **install verify packages** command.
- Uninstall the packages or SMUs if their installation causes any issues on the router. See Uninstall Packages, on page 88.

Note ISO images cannot be uninstalled. However, you can perform a system downgrade by installing an older ISO version.

Named SDR XR Upgrade

Perform sequentially XR VM upgrade or downgrade for named SDRs. Each of these SDRs shall be upgraded or downgraded to run different versions of the software, based on the XR image.

SUMMARY STEPS

1. Execute one of these:
   - **install add source** *<tftp transfer protocol>/package_path/ filename1 filename2 ...*
   - **install add source** *<harddisk:/>package_path/ filename1 filename2 ...*
   - **install add source** *<ftp or sftp transfer protocol>//user@server:/package_path/ filename1 filename2 ...*
2. **show install repository**
3. **install extract** *mini_package*
4. **show install repository**
5. **install prepare** *<xr package> package1 package2 ...*
6. **install activate**
7. **install commit**

DETAILED STEPS

Step 1 Execute one of these:

- **install add source** *<tftp transfer protocol>/package_path/ filename1 filename2 ...*
- **install add source** *<harddisk:/>package_path/ filename1 filename2 ...*
- **install add source** *<ftp or sftp transfer protocol>//user@server:/package_path/ filename1 filename2 ...*

Example:

```
RP/0/RP0/CPU0:router#install add source tftp://<path> ncs6k-mini-x.iso-<release-version>.DT_IMAGE
ncs6k-mpls.pkg-<release-version>.DT_IMAGE ncs6k-mgbl.pkg-<release-version>.DT_IMAGE
ncs6k-mcast.pkg-<release-version>.DT_IMAGE ncs6k-doc.pkg-<release-version>.DT_IMAGE
ncs6k-k9sec.pkg-<release-version>.DT_IMAGE
```

```
RP/0/RP0/CPU0:router#install add source tftp://<path>I ncs6k-mini-x.iso-<release-version>.DT_IMAGE
ncs6k-mpls.pkg-<release-version>.DT_IMAGE ncs6k-mgbl.pkg-<release-version>.DT_IMAGE
ncs6k-mcast.pkg-<release-version>.DT_IMAGE ncs6k-doc.pkg-<release-version>.DT_IMAGE
ncs6k-k9sec.pkg-<release-version>.DT_IMAGE
```

The software files are unpacked from the package and added to the software repository. This operation might take time depending on the size of the files being added. The operation is performed in asynchronous mode. The **install add** command runs in the background, and the XR EXEC mode is returned as soon as possible.

```
Dec 05 16:17:22 Install operation 15 started by root:
 install add source tftp://<path> ncs6k-mini-x.iso-<release-version>.DT_IMAGE
ncs6k-mpls.pkg-<release-version>.DT_IMAGE ncs6k-mgbl.pkg-<release-version>.DT_IMAGE
ncs6k-mcast.pkg-<release-version>.DT_IMAGE ncs6k-doc.pkg-<release-version>.DT_IMAGE
ncs6k-k9sec.pkg-<release-version>.DT_IMAGE
Dec 05 16:17:23 Install operation will continue in the background
RP/0/RP0/CPU0:router#Dec 05 16:32:18 Install operation 15 finished successfully
```

Step 2 **show install repository**

Example:

```
RP/0/RP0/CPU0:router#show install repository
```

Displays packages that are added to the repository. Packages are displayed only after the **install add source** operation is complete.

```
19 package(s) in XR repository:
    ncs6k-xr-<release-version>
    ncs6k-mpls-<release-version>
    ncs6k-mcast-<release-version>
    ncs6k-doc-<release-version>
    ncs6k-k9sec-<release-version>
    ncs6k-mini-x-<release-version>
    ncs6k-k9sec-<release-version>
    ncs6k-xr-<release-version>
    ncs6k-doc-<release-version>
    ncs6k-mgbl-<release-version>
    ncs6k-mpls-<release-version>
    ncs6k-doc-<release-version>
    ncs6k-mgbl-<release-version>
    ncs6k-mcast-<release-version>
    ncs6k-k9sec-<release-version>
    ncs6k-mgbl-<release-version>
    ncs6k-mpls-<release-version>
    ncs6k-mcast-<release-version>
    ncs6k-mini-x-<release-version>
```

Step 3 **install extract** *mini_package*

Example:

```
RP/0/RP0/CPU0:router#install extract ncs6k-mini-x-<release-version>
```

Extracts the ISO image from ncs6k-mini-x and places it in repository. Running the command from XR VM extracts only the ISO file for XR.

```
Dec 05 16:38:08 Install operation 16 started by root:
  install extract ncs6k-mini-x-<release-version>
Dec 05 16:38:08 Package list:
Dec 05 16:38:08     ncs6k-mini-x-<release-version>
Dec 05 16:38:09 Install operation will continue in the background
RP/0/RP0/CPU0:router#Dec 05 16:39:16 Install operation 16 finished successfully
```

Step 4 **show install repository**

To get the XR package that is extracted in the previous step.

Example:

```
RP/0/RP0/CPU0:router#show install repository
```

Displays XR packages that are added to the repository. Packages are displayed only after the **install extract** of the mini package is complete.

Step 5 **install prepare** *<xr package> package1 package2 ...*

Example:

```
RP/0/RP0/CPU0:router#install prepare ncs6k-xr-<release-version> ncs6k-mcast-<release-version>
ncs6k-mpls-<release-version> ncs6k-mgbl-<release-version> ncs6k-doc-<release-version>
ncs6k-k9sec-<release-version>
```

Prepares the installable files before activation. During the prepare phase, pre-activation checks are made and the components of the installable files are loaded on to the router setup.

```
Dec 05 16:42:38 Install operation 17 started by root:
  install prepare pkg ncs6k-xr-<release-version> ncs6k-mcast-<release-version>
ncs6k-mpls-<release-version> ncs6k-mgbl-<release-version> ncs6k-doc-<release-version>
ncs6k-k9sec-<release-version>
Dec 05 16:42:38 Package list:
Dec 05 16:42:38     ncs6k-xr-<release-version>
Dec 05 16:42:38     ncs6k-mcast-<release-version>
Dec 05 16:42:38     ncs6k-mpls-<release-version>
Dec 05 16:42:38     ncs6k-mgbl-<release-version>
Dec 05 16:42:38     ncs6k-doc-<release-version>
Dec 05 16:42:38     ncs6k-k9sec-<release-version>
Dec 05 16:42:39 Install operation will continue in the background
RP/0/RP0/CPU0:router#Dec 05 16:44:42 Install operation 17 finished successfully
```

Step 6 **install activate**

Example:

```
RP/0/RP0/CPU0:router#install activate
```

All the packages that have been prepared are activated together to make the package configurations active on the router.

Activation of the SMUs requires reboot of the SDR and a warning message is displayed to perform reboot. The components of the SMU get activated only after the reboot is complete. Perform reboot immediately after the execution of the **install activate** command is completed.

```
Dec 05 16:47:35 Install operation 18 started by root:
  install activate
This install operation will reboot the sdr, continue?
 [yes/no]:[yes] yes
Dec 05 16:47:38 Install operation will continue in the background
RP/0/RP0/CPU0:router#Dec 05 16:47:51 Install operation 18 finished successfully
```

Step 7 **install commit**

Example:

```
RP/0/RP0/CPU0:router#install commit
```

Commits the newly activated software.

Note If you want to do the system upgrade of more than one SDR, the **install commit** command has to be executed on the first upgraded SDR before trying to upgrade the remaining SDRs.

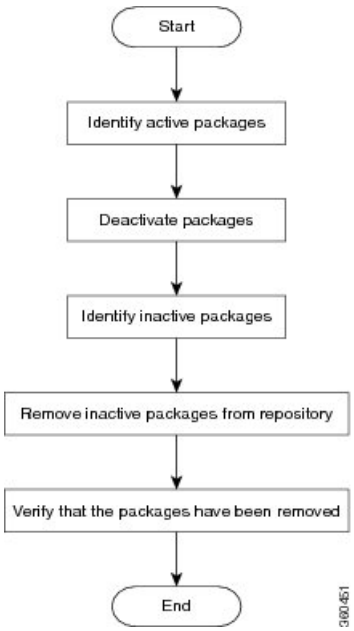
Uninstall Packages

Complete this task to uninstall a package. All router functionalities that are part of the uninstalled package are deactivated. Packages that are added in the XR VM cannot be uninstalled from the System Admin VM, and vice versa.

Note Installed ISO images cannot be uninstalled. Also, kernel SMUs that install third party SMU on host, XR VM and System Admin VM, cannot be uninstalled. However, subsequent installation of ISO image or kernel SMU overwrites the existing installation.

The workflow for uninstalling a package is shown in this flowchart.

Figure 8: Uninstalling Packages Workflow



This task uninstalls XR VM packages. If you need to uninstall System Admin packages, run the same commands from the System Admin EXEC mode.

