System Setup and Software Installation Guide for Cisco NCS 540 Series Routers, IOS XR Release 6.5.x

First Published: 2019-03-29

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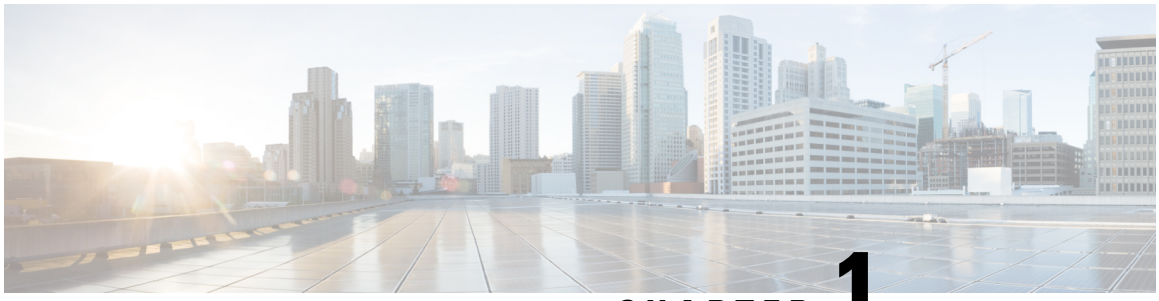


CHAPTER 1

Overview of the Router

The Cisco NCS 540 system is a high fault-resilient platform, which provides next generation data-center switching environment with high bandwidth and low latency.

Cisco NCS 540 system provides:

- High performance (300 Gbps full-duplex switching)
- Flexible network interface (10GbE, 25GbE, 40GbE, 50GbE, and 100GbE interfaces as well as ILKN interfaces)
- Traffic manager and in-band management
- Flexible and microcode-programmable packet processor
- Label Switched Router (LSR) and possible Light Label switched Edge Router (LER) features and functionality with limited hardware scale and software functionality.

- Command Modes, on page 1

Command Modes

The router runs on virtualized Cisco IOS XR software. Therefore, the CLI commands must be executed on virtual machines, namely the XR LXC and the System Admin LXC.

The command modes are applicable for the Cisco NCS 5500 Series Routers. This table lists the command modes for the LXCs.

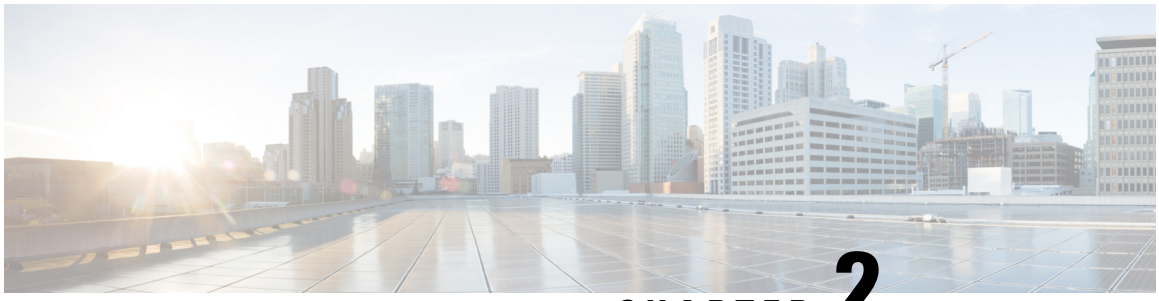
Command Mode	Description
XR EXEC mode (XR LXC execution mode)	Run commands on the XR LXC to display the operational state of the router. Example: `RP/0/RP0/CPU0:router#`

Command Mode	Description

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

System Admin EXEC mode
(System Admin LXC execution mode)
	Run commands on the System Admin LXC 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 LXCconfiguration mode)
	Run configuration commands on the System Admin LXC 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)#`



CHAPTER 2

Boot the Router

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

Procedure

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

Step 2 Start the terminal emulation program on your workstation.

The console settings are:

- For modular chassis RP, the console settings are baud rate 9600 bps, no parity, 2 stop bits and 8 data bits
- For fixed chassis, the console settings are baud rate 115200 bps, no parity, 2 stop bits and 8 data bits.

The baud rate is set by default and cannot be changed.

Step 3 Power on the router.

Connect the power cord to Power Entry Module (PEM) and the router boots up. The boot process details are displayed on the console screen of the terminal emulation program.

Step 4 Press **Enter**.

The boot process is complete when the system prompts to enter the root-system username. 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 preinstalled image on the router is corrupt. In this case, the router can be booted using an external bootable USB drive.

Note We recommended that you check the `md5sum` of the image after copying from source location to the server from where router boots up with new version. This ensures that if `md5sum` mismatch is observed, you can remove the corrupted file and ensure that a working copy of the image file is available for setup to begin.

What to do next

Specify the root username and password.

- Setup Root User Credentials, on page 4
- Access the System Admin Console, on page 5
- Configure the Management Port, on page 5
- Perform Clock Synchronization with NTP Server, on page 7

Setup Root User Credentials

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 (root-lr) console, the System Admin VM (root-system), and as disaster-recovery credentials.

Procedure

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

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 console. It is also mapped as the "root-system" user on the System Admin console.

When starting the router for the first time, or after a reimage, 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*

Enter the password for the root user. The character range of the password is from 6 through 253 characters. The password that 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*

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

Step 4 **Username:** *username*

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

Step 5 **Password:** *password*

Enter the password of the root user. The correct password displays the router prompt. You are now logged into the XR VM console.

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

Displays user details.

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

Access the System Admin Console

You must login to the System Admin console through the XR console to perform all system administration and hardware management setups.

Procedure

Step 1 Login to the XR console as the root user.

Step 2 **admin**

Example:

The login banner is enabled by default. The following example shows the command output with the login banner enabled:

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

Mon May 22 06:57:29.350 UTC

root connected from 127.0.0.1 using console on host
sysadmin-vm:0_RP0# exit
Mon May  22 06:57:32.360 UTC
```

The following example shows the command output with the login banner disabled:

```
RP/0/RP0/CPU0:router#admin
Thu Mar 01:07:14.509 UTC
sysadmin-vm:0_RP0# exit
```

Step 3 (Optional) **exit**

Return to the XR mode from the System Admin mode.

Configure the Management Port

To use the 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 and Ethernet 1 on RP are the management ports. Ensure that the port is connected to management network.

Note The Physical port MgmtEth0/RP0/CPU0/1 on XR must be shut down while configuring manageability applications.

Procedure

Step 1 **configure**

Example:

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

Enters mode.

Step 2 **interface MgmtEth** *rack/slot/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 (Optional) **vrf** *vrf-id*

Example:

```
RP/0/RP0/CPU0:router(config-sg-tacacs+)# vrf vrf-id
```

Specifies the Virtual Private Network (VPN) routing and forwarding (VRF) reference.

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

Example:

```
RP/0/RP0/CPU0:router(config-if)#ipv4 address 10.1.1.1/8
```

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

Step 5 **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 6 **no shutdown**

Example:

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

Places the interface in an "up" state.

Step 7 **exit**

Example:

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

Exits the Management interface configuration mode.

Step 8 **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 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

Connect to the management port to the ethernet network. With a terminal emulation program, establish a SSH or telnet connection to the management interface port using its IP address. 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.

Perform Clock Synchronization with NTP Server

There are independent system clocks for the XR console and the System Admin console. 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 console. After the XR console clock is synchronized, the System Admin console clock will automatically synchronize with the XR console clock.

Before you begin

Configure and connect to the management port.

Procedure

Step 1 **configure**

Example:

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

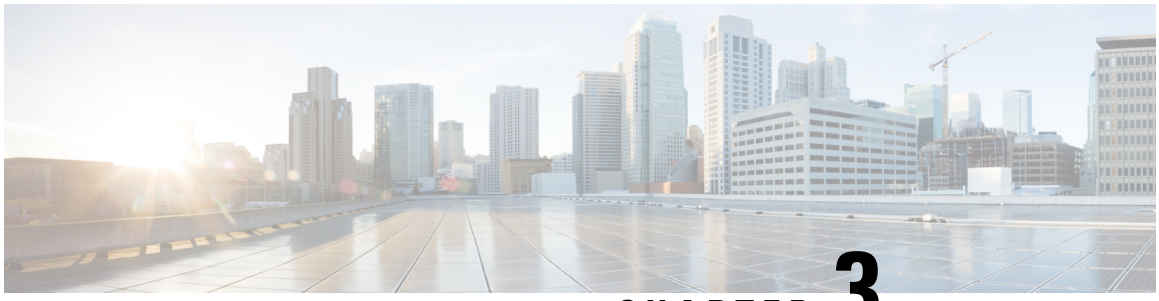
Enters mode.

Step 2 **ntp server** *server_address*

Example:

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

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



CHAPTER 3

Perform Preliminary Checks

After successfully logging into the 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 Status of Hardware Modules

Hardware modules include RPs, LCs, fan trays, 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.

Procedure

Step 1 **admin**

Example:

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

Enters System Admin EXEC mode.

Step 2 **show platform**

Example:

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

Displays the list of hardware modules detected on the router.