SUMMARY STEPS

1. **show install active**
2. Execute one of these:
   - **install deactivate** *package_name*
   - **install deactivate id** *operation_id*
3. **show install inactive**
4. **install remove** *package_name*
5. **show install repository**

DETAILED STEPS

Step 1 **show install active**

Example:

```
RP/0/RP0/CPU0:router#show install active
```

Displays active packages. Only active packages can be deactivated.

```
Node 0/RP0/CPU0 [RP]
    Boot Partition: xr_lv0
    Active Packages: 3
        ncs6k-mini-x-<release-version> version=<release-version> [Boot image]
        ncs6k-mcast-<release-version>
        ncs6k-mpls-<release-version>

Node 0/RP1/CPU0 [RP]
    Boot Partition: xr_lv0
    Active Packages: 3
        ncs6k-mini-x-<release-version> version=<release-version> [Boot image]
        ncs6k-mcast-<release-version>
        ncs6k-mpls-<release-version>

Node 0/3/CPU0 [LC]
    Boot Partition: xr_lv0
    Active Packages: 3
        ncs6k-mini-x-<release-version> version=<release-version> [Boot image]
        ncs6k-mcast-<release-version>
        ncs6k-mpls-<release-version>
```

Step 2 Execute one of these:

- **install deactivate** *package_name*
- **install deactivate id** *operation_id*

Example:

```
RP/0/RP0/CPU0:router#install deactivate ncs6k-mcast-<release-version> ncs6k-mpls-<release-version>
```

or

```
RP/0/RP0/CPU0:router#install deactivate id 8
```

All features and software patches associated with the package are deactivated. You can specify multiple package names and deactivate them simultaneously.

If you use the operation ID, all packages that were added in the specified operation are deactivated together. You do not have to deactivate the packages individually.

Step 3 **show install inactive**

Example:

```
RP/0/RP0/CPU0:router#show install inactive
```

The deactivated packages are now listed as inactive packages. Only inactive packages can be removed from the repository.

```
Two inactive package(s) found:
    ncs6k-mcast-<release-version>
    ncs6k-mpls-<release-version>
```

Step 4 **install remove** *package_name*

Example:

```
RP/0/RP0/CPU0:router#install remove ncs6k-mcast-<release-version> ncs6k-mpls-<release-version>
```

The inactive packages are removed from the repository.

Use the **install remove** command with the **id** *operation-id* keyword and argument to remove all packages that were added for the specified operation ID.

Step 5 **show install repository**

Example:

```
RP/0/RP0/CPU0:router#show install repository
```

Displays packages available in the repository. The package that are removed are no longer displayed in the result.

```
1 package(s) in XR repository:
    ncs6k-mini-x-<release-version>
```

What to do next

Install required packages. See Install Packages, on page 80

Orchestrated Calvados Upgrade (OCU)

SUMMARY STEPS

1. **install add source/harddisk** *ncs6k-mini-x.iso-<release-version>.DT_IMAGE*
2. **show install repository**
3. **install extract** *mini_package*
4. **show install repository all**
5. **install prepare issu***ncs6k-sysadmin-<release-version>host-<release-version>*
6. **install activate issu**
7. **install commit**

DETAILED STEPS

Step 1 **install add source/harddisk** *ncs6k-mini-x.iso-<release-version>.DT_IMAGE*

Example:

```
RP/0/RP0/CPU0:router## install add source /harddisk: ncs6k-mini-x.iso-<release-version>.DT_IMAGE
```

The software files are unpacked from the package and added to the software repository. This operation might take time depending on the size of the files being added. The operation is performed in asynchronous mode. The **install add** command runs in the background.

```
Tue Apr  19 18:25:37.570 UTC
result Tue Apr 19 18:25:38 2016 Install operation 4 (install add) started by user 'root' will continue
 asynchronously.
sysadmin-vm:0_RP0# show install log 4
Tue Apr  19 18:27:51.667 UTC
log 4
  Apr 19 18:25:37 Admin install operation 4 started by user 'root'
```

```
Apr 19 18:25:37 install add source /harddisk: ncs6k-mini-x.iso-<release-version>.DT_IMAGE
```

Step 2 **show install repository**

Example:

```
RP/0/RP0/CPU0:router#show install repository
```

Verifies that the host ISO and sysadmin ISO files are properly added to repository.

```
Tue Apr  19 18:28:17.270 UTC
Admin repository
---------------------
ncs6k-mini-x-<release-version>
ncs6k-mini-x-<release-version>
ncs6k-sysadmin-<release-version>
sysadmin-vm:0_RP0# install extract ncs6k-mini-x-<release-version>
Tue Apr  19 18:28:34.155 UTC
result Tue Apr 19 18:28:35 2016 Install operation 5 (install extract) started by user 'root' will
continue asynchronously.
sysadmin-vm:0_RP0# Tue Apr 19 18:30:13 2016 Install operation 5 completed successfully.
sysadmin-vm:0_RP0# show install repository all
Tue Apr  19 18:30:33.564 UTC
Admin repository
---------------------
ncs6k-mini-x-<release-version>
ncs6k-mini-x-<release-version>
ncs6k-sysadmin-<release-version>
ncs6k-sysadmin-<release-version>

  XR repository
------------------
ncs6k-mini-x-<release-version>
ncs6k-mini-x-<release-version>
ncs6k-xr-<release-version>

  Host repository
---------------------
host-<release-version>
host-<release-version>
```

Step 3 **install extract** *mini_package*

Example:

```
RP/0/RP0/CPU0:router#install extract ncs6k-mini-x-<release-version>
```

Running the command from System Admin VM extracts the host and ISO file for System Admin installation.

```
Tue Apr  19 18:28:34.155 UTC
result Tue Apr 19 18:28:35 2016 Install operation 5 (install extract) started by user 'root' will
continue asynchronously.
sysadmin-vm:0_RP0# Tue Apr 19 18:30:13 2016 Install operation 5 completed successfully.
```

Step 4 **show install repository all**

Example:

```
RP/0/RP0/CPU0:router#show install repository all
```

Verifies that the host ISO and sysadmin ISO files are properly added to repository.

```
Tue Apr  19 18:30:33.564 UTC
Admin repository
---------------------
```

```
ncs6k-mini-x-<release-version>
ncs6k-mini-x-<release-version>
ncs6k-sysadmin-<release-version>
ncs6k-sysadmin-<release-version>

  XR repository
------------------
ncs6k-mini-x-<release-version>
ncs6k-mini-x-<release-version>
ncs6k-xr-<release-version>

  Host repository
---------------------
host-<release-version>
host-<release-version>
```

Step 5 **install prepare issu***ncs6k-sysadmin-<release-version>host-<release-version>*

Example:

```
RP/0/RP0/CPU0:router# install prepare issu ncs6k-sysadmin-<release-version> host-<release-version>
```

Prepares the installable files before activation. During the prepare phase, pre-activation checks are made and the components of the installable files are loaded on to the router setup.

```
Tue Apr  19 18:30:55.754 UTC
result Tue Apr 19 18:30:59 2016 Install operation 6 (install prepare issu) started by user 'root'
will continue asynchronously.
sysadmin-vm:0_RP0# Tue Apr 19 18:33:03 2016 Install operation 6 completed successfully.
```

Step 6 **install activate issu**

Example:

```
RP/0/RP0/CPU0:router#install activate issu
```

Activates the upgrade to new version.

```
Tue Apr  19 18:33:14.470 UTC
This install operation will result in admin VMs reload
Do you want to proceed [yes/no]: yes
Proceeding with operation
result Tue Apr 19 18:33:17 2016 Install operation 6 (install activate issu) started by user 'root'
will continue asynchronously.
sysadmin-vm:0_RP0# Tue Apr 19 18:33:17 2016 Calvados ISSU phase one Initiated
sysadmin-vm:0_RP0# Tue Apr 19 18:33:22 2016 Install operation 7 (install activate issu) started by
user 'root' will continue asynchronously.
sysadmin-vm:0_RP0# Tue Apr 19 18:34:46 2016 Install sub operation 7 completed successfully.
sysadmin-vm:0_RP0# Tue Apr 19 18:34:46 2016 Admin VM of nodes 0/RP1,0/1,0/6,0/0 will now reload as
part of the issu operation
Tue Apr 19 18:36:33 2016 Install sub operation 7 (install activate issu) started by user 'root' will
 continue asynchronously.
sysadmin-vm:0_RP0# sysadmin-vm:0_RP0#
sysadmin-vm:0_RP0# Tue Apr 19 18:37:55 2016 Install operation 7 completed successfully.
sysadmin-vm:0_RP0# Tue Apr 19 18:37:55 2016 Admin VM of node 0/RP0 will now reload as part of the
issu operation
```

Step 7 **install commit**

Example:

```
RP/0/RP0/CPU0:router#install commit
```

Commits the newly activated software.

Note After Orchestrated Calvados Upgrade (OCU), wait for few minutes to run the **admin** command.

Install Prepared Packages

A system upgrade or feature upgrade is performed by activating the ISO image file, packages, and SMUs. It is possible to prepare these installable files before activation. During the prepare phase, pre-activation checks are made and the components of the installable files are loaded on to the router setup. The prepare process runs in the background and the router is fully usable during this time. When the prepare phase is over, all the prepared files can be activated instantaneously. The advantages of preparing before activation are:

- If the installable file is corrupted, the prepare process fails. This provides an early warning of the problem. If the corrupted file was activated directly, it might cause router malfunction.
- Directly activating an ISO image for system upgrade takes considerable time during which the router is not usable. However, if the image is prepared before activation, not only does the prepare process run asynchronously, but when the prepared image is subsequently activated, the activation process too takes very less time. As a result, the router downtime is considerably reduced.

Complete this task to upgrade the system and install packages by making use of the prepare operation.