```
Location  Card Type              HW State      SW State      Config State
```

```
------------------------------------------------------------------------------
0/RP0     N540-24Z8Q2C-M   OPERATIONAL    OPERATIONAL   NSHUT
0/FT0     N540-FAN   OPERATIONAL    N/A     NSHUT
0/FT1     N540-FAN   OPERATIONAL    N/A     NSHUT
0/FT2     N540-FAN   OPERATIONAL    N/A     NSHUT
0/FT3     N540-FAN   OPERATIONAL    N/A     NSHUT
```

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.

Step 3 **show hw-module fpd**

Example:

```
RP/0/RP0/CPU0:router# show hw-module fpd
```

Displays the list of hardware modules detected on the router.

```
RP/0/RP0/CPU0:Router#show hw-module fpd
FPD Versions
=================
Location Card type      HWver FPD device ATR Status Running Programd
------------------------------------------------------------------------------
0/RP0    N540-24Z8Q2C-M 0.5   MB-MIFPGA      CURRENT 0.04    0.04
0/RP0    N540-24Z8Q2C-M 0.5   Bootloader     CURRENT 1.07    1.07
0/RP0    N540-24Z8Q2C-M 0.5   CPU-IOFPGA     CURRENT 0.03    0.03
0/RP0    N540-24Z8Q2C-M 0.5   MB-IOFPGA      CURRENT 0.16    0.16
RP/0/RP0/CPU0:ios#
```

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 and System Admin mode CLIs.

Procedure

Step 1 **show platform**

Example:

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

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

```
RP/0/RP0/CPU0:<router>#show platform
Node   Type  State  Config state
------------------------------------------------------------------------------
0/RP0/CPU0 N540-X-24Z8Q2C-M(Active) IOS XR RUN NSHUT
0/RP0/NPU0 Slice UP
0/FT0  N540-FAN OPERATIONAL  NSHUT
0/FT1  N540-FAN OPERATIONAL  NSHUT
0/FT2  N540-FAN OPERATIONAL  NSHUT
0/FT3  N540-FAN OPERATIONAL  NSHUT
```

Verify that all RPs are listed and their state is OPERATIONAL. This indicates that the XR console is operational on the cards.

Step 2 **admin**

Example:

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

Enters mode.

Step 3 **show platform**

Example:

```
#show platform
```

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

This is an example for single-chassis system:

```
RP/0/RP0/CPU0:<router>#sh platform
Thu Mar 29 06:50:06.788 UTC
Location  Card Type  HW State  SW State  Config State
------------------------------------------------------------------------------
0/RP0  N540-X-24Z8Q2C-M OPERATIONAL  OPERATIONAL  NSHUT
0/FT0  N540-FAN   OPERATIONAL  N/A    NSHUT
0/FT1  N540-FAN   OPERATIONAL  N/A    NSHUT
0/FT2  N540-FAN   OPERATIONAL  N/A    NSHUT
0/FT3  N540-FAN   OPERATIONAL  N/A    NSHUT
```

Verify that all cards installed on the router are displayed in the result. The software state of LCs/IMs 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:

- 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

Verify Software Version

The 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.

Procedure

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 and its various components.

Example

```
Cisco IOS XR Software, Version <release-version>
Copyright (c) 2013-2017 by Cisco Systems, Inc.

Build Information:
Built By : <user>
Built On : <date and time stamp>
Build Host : iox-lnx-030
Workspace : /x.x.x/ncs540/ws
Version : <release-version>
Location : /opt/cisco/XR/packages/