Note Depending on whether you are installing a System Admin package or a XR package, execute the **install** commands in the System Admin EXEC mode or XR EXEC mode respectively. All **install** commands are applicable in both these modes.

Before you begin

- Configure and connect to the XR VM management port. The installable file is accessed through the management port. For details about configuring the XR VM management port, see Configure the XR VM Management Port, on page 10.
- Copy the package to be installed wither on the router's hard disk or on a network server to which the router has access.

SUMMARY STEPS

1. Add the required ISO image and packages to the repository.
2. **show install repository**
3. Execute one of these:
   - **install prepare** *package_name*
   - **install prepare id** *operation_id*
4. **show install prepare**
5. **install activate**
6. **show install active**

DETAILED STEPS

Step 1 Add the required ISO image and packages to the repository.

For details, see Install Packages, on page 80.

Step 2 **show install repository**

Example:

```
RP/0/RP0/CPU0:router#show install repository
```

Perform this step to verify that the required installable files are available in the repository. Packages are displayed only after the "install add" operation is complete.

```
4 package(s) in XR repository:
    ncs6k-iosxr-os-1.0.0.1-r63113I.CSCxr11111.x86_64
    ncs6k-xr-6.3.1.13I
    ncs6k-mini-x-6.3.1.13I
    ncs6k-mpls-1.0.0.0-r63113I.x86_64
```

Step 3 Execute one of these:

- **install prepare** *package_name*
- **install prepare id** *operation_id*

Example:

```
RP/0/RP0/CPU0:router#install prepare ncs6k-mini-x-<release-version> ncs6k-mcast-<release-version>
ncs6k-mpls-<release-version>
```

or

```
RP/0/RP0/CPU0:router#install prepare id 8
```

The prepare process takes place. This operation is performed in asynchronous mode. The **install prepare** command runs in the background, and the EXEC prompt is returned as soon as possible.

If you use the operation ID, all packages that were added in the specified operation are prepared together. For example, if 5 packages are added in operation 8, by executing **install prepare id 8**, all 5 packages are prepared together. You do not have to prepare the packages individually.

Step 4 **show install prepare**

Example:

```
RP/0/RP0/CPU0:router#show install prepare
```

Displays packages that are prepared.

```
RP/0/RP0/CPU0:router#show install prepare
Thu Nov 21 11:48:33.669 UTC
Prepared Boot Image:  ncs6k-mini-x-<release-version>
Prepared Boot Partition:  /dev/panini_vol_grp/xr_lv6
Restart Type: Reboot
Prepared Packages:
 ncs6k-mini-x-<release-version>
 ncs6k-mpls-<release-version>
 ncs6k-mcast-<release-version>

Use the "install activate" command to activate the prepared packages.
Use the "install prepare clean" command to undo the install prepare operation.
```

From the result, verify that all the required packages have been prepared.

Step 5 **install activate**

Example:

```
RP/0/RP0/CPU0:router#install activate
```

All the packages that have been prepared are activated together to make the package configurations active on the router.

Note You should not specify any package name or operation ID in the CLI.

Activation of some SMUs require manual reload of the router. When such SMUs are activated, a warning message is displayed to perform reload. The components of the SMU get activated only after the reload is complete. Perform router reload immediately after the execution of the **install activate** command is completed.

Step 6 **show install active**

Example:

```
RP/0/RP0/CPU0:router#show install active
```

Displays packages that are active.

```
Node 0/RP0/CPU0 [RP]
  Boot Partition: xr_lv0
  Active Packages: 7
        ncs6k-xr-6.3.1.13I version=6.3.1.13I [Boot image]
        ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm
        ncs6k-mpls-1.0.0.0-r63113I
        ncs6k-iosxr-os-1.0.0.1-r63113I.CSCxr11111

Node 0/RP1/CPU0 [RP]
  Boot Partition: xr_lv0
  Active Packages: 7
        ncs6k-xr-6.3.1.13I version=6.3.1.13I [Boot image]
        ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm
        ncs6k-mpls-1.0.0.0-r63113I
        ncs6k-iosxr-os-1.0.0.1-r63113I.CSCxr11111

Node 0/3/CPU0 [LC]
  Boot Partition: xr_lv0
  Active Packages: 7
        ncs6k-xr-6.3.1.13I version=6.3.1.13I [Boot image]
        ncs6k-mcast-1.0.0.0-r63113I.x86_64.rpm
        ncs6k-mpls-1.0.0.0-r63113I
        ncs6k-iosxr-os-1.0.0.1-r63113I.CSCxr11111
```

From the result, verify that on all RPs and LCs, the same image and package versions are active.

Installing Packages: Related Commands

Related Commands	Purpose
show install log	Displays the log information for the install process; this can be used for troubleshooting in case of install failure.
show install package	Displays the details of the packages that have been added to the repository. Use this command to identify individual components of a package.

Related Commands	Purpose
install prepare clean	Clears the prepare operation and removes all the packages from the prepared state.

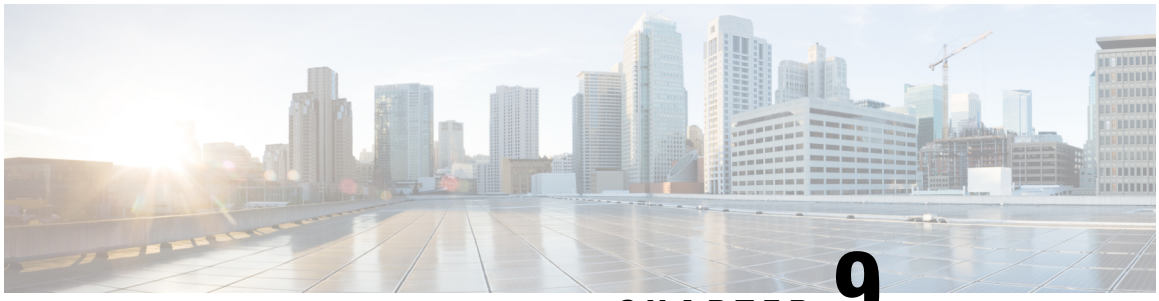
What to do next

- After performing a system upgrade, upgrade FPD by using the **upgrade hw-module location all fpd all** command from the System Admin EXEC mode. The progress of FPD upgrade process can be monitored using the **show hw-module fpd** command in the System Admin EXEC mode. Reload the router after the FPD upgrade is completed.
- Verify the installation using the **install verify packages** command.
- Uninstall the packages or SMUs if their installation causes any issues on the router. See Uninstall Packages, on page 88.

Note ISO images cannot be uninstalled. However, you can perform a system downgrade by installing an older ISO version.

Related Topics

Upgrading the OS and Features, on page 79
install prepare

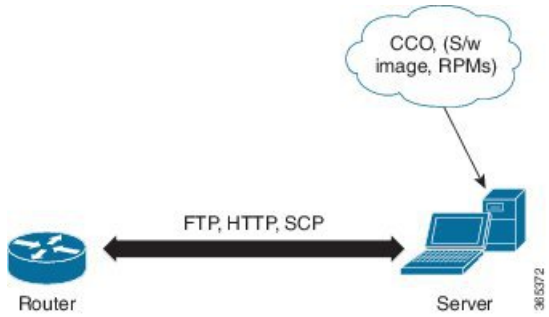


CHAPTER 9

Manage Automatic Dependency

Flexible packaging supports automatic dependency management. While you update an RPM, the system automatically identifies all relevant dependent packages and updates them.

Figure 9: Flow for Installation (base software, RPMs and SMUs)



Until this release, you download the software image and required RPMs from CCO on a network server (the repository), and used the **install add** and the **install activate** commands to add and activate the downloaded files on the . Then, you manually identified relevant dependent RPMs, to add and activate them.

With automatic dependency management, you need not identify dependent RPMs to individually add and activate them. You can execute new install commands to identify and install dependent RPMs automatically.

The new commands are **install update install source** and **install upgrade**. The **install update install source** command identifies and updates dependent packages. The command does not update the base package. The **install upgrade** command upgrades the base package.

Note **1.**
2.

The rest of this chapter contains these sections:

- Update RPMs and SMUs, on page 98
- Upgrade Base Software Version, on page 98

Update RPMs and SMUs

An RPM may contain a fix for a specific defect, and you may need to update the system with that fix. To update RPMs and SMUs to a newer version, use the **install update install source** command. When the **install update install source** command is issued for a particular RPM, the router communicates with the repository, and downloads and activates that RPM. If the repository contains a dependent RPM, the router identifies that dependent RPM and installs that too.

The syntax of the **install update install source** command is:

install update source install source *repository* **[rpm]**

Four scenarios in which you can use the **install update install source** command are:

- **When a package name is not specified**

  When no package is specified, the command updates the latest SMUs of all installed packages.

  ```
  install update source install source [repository]
  ```

- **When a package name is specified**

  If the package name is specified, the command installs that package, updates the latest SMUs of that package, along with its dependencies. If the package is already installed, only the SMUs of that package are installed. (SMUs that are already installed are skipped.)

- **When a package name and version number are specified**

  If a particular version of package needs to be installed, the complete package name must be specified; that package is installed along with the latest SMUs of that package present in the repository.

- **When an SMU is specified**

  If an SMU is specified, that SMU is downloaded and installed, along with its dependent SMUs.

Upgrade Base Software Version

You may choose to upgrade to a newer version of the base software when it becomes available. To upgrade to the latest base software version, use the **install upgrade** command. With the upgrade of the base version, RPMs that are currently available on the router are also upgraded.

Note SMUs are not upgraded as part of this process.

The syntax of the **install upgrade** command is:

install upgrade source *repository* **version** *version***[rpm]**

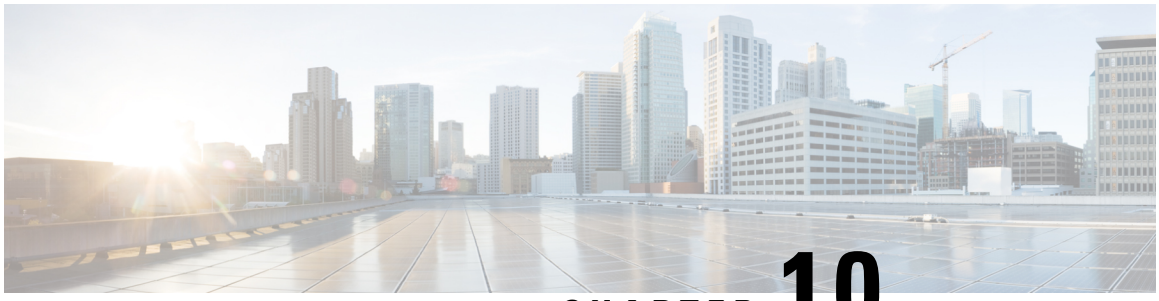
Note VRF and TPA on dataport is not supported. If the server is reachable only through non-default VRF interface, the file must already be retrieved using ftp, sfp, scp, http or https protocols.

You can use the **install upgrade** command when:

- **The version number is specified**

  The base software (.mini) is upgraded to the specified version; all installed RPMs are upgraded to the same release version.

  install upgrade source [repository] version *<release-number>*



CHAPTER 10

Customize Installation using Golden ISO

Golden ISO (GISO) is a customized ISO that a user can build to suit the installation requirement. The user can customize the installable image to include the standard base image with the basic functional components, and add additional RPMs, SMUs and configuration files based on requirement.

The ease of installation and the time taken to seamlessly install or upgrade a system plays a vital role in a cloud-scale network. An installation process that is time-consuming and complex affects the resiliency and scale of the network. The GISO simplifies the installation process, automates the installation workflow, and manages the dependencies in RPMs and SMUs automatically.

GISO is built using a build script `gisobuild.py` available on the github location Github location.

When a system boots with GISO, additional SMUs and RPMs in GISO are installed automatically, and the router is pre-configured with the XR configuration in GISO. For more information about downloading and installing GISO, see Install Golden ISO, on page 104.

The capabilities of GISO can be used in the following scenarios:

- Initial deployment of the router
- Software disaster recovery
- System upgrade from one base version to another
- System upgrade from same base version but with additional SMUs
- Install update to identify and update dependant packages

- Limitations, on page 102
- Customize Installation using Golden ISO, on page 102
- Golden ISO Workflow, on page 102
- Build Golden ISO, on page 103
- Install Golden ISO, on page 104

Limitations

The following are the known problems and limitations with the customized ISO:

- Building and booting GISO for asynchronous package (a package of different release than the ISO) is not supported.
- Verifying the XR configuration is not supported in the GISO build script `gisobuild.py`.

- Renaming a GISO build and then installing from the renamed GISO build is not supported.
- Install operation over IPv6 is not supported.

Customize Installation using Golden ISO

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- Initial deployment of the router
- Software disaster recovery
- System upgrade from one base version to another
- System upgrade from same base version but with additional SMUs
- Install update to identify and update dependant packages

Limitations

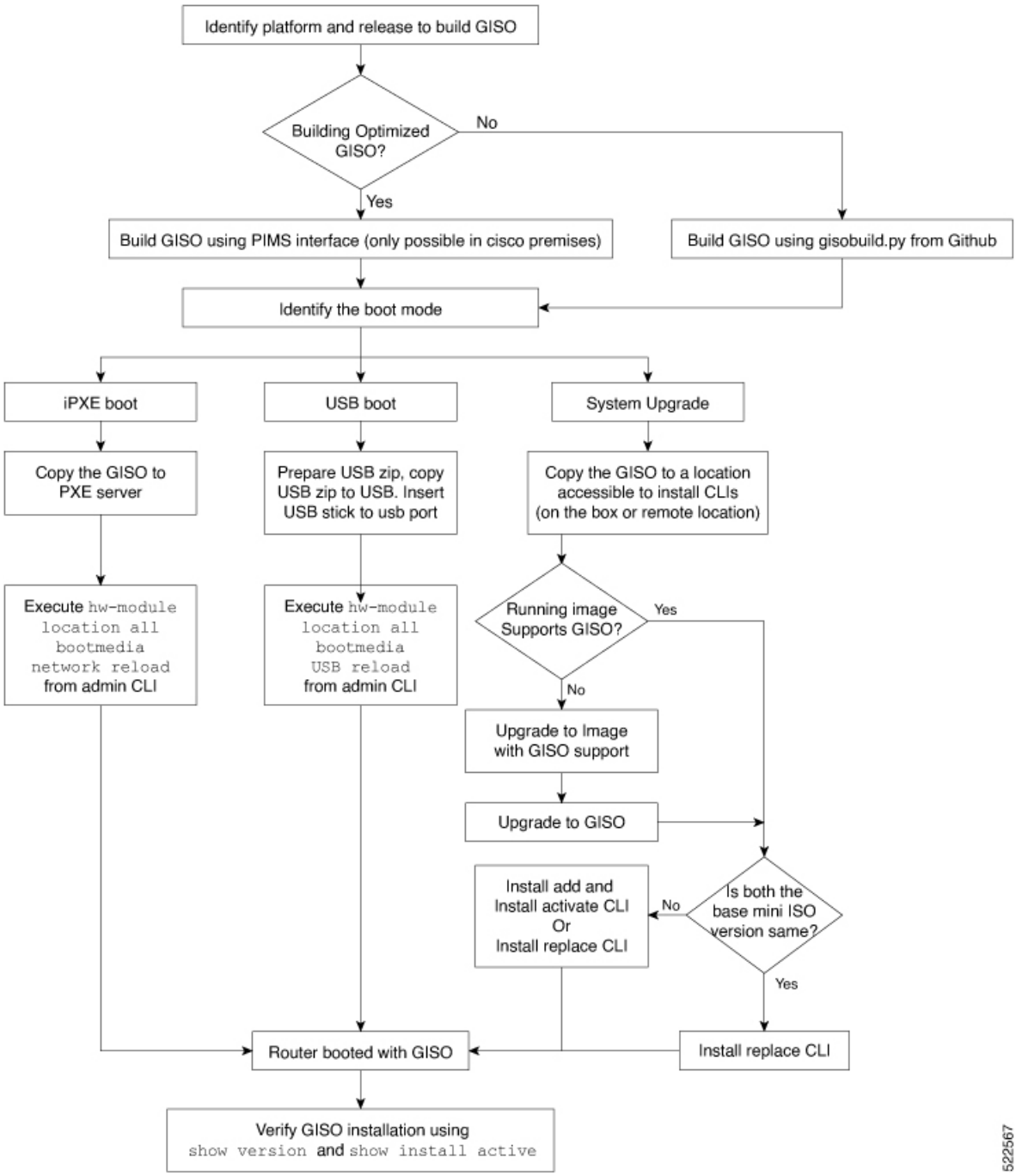
The following are the known problems and limitations with the customized ISO:

- Building and booting GISO for asynchronous package (a package of different release than the ISO) is not supported.
- Verifying the XR configuration is not supported in the GISO build script `gisobuild.py`.
- Renaming a GISO build and then installing from the renamed GISO build is not supported.
- Install operation over IPv6 is not supported.

Golden ISO Workflow

The following image shows the workflow for building and installing golden ISO.

Figure 10: Golden ISO Workflow



Build Golden ISO

The customized ISO is built using Cisco Golden ISO (GISO) build script `gisobuild.py` available on the Github location.

The GISO build script supports automatic dependency management, and provides these functionalities:

- Builds RPM database of all the packages present in package repository.
- Scans the repositories and selects the relevant Cisco RPMs that matches the input iso.
- Skips and removes third-party RPMs that are not SMUs of already existing third-party base package in mini-x.iso.
- Displays an error and exits build process if there are multiple base RPMs of same release but different versions.
- Performs compatibility check and dependency check for all the RPMs. For example, the child RPM is dependent on the parent RPM . If only the child RPM is included, the Golden ISO build fails.

Install Golden ISO

Golden ISO (GISO) automatically performs the following actions:

- Installs host and system admin RPMs.
- Partitions repository and TFTP boot on RP.
- Creates software profile in system admin and XR modes.
- Installs XR RPMs. Use **show install active** command to see the list of RPMs.
- Applies XR configuration. Use **show running-config** command in XR mode to verify.

Step 1 Download GISO image to the router using one of the following options:

- **PXE boot:** when the router is booted, the boot mode is identified. After detecting PXE as boot mode, all available ethernet interfaces are brought up, and DHClient is run on each interface. DHClient script parses HTTP or TFTP protocol, and GISO is downloaded to the box.
- **USB boot or Disk Boot:** when the USB mode is detected during boot, and GISO is identified, the additional RPMs and XR configuration files are extracted and installed.
- **System Upgrade:** when the system is upgraded, GISO can be installed using **install add**, **install activate**, or using **install replace** commands.

Important To replace the current version and packages on the router with the version from GISO, note the change in command and format.

- In versions prior to Cisco IOS XR Release 6.3.3, 6.4.x and 6.5.1, use the **install update** command:

```
install update source <source path> <Golden-ISO-name> replace
```

- In Cisco IOS XR Release 6.5.2 and later, use the **install replace** command.

```
install replace <absolute-path-of-Golden-ISO>
```

Note To create a Bootable External USB Disk, do the following:

- Ensure that the USB Boot Disk has a minimum storage of 8GB, and that you have root/admin or appropriate permission to create bootable disk on linux machine.

a. Copy and execute usb-install script on the Linux machine to create a bootable external USB.

b. Reset the RSP/RP and plug in bootable USB to RSP/RP's front panel. The USB will get detected in ROMMON. Note that when the system is in ROMMON, and if you add a front panel external USB, the USB will not be detected until the RSP/RP is reset.

The options to upgrade the system are as follows:

- **system upgrade from a non-GISO (image that does not support GISO) to GISO image:** If a system is running a version1 with an image that does not support GISO, the system cannot be upgraded directly to version2 of an image that supports GISO. Instead, the version1 must be upgraded to version2 mini ISO, and then to version2 GISO.
- **system upgrade in a release from version1 GISO to version2 GISO:** If both the GISO images have the same base version but different labels, **install add** and **install activate** commands does not support same version of two images. Instead, using **install source** command installs only the delta RPMs. System reload is based on restart type of the delta RPMs.

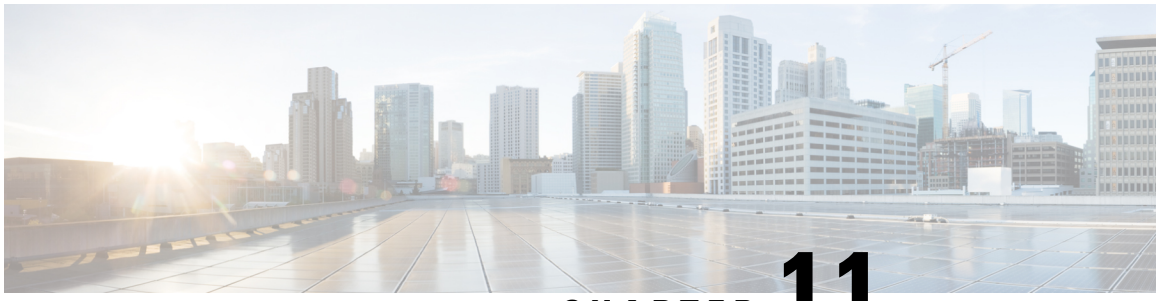
  Using **install replace** command performs a system reload, irrespective of the difference between ISO and the existing version.
- **system upgrade across releases from version1 GISO to version2 GISO:** Both the GISO images have different base versions. Use **install add** and **install activate** commands, or **install replace** command to perform the system upgrade. The router reloads after the upgrade with the version2 GISO image.

Step 2 Run the **show install repository all** command in System Admin mode to view the RPMs and base ISO for host, system admin and XR.

Step 3 Run the **show install package <golden-iso>** command to display the list of RPMs, and packages built in GISO.

Note To list RPMs in the GISO, the GISO must be present in the install repository.

The ISO, SMUs and packages in GISO are installed on the router.



CHAPTER 11

Perform Disaster Recovery

This chapters covers details on performing disaster recovery using hard disk recovery partition and USB boot process.

- Disaster Recovery by Using a Hard Disk Partition, on page 107
- Create a Bootable USB Drive, on page 111
- Boot the Router Using USB, on page 115
- Boot the Multi-chassis Router using USB, on page 116
- Perform System Upgrade Using USB, on page 120

Disaster Recovery by Using a Hard Disk Partition

How Disaster Recovery Using a Hard Disk Recovery Partition Works

This new method of disaster recovery introduced from Cisco IOS XR Release 5.2.5 onwards helps overcome operational delays that may occur when a router is in a non-responding state.

Typically, when the router is in a non-responsive state, the administrator has to physically access the router and then take corrective action. Inability to quickly access the router can lead to delays in recovering the router and subsequently cause extended downtime in router operations. To overcome this constraint, this new method of disaster recovery can be performed remotely.

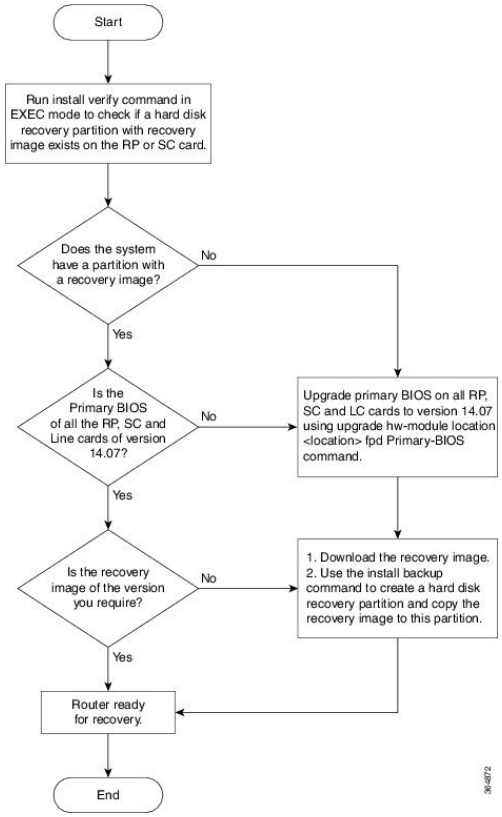
In this method of disaster recovery, while the router is in operational state, a recovery image is copied to a hard disk recovery partition in the RP (route processor) and SC (shelf controller) card. The administrator remotely accesses this recovery image to restore a router.

When the system is in a state of disaster, recovery can be performed only if the following conditions are met:

- The primary BIOS on all RP or SC cards is of version 14.07.
- A hard disk recovery partition already exists on a RP and SC card hard disk with the desired recovery image content.

The following figure illustrates the process of getting a system ready for recovery.

Figure 11: Preparing the System for Disaster Recovery



Note

- To perform disaster recovery in a production environment, it is important that the recovery image be of a release no earlier than Cisco IOS XR Release 5.2.5. The disaster recovery feature is not supported on a release earlier than Cisco IOS XR Release 5.2.5.
- If you upgrade the system to a version higher than R5.2.5, but if the recovery image in the hard disk recovery partition is of Cisco IOS XR Release 5.2.5, the router can still be recovered using this recovery image. After recovery you can upgrade the system to the latest version of software.
- If the system already has a hard disk recovery partition and there is a need to perform disaster recovery using either USB boot or PXE boot, ensure that the image is no earlier than Cisco IOS XR Release 5.2.5 version 37I.

Performing disaster recovery by using a hard disk partition involves the following:

Preparing the Router for Disaster Recovery

Preparing the router for disaster recovery involves copying the recovery image to a hard disk recovery partition when the router is in a fully functional state. To prepare a router for disaster recovery, execute the following steps:

Before you begin

- Download the compressed recovery image from software download page at cisco.com to the hard disk of the router. The filename for the compressed boot file is in this format: ncs6k-dr-boot.tar-*release_number*. For example, ncs6k-dr-boot.tar-5.2.5
- Ensure that the version of primary BIOS on all the RP and SC cards is of version 14.07. If the primary BIOS is of a lower version, use the **upgrade hw-module location location fpd Primary-BIOS** command.
- If you are performing disaster recovery in a multi-chassis environment ensure that there is control ethernet connectivity between the chassis before you boot an RP or SC card from the hard disk recovery partition.

SUMMARY STEPS

1. **install verify packages location** *node-id*
2. **show install log** *install-id*
3. **install backup** *node-id* **location** *destination*

DETAILED STEPS

Step 1 install verify packages location *node-id*

Use this command to verify if a partition with a recovery image exists.

Example:

```
sysadmin-vm:0_RP0# install verify packages location 0/RP0

Install operation 30 (install verify) started by user 'root' will continue asynchronously.
replied.check show install log 30 for detailed log.
Install operation completed successfully.
```

Step 2 show install log *install-id*

Verify the contents of the log to determine whether creation of hard disk partition is successful.

Example:

```
sysadmin-vm:0_RP0#show install log 30
```

If a hard disk partition already exists, similar output is displayed:

```
sysadmin-vm:0_RP1# show install log 30
Thu Mar  17 01:54:36.776 UTC
log 30
  Mar 17 01:42:00 Admin install operation 30 started by user 'root'
Mar 17 01:42:00 install verify packages location 0/RP1
Mar 17 01:42:26 Disaster Recovery Partition found
./system_image.iso 833636352
MD5: bb73f05528286c87b6b1209754ac9e64 ./system_image.iso
./EFI/Recovery/grub.cfg 516
MD5: 525ce5b5b65701c3942afefd3d4a3249 ./EFI/Recovery/grub.cfg
./EFI/Recovery/grub.efi 887836
MD5: 4abf58ec0fd23255d42e1548aeae2e3e ./EFI/Recovery/grub.efi
Mar 17 01:42:26 Node 0/RP1  completed verification successfully

Mar 17 01:42:26 Install operation 30 completed successfully.
Mar 17 01:42:26 Ending 'install verify' operation 30
```

If a hard disk partition does not exist, similar output is displayed:

```
sysadmin-vm:0_RP1# show install log 30
Thu Mar  17 01:54:36.776 UTC
log 30
  Mar 17 01:42:00 Admin install operation 30 started by user 'root'
Mar 17 01:42:00 install verify packages location 0/RP1
Mar 17 01:42:26 Disaster Recovery Partition Not found
./system_image.iso 833636352
MD5: bb73f05528286c87b6b1209754ac9e64 ./system_image.iso
./EFI/Recovery/grub.cfg 516
MD5: 525ce5b5b65701c3942afefd3d4a3249 ./EFI/Recovery/grub.cfg
./EFI/Recovery/grub.efi 887836
MD5: 4abf58ec0fd23255d42e1548aeae2e3e ./EFI/Recovery/grub.efi
Mar 17 01:42:26 Node 0/RP1  completed verification successfully

Mar 17 01:42:26 Install operation 30 completed successfully.
Mar 17 01:42:26 Ending 'install verify' operation 30.
```

Step 3 **install backup** *node-id* **location** *destination*

Creates a hard disk partition and copies the recovery image to the hard disk of the RP and SC card. If a partition already exists, the recovery image is updated.

Example:

```
sysadmin-vm:0_RP0#install backup /harddisk:/ncs6k-dr-boot.tar-<release-version>.zip location 0/RP1

The harddisk  and /misc/scratch/core on 0/RP1 may need to be erased to perform this operation
Do you want to proceed [yes/no]:

Yes
Install operation 9 (install backup) started by user 'root' will continue asynchronously.
Install operation 9 completed successfully.
```

After the operation is completed, use the **show install log** command to verify the details of the operation.

Example:

The following example shows the contents of the log file after **install backup** command is executed.

```
sysadmin-vm:0_RP1# show install log 9
Thu Mar  17 01:55:24.939 UTC
log 9
  Mar 14 18:10:46 Admin install operation 9 started by user 'root'
Mar 14 18:10:46 install backup  /harddisk:/ncs6k-dr-boot.tar-<release-version>.SIT_IMAGE location
0/RP0
Mar 14 18:13:07 all nodes responded,phase 1 done
Mar 14 18:13:07 Install operation 9 completed successfully.
Mar 14 18:13:07 Ending 'install backup' operation 9
```

What to do next

After the router is prepared for disaster recovery, you can recover the router by the recovery image stored in the hard disk recovery partition. For details on recovering the router when it is in a non-responding state, see Recovering a Router, on page 110

Recovering a Router

If the router is in a non-responding state, it can be restored by using a recovery image that is stored in the hard disk recovery partition of the router. Sometimes, even if the router is in a non-responding state, the

command-line interface will respond and can be used to execute commands to recover the router. Determine the state of the command-line interface and execute the steps based on the requirement.

The router can be recovered using the following method:

Recovering a Router Using Boot Manager

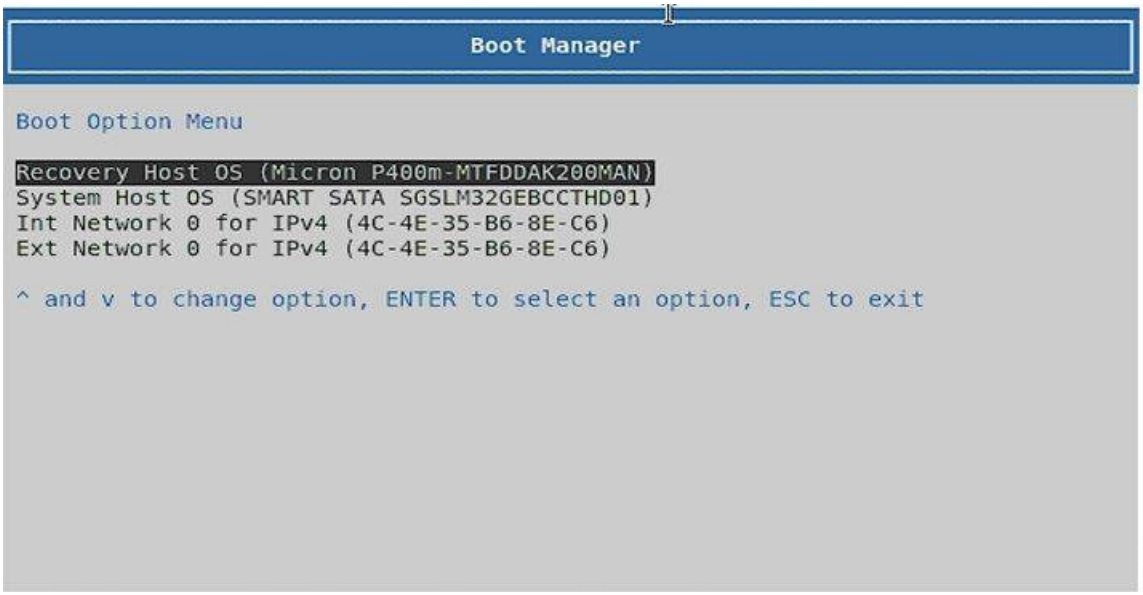
Use this method of recovery if the router is in a non-responding state and the command line interface is not functional.

Before you begin

Ensure that you have prepared the router for disaster recovery by using the information in Preparing the Router for Disaster Recovery, on page 108

Step 1 Power cycle the router.
This results in the entire router rebooting inclusive of all the cards.

Step 2 Press F12 to go to the Boot Manager and select **Recovery Host OS**



The router is recovered by using the recovery image in the hard disk recovery partition.

Create a Bootable USB Drive

The bootable USB drive is used to re-image the router for the purpose of system upgrade or for booting the router in case of boot failure. The bootable USB drive can be created in two ways:

Create a Bootable USB Drive Using Compressed Boot File

This task is applicable to Cisco IOS XR Software Release 5.0.1.

A bootable USB drive is created by copying a compressed boot file into a USB drive. The USB drive becomes bootable after the contents of the compressed file are extracted.

This task can be completed using Windows, Linux, or MAC operating systems available on your local machine. The exact operation to be performed for each generic step outlined here depends on the operating system in use.

Before you begin

- Have access to a USB drive with a storage capacity that is between 2GB (min) and 32 GB (max). USB 2.0 and USB 3.0 are supported.
- Copy the compressed boot file from the software download page at cisco.com to your local machine. The file name for the compressed boot file is in the format *ncs6k-usb-boot-<release_number>.zip*. For example, *ncs6k-usb-boot-5.0.1.zip*.

SUMMARY STEPS

1. Connect the USB drive to your local machine and format it with FAT32 file system.
2. Copy the compressed boot file to the USB drive.
3. Verify that the copy operation is successful. To verify, compare the file size at source and destination. Additionally, verify the MD5 checksum value.
4. Extract the content of the compressed boot file by unzipping it inside the USB drive. This converts the USB drive to a bootable drive.

DETAILED STEPS

Step 1 Connect the USB drive to your local machine and format it with FAT32 file system.

Step 2 Copy the compressed boot file to the USB drive.

Step 3 Verify that the copy operation is successful. To verify, compare the file size at source and destination. Additionally, verify the MD5 checksum value.

Step 4 Extract the content of the compressed boot file by unzipping it inside the USB drive. This converts the USB drive to a bootable drive.

Note The content of the zipped file ("EFI" and "boot" directories) should be extracted directly into root of the USB drive. If the unzipping application places the extracted files in a new folder, move the "EFI" and "boot" directories to root of the USB drive.

What to do next

Use the bootable USB drive to boot the router or upgrade its image. See:

- Boot the Router Using USB, on page 115
- Perform System Upgrade Using USB, on page 120

Create Bootable USB Drive Using Shell Script

To create the bootable USB drive using shell script, you need an ISO image file and the shell script that creates the boot device. The shell script is already available on the router. Create the bootable USB drive as an preemptive measure when the router is operational. If the router is already unusable, create the bootable USB drive on another active router.

Note The contents of the USB drive is erased during the process of creating the bootable drive.

Before you begin

- Have access to a USB drive with a storage capacity that is between 2GB (min) and 32 GB (max). USB 2.0 and USB 3.0 are supported.
- The ISO image must be present on a network server.

SUMMARY STEPS

1. **copy tftp:***source* **harddisk:***destination*
2. **dir /harddisk:**
3. **dir /usr/bin/usb*.sh**
4. Connect the USB drive.
5. **run**
6. **tail /var/log/messages**
7. **cd** *directory path*
8. *<shell_script_file_name> <location_of_iso_image> <mount_location_of_USB_device>*

DETAILED STEPS

Step 1 **copy tftp:***source* **harddisk:***destination*

Example:

```
RP/0/RP0/CPU0:router# copy tftp://223.255.254.254/image/ncs6k-mini-x.iso harddisk\:/ncs6k-mini-x.iso
```

Copy the ISO image from a network server to the router hard disk.

Step 2 **dir /harddisk:**

Example:

```
RP/0/RP0/CPU0:router#dir /harddisk:
```

Verify that the image is copied. The result of this command displays the ISO file name.

```
Directory of /harddisk:/

    12 -rw-r--r-- 1  7864320 Jun 27 20:30 ncs6k-mini-x.iso
```

Step 3 **dir /usr/bin/usb*.sh**

Example:

```
RP/0/RP0/CPU0:router# dir /usr/bin/usb*.sh
```

Verify that the shell script is available on the router. The *usb-install.sh* script must be present in the command output.

```
Directory of /usr/bin/usb*.sh

430 -rwx------ 1 8456 Jun 20 23:30 /usr/bin/usb-install.sh
```

Step 4 Connect the USB drive.

The USB drive must be connected to the USB port on the RP to which the *iso* image has been copied. The USB port is shown in this figure.

Step 5 **run**

Example:

```
RP/0/RP0/CPU0:router# run
```

Enters the XR VM Linux shell. The router prompt changes to:

```
[xr-vm_node0_RP0_CPU0:/]$
```

Step 6 **tail /var/log/messages**

Example:

```
[xr-vm_node0_RP0_CPU0:/]$ tail /var/log/messages
```

Identifies the device name to which the USB drive is been mapped. The USB drive is auto-discoverable on the XR VM shell.

```
...
...
Aug 16 18:56:07 xr-vm kernel: virtio-pci 0000:c0:08.0: setting latency timer to 64
Aug 16 18:56:07 xr-vm kernel: virtio-pci 0000:c0:08.0: irq 93 for MSI/MSI-X
Aug 16 18:56:07 xr-vm kernel: virtio-pci 0000:c0:08.0: irq 94 for MSI/MSI-X
Aug 16 18:56:07 xr-vm kernel:  vde: vde1
```

In this example, we identify from the last entry that the USB is mapped as "vde".

Step 7 **cd** *directory path*

Example:

[xr-vm_node0_RP0_CPU0:/]$ cd /usr/bin

Access the directory where the shell script is present.

Step 8 *<shell_script_file_name> <location_of_iso_image> <mount_location_of_USB_device>*

Example:

```
[xr-vm_node0_RP0_CPU0:/usr/bin]$ ./usb-install.sh /harddisk:/ncs6k-mini-x.iso /dev/vde/
```

Runs the script to create the bootable USB drive. After the process is complete, this message is displayed:

```
USB stick set up for EFI boot!
```

What to do next

Use the bootable USB drive to boot the router or upgrade its image. See:

• Boot the Router Using USB, on page 115
• Perform System Upgrade Using USB, on page 120

Boot the Router Using USB

The router can be booted using an external bootable USB drive. This might be required when the router is unable to boot from the installed image. A boot failure may happen when the image gets corrupted. During the USB boot, process the router gets re-imaged with the version available on the USB drive.

The default boot sequence is USB disk, Sata disk, and PXE boot. But from Cisco IOS XR Release 5.2.4 and later, the boot sequence is changed to Sata disk, USB disk and PXE boot.

Note During the USB boot process, the router is completely re-imaged with the ISO image version present in the bootable USB drive. All existing configurations are deleted because the disk 0 content is erased. No optional packages are installed during the upgrade process; they need to be installed after the upgrade is complete.

Before you begin

Create a bootable USB drive.

Step 1 Connect the USB drive to an RP.

The USB port on the RP is shown in this figure.

Step 2 Connect to the console.

If it is not already connected, connect a terminal to the System Admin console port of the RP. If two RPs are installed on the router, connect to the System Admin console port of both RPs. Start the terminal emulation program on your workstation.

Step 3 Power on the router.

Step 4 Press F12 on the console of the RP to which the USB is not connected. This action displays the boot menu and pauses the boot process. The RP on which the USB is connected should boot normally.

Only the RP having the USB should boot. The booting of other RP is paused.

Step 5 Select the USB drive to boot from USB.

According to the default boot sequence, the Sata disk is the first boot source and the USB drive is the second boot source. During the boot process, the OS image is installed on the router so that in future the router boots without the USB.

Step 6 Press **Enter** to get the host prompt.

Step 7 Login to the host using *root* and *lab* as username and password respectively.

Example:

```
host login: root
Password:
```

If there is no space in the RP, a prompt to either cancel the installation, or to continue with formatting the disk is displayed.

The prompt changes to:

```
[Install image, reboot required host:~]$
```

Step 8 Run the **reboot** command.

Example:

```
[Install image, reboot required host:~]$ reboot
```

The RP reboots with the new image. After the booting is completed, specify the root-system username and password.

Step 9 Access the System Admin EXEC mode and reload the RP for which the boot process was paused in Step 4.

Example:

```
sysadmin-vm:0_RP0#hw-module location 0/RP1 reload
```

The shut down RP is reloaded and gets synchronized with the other RP running the new image.

What to do next

- After the booting process is complete, specify the root username and password.
- Install the required optional packages.

Boot the Multi-chassis Router using USB

A multi-chassis router can be booted using an external bootable USB drive when the router is unable to boot from the installed image. A boot failure can happen when the image is corrupt. During the USB boot process, the router is re-imaged with the version available on the USB drive.

The router image can also be upgraded on multi-chassis configuration using an external bootable USB drive. This is required when the router has to be re-imaged, but the ISO image cannot be accessed over the network because of non-availability of network connectivity.

Before you begin

Create a bootable USB drive. See Create Bootable USB Drive Using Shell Script, on page 113.

Step 1 Power off the Line card chassis (LCC) and the Fabric card chassis (FCC).

Step 2 Remove the standby Route processors (RPs) from the LCC.

The initial USB boot recovery procedure must be performed with only the primary RP. The secondary RPs must be removed from both the LCCs.

Step 3 Remove the standby Shelf controllers (SCs) from the FCC.

The initial USB boot recovery procedure must be performed only with the primary SC. The secondary SCs must be removed from the FCCs.

Step 4 Follow the USB boot procedure on LCC0 that is similar to booting a single chassis.

a) Connect the bootable USB drive to an RP.

b) Connect to the console.

If it is not already connected, connect a terminal to the XR VM console port of the RP. If two RPs are installed on the router, connect to the XR VM console port of both RPs. Start the terminal emulation program on your workstation.

c) Power on the router.

d) RP automatically boots from the USB.

According to the default boot sequence, the USB drive is the first source to boot the router. The router automatically boots from the USB device connected to it. During the boot process, the OS image is installed on the router. This helps to boot the router without the USB in future.

```
Cisco BIOS version : <version>
BIOS Build Date : MM/DD/YYYY by
System Memory Speed : 1600 MHz
Processor Type : Intel(R) Xeon(R) CPU E5-2448L @ 1.80GHz

Press F12 to goto Boot Manager..

Booting EFI USB Device (KingstonDataTraveler G3)..

GNU GRUB version 2.00
Press F2 to goto grub Menu..
Booting from USB..
Loading Kernel..
Loading initrd..
?[    6.660104] i8042.c: No controller found.
Starting udev: [  OK  ]
Setting hostname host:  [  OK  ]
Checking filesystems:[  OK  ]
Remounting root filesystem in read-write mode:  [  OK  ]
Entering non-interactive startup
Bringing up loopback interface:  [  OK  ]
Starting system logger: [  OK  ]
Starting kernel logger: [  OK  ]
Starting kdump:[  OK  ]
Starting system message bus: [  OK  ]
Starting smartd: [  OK  ]
Generating SSH1 RSA host key: [  OK  ]
Generating SSH2 RSA host key: [  OK  ]
Generating SSH2 DSA host key: [  OK  ]
Starting sshd: [  OK  ]
Starting xinetd: [  OK  ]
Fri Aug 22 18:05:29 UTC 2014: Running in  Data LV support model
/etc/rc3.d/S60xrnginstall: line 135: SIMULATION: readonly variable
Fri Aug 22 18:05:29 UTC 2014: Prepping System with calvados.iso
Fri Aug 22 18:05:29 UTC 2014: Installer will install image on sda
Fri Aug 22 18:05:29 UTC 2014: Running in LVM support model
Fri Aug 22 18:05:31 UTC 2014: Partition creation on /dev/sda took 1 seconds
Fri Aug 22 18:05:31 UTC 2014: File system creation on /dev/sda1 took 0 seconds
```

e) Remove the USB drive.

After the initial boot sequences are completed, a message is displayed: `Running install image: Please reboot the system`. Remove the USB drive.

Note The USB drive should not be left connected on the router during regular operation. If the router reloads when the USB drive is connected, all existing configurations are deleted as the router is re-imaged.

f) Press Enter to get the host prompt.

g) Login to the host using *root* and *lab* as username and password respectively.

Example:

```
host login: root Password:
The prompt changes to:
[Install image, reboot required host:~]$
```

h) Run the reboot command.

Example:

```
[Install image, reboot required host:~]$ reboot
```

The RP reboots with the new image. After the booting is completed, specify "**root**" and "**system**" as username and password respectively.

i) Enter username and password when the router prompts for the same.

Example:

```
!!!!!!!!!!!!!!!!!!! NO root-system username is configured. Need to configure root-system
username. !!!!!!!!!!!!!!!!!!!

         --- Administrative User Dialog ---


  Enter root-system username:
  % Entry must not be null.

  Enter root-system username: root
  Enter secret:
Use the 'configure' command to modify this configuration.
User Access Verification

Username: root
Password:
```

j) Confirm that the router has the new image on RP.

Example:

```
sysadmin-vm:0_RP0# show version
Fri Aug  22 18:45:34.794 UTC

Cisco IOS XR Admin Software, Version <release-version>
Copyright (c) 2013-2014 by Cisco Systems, Inc.

Build Information:
 Built By     :
 Built On     : Tue Aug 19 00:50:48 PDT 2014
 Build Host   : iox-lnx-003
 Workspace    : /<path>
 Version      : <release-version>
 Location     : /opt/cisco/calvados/packages/

BIOS Version  : 13.8

System uptime is 28 minutes.
```

Step 5 Configure LCC0 with **chassis serial configuration** and **fabric plane configuration**.

Example:

```
sysadmin-vm:0_RP0(config)# chassis serial FLM17326A2J
sysadmin-vm:0_RP0(config-serial-FLM17326A2J)#  rack 1
sysadmin-vm:0_RP0(config-serial-FLM17326A2J)# !
sysadmin-vm:0_RP0(config-serial-FLM17326A2J)# chassis serial FLM17326A2K
sysadmin-vm:0_RP0(config-serial-FLM17326A2K)#  rack 0
sysadmin-vm:0_RP0(config-serial-FLM17326A2K)# !
```

```
sysadmin-vm:0_RP0(config-serial-FLM17326A2K)# chassis serial FMP17210228
sysadmin-vm:0_RP0(config-serial-FMP17210228)#  rack F0
sysadmin-vm:0_RP0(config-serial-FMP17210228)# !
sysadmin-vm:0_RP0(config-serial-FMP17210228)# chassis serial FMP17380420
sysadmin-vm:0_RP0(config-serial-FMP17380420)#  rack F1
sysadmin-vm:0_RP0(config-serial-FMP17380420)# !
sysadmin-vm:0_RP0(config-serial-FMP17380420)#
Mon Aug  25 22:27:49.594 UTC
Uncommitted changes found, commit them? [yes/no/CANCEL] yes

sysadmin-vm:0_RP0# conf t
Mon Aug  25 22:47:38.999 UTC
Entering configuration mode terminal
sysadmin-vm:0_RP0 (config)# controller fabric plane 0
sysadmin-vm:0_RP0 (config-plane-0)# no shutdown
sysadmin-vm:0_RP0(config-plane-0)# instance 0
sysadmin-vm:0_RP0(config-instance-0)#   location F0/FC6
sysadmin-vm:0_RP0(config-instance-0)#  !
sysadmin-vm: 0_RP0 (config-instance-0)# !
sysadmin-vm:0_RP0(config-instance-0)# controller fabric plane 1
sysadmin-vm:0_RP0(config-plane-1)#  no shutdown
Mon Aug  25 22:47:45.944 UTC
sysadmin-vm:0_RP0(config-plane-1)#  instance 0
sysadmin-vm:0_RP0(config-instance-0)#   location F1/FC6
sysadmin-vm:0_RP0(config-instance-0)#  !
sysadmin-vm:0_RP0(config-instance-0)# !
sysadmin-vm:0_RP0(config-instance-0)# controller fabric plane 2
sysadmin-vm:0_RP0(config-plane-2)#  no shutdown
Mon Aug  25 22:47:45.958 UTC
sysadmin-vm:0_RP0(config-plane-2)#  instance 0
sysadmin-vm:0_RP0(config-instance-0)#   location F0/FC7
sysadmin-vm:0_RP0(config-instance-0)#  !
sysadmin-vm:0_RP0(config-instance-0)# !
sysadmin-vm:0_RP0(config-instance-0)# controller fabric plane 3
sysadmin-vm:0_RP0(config-plane-3)#  no shutdown
Mon Aug  25 22:47:45.974 UTC
sysadmin-vm:0_RP0(config-plane-3)#  instance 0
sysadmin-vm:0_RP0(config-instance-0)#   location F1/FC7
sysadmin-vm:0_RP0(config-instance-0)#  !
sysadmin-vm:0_RP0(config-instance-0)# !
sysadmin-vm:0_RP0(config-instance-0)# controller fabric plane 4
sysadmin-vm:0_RP0(config-plane-4)#  no shutdown
Mon Aug  25 22:47:45.983 UTC
sysadmin-vm:0_RP0(config-plane-4)#  instance 0
sysadmin-vm:0_RP0(config-instance-0)#   location F0/FC8
sysadmin-vm:0_RP0(config-instance-0)#  !
sysadmin-vm:0_RP0(config-instance-0)# !
sysadmin-vm:0_RP0(config-instance-0)# controller fabric plane 5
sysadmin-vm:0_RP0(config-plane-5)#  no shutdown
Mon Aug  25 22:47:45.993 UTC
sysadmin-vm:0_RP0(config-plane-5)#  instance 0
sysadmin-vm:0_RP0(config-instance-0)#   location F1/FC8
sysadmin-vm:0_RP0(config-instance-0)#  !
sysadmin-vm:0_RP0(config-instance-0)# !
Mon Aug  25 22:47:55.321 UTC
Uncommitted changes found, commit them? [yes/no/CANCEL] yes
```

Step 6 Power off the LCC0 chassis.

Step 7 Follow Steps 4 to 6 for LCC1, FCC0 and FCC1.

Step 8 Power up all the chassis at the same time. The system boots with the new image.

Note After the router is reboots, all primary RPs have the new image.

```
sysadmin-vm:0_RP0# show install active
Fri Aug  22 21:43:09.700 UTC
 Node 1/RP0 [RP]
    Active Packages: 1
       ncs6k-sysadmin-<release-version> version=<release-version> [Boot image]

 Node 0/RP0 [RP]
    Active Packages: 1
       ncs6k-sysadmin-<release-version> version=<release-version> [Boot image]

 Node F0/SC0 [SC]
    Active Packages: 1
       ncs6k-sysadmin-<release-version> version=<release-version> [Boot image]

 Node F1/SC0 [SC]
    Active Packages: 1
       ncs6k-sysadmin-<release-version> version=<release-version> [Boot image]

 Node 1/1 [LC]
    Active Packages: 1
       ncs6k-sysadmin-<release-version> version=<release-version> [Boot image]

 Node 0/3 [LC]
    Active Packages: 1
       ncs6k-sysadmin-<release-version> version=<release-version> [Boot image]
```

```
sysadmin-vm:1_RP0# show chassis
Thu Aug  21 19:42:41.599 UTC
Serial Num    Rack Num    Rack Type   Rack State  Data Plane  Ctrl Plane
------------------------------------------------------------------------
FMP12180264   0           LCC         UP          NCONN       CONN
FMP12180281   1           LCC         UP          NCONN       CONN
FMP12240401   F1          FCC         UP          NCONN       CONN
FMP17400526   F0          FCC         UP          NCONN       CONN
```

Step 9 Insert secondary RPs in both LCCs.

Step 10 Insert secondary SC cards in both FCCs.

Note On inserting the secondary SC cards on each FCC, the SC card triggers an internal PXE boot and starts with the new image.

Step 11 Verify that the router has the new image on all RPs, SCs, and LCs.

Perform System Upgrade Using USB

The router image can be upgraded using an external bootable USB drive. This may be required when the router is to be re-imaged, but the ISO image cannot be accessed over the network. It may happen when the network connectivity is unavailable.

Note During an upgrade, all existing configurations are deleted because the disk 0 content is erased.

Before you begin

- Create a bootable USB drive.
- Ensure that the router BIOS version is 9.10, or higher.
  - Verify the BIOS version using the **show fpd package** command in the System Admin EXEC mode.
  - Verify the actual state of all field-programmable gate array (FPGA) of the system and whether it requires an upgrade or not using the **show hw-module fpd** command in System Admin EXEC mode.
  - If required, upgrade the BIOS using the **upgrade hw-module location all fpd BIOS\ FPD** command in the System Admin EXEC mode.

Step 1 **hw-module location** *node-id* **shutdown**

Example:

```
sysadmin-vm:0_RP0#hw-module location 0/RP1 shutdown
```

Shut down one RP. In this example, the RP1 is shut down. During the system upgrade, only one RP should be operational.

Step 2 Connect the USB drive.

The USB drive must be connected to the USB port on the operational RP.

Step 3 *hw-module* **location** *node-id* **reload**

Example:

```
sysadmin-vm:0_RP0#hw-module location 0/RP0 reload
```

Reload the RP on which the USB is connected. As the RP reloads, it boots from the USB drive and gets re-imaged.

Step 4 Remove the USB drive.

After the initial boot sequences are complete, this message is displayed:

```
Running install image: Please reboot the system
```

On receiving this message, remove the USB drive.

Note The USB drive should not be left connected on the router during regular operation. If the router reloads when the USB drive is connected, all existing configurations are deleted as the router gets re-imaged.

Step 5 Press **Enter** to get the host prompt.

Step 6 Login to the host using *root* and *lab* as username and password respectively.

Example:

```
host login: root
Password:
```

The prompt changes to:

```
[Install image, reboot required host:~]$
```

Step 7 Run the **reboot** command.

Example:

```
[Install image, reboot required host:~]$ reboot
```

The RP reboots with the new image. After the booting is completed, specify the root-system username and password.

Step 8 Access the System Admin EXEC mode and reload the RP that was shut down in Step 1.

Example:

```
sysadmin-vm:0_RP0#hw-module location 0/RP1 reload
```

The shut down RP is reloaded and gets synchronized with the other RP running the new image.

What to do next

- Run the **show version** command in the XR EXEC mode to verify that the new image version is successfully installed.
- Install the required optional packages.