cisco NCS-540 () processor
System uptime is 1 day, 16 hours, 18 minutes
```

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 29.

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.

Procedure

show hw-module fpd

Example:

Displays the list of hardware modules detected on the router.

Note This command can be run from both XR VM and System Admin VM modes.

In the above output, some of the significant fields are:

- FPD Device- Name of the hardware component such as FPD, CFP, and so on.
- ATR-Attribute of the hardware component. Some of the attributes are:
  - B- Backup Image
  - S-Secure Image
  - P-Protected Image
- Status- Upgrade status of the firmware. The different states are:
  - CURRENT-The firmware version is the latest version.
  - 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.
  - RLOAD REQ-The upgrade has been completed, and the ISO image requires a reload.
  - 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.
- Running- Current version of the firmware running on the FPD.

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.

Procedure

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.

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 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 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 installed in the routing system. An instance of this SDR runs on line cards and route processors. Complete this task to verify the details of the SDR instances.

Procedure

Step 1 **admin**

Example:

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

Enters mode.

Step 2 **show sdr**

Example:

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

Displays the SDR information for every node.

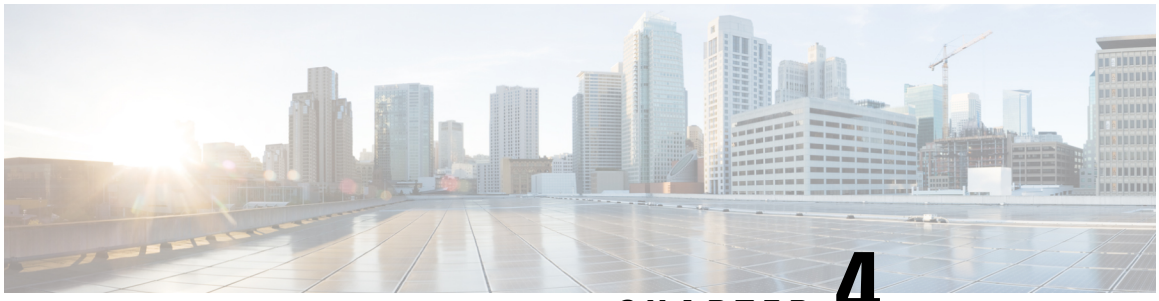
```
RP/0/RP0/CPU0:router#show  sdr
Type                 NodeName       NodeState      RedState       PartnerName
------------------------------------------------------------------------------
LC                   0/0/CPU0       IOS XR RUN     N/A            N/A
RP                   0/RP0/CPU0     IOS XR RUN     ACTIVE         NONE
```

```
Slice                0/RP0/NPU0     UP             N/A            N/A
N540-X-24Z8Q2C-M     0/RP0          OPERATIONAL                   N/A
N540-FAN             0/FT0          OPERATIONAL                   N/A
N540-FAN             0/FT1          OPERATIONAL                   N/A
N540-FAN             0/FT2          OPERATIONAL                   N/A
N540-FAN             0/FT3          OPERATIONAL                   N/A
```

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.

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.



CHAPTER 4

Create User Profiles and Assign Privileges

To provide controlled access to the XR and System Admin configurations on the 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 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.

Configure AAA authorization to restrict users from uncontrolled access. If AAA authorization is not configured, the command and data rules associated to the groups that are assigned to the user are bypassed. An IOS-XR user can have full read-write access to the IOS-XR configuration through Network Configuration Protocol (NETCONF), google-defined Remote Procedure Calls (gRPC) or any YANG-based agents. In order to avoid granting uncontrolled access, enable AAA authorization before setting up any configuration.

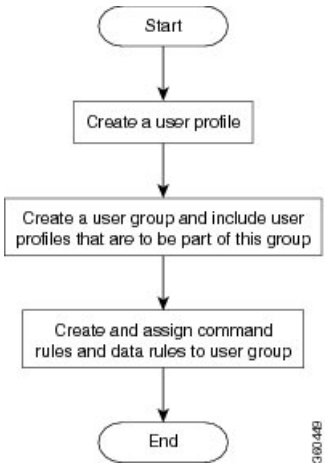
Note If any user on XR is deleted, the local database checks whether there is a first user on System Admin VM.

- 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.
- When a user is added in XR, if there is no user on System Admin mode, then the user is synced to sysadmin-vm. After the synchronization, any changes to the user on XR VM does not synchronize on the System Admin VM.
- A user added on the System Admin VM does not synchronize with XR VM.
- Only the first user or disaster-recovery user created on System Admin VM synchronizes with the host VM.
- Changes to credentials of first user or disaster-recovery user on System Admin VM synchronizes with the host VM.
- The first user or disaster-recovery user deleted on System Admin VM does not synchronize with the host VM. The host VM retains the user.

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 1: 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 Config mode to view existing aaa configurations.

The topics covered in this chapter are:

Create a User Profile in System Admin VM

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.

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.

Procedure

Step 1 **admin**

Example:

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

Enters 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 in System Admin VM, on page 20.
- Create command rules that apply to the user group. See Create Command Rules, on page 21.
- Create data rules that apply to the user group. See Create Data Rules, on page 24.

Create a User Group in System Admin VM

Create a user group for the System Admin VM.

The router supports a maximum of 32 user groups.

Before you begin

Create a user profile. See the *Create User* section.

Procedure

Step 1 **admin**

Example:

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

Enters 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 21.
- Create data rules. See Create Data Rules, on page 24.

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 in System Admin VM, on page 20.

Procedure

Step 1 **admin**

Example:

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

Enters 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 24.

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 in System Admin VM, on page 20.

Procedure

Step 1 **admin**

Example:

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

Enters 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 console. 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 console is corrupted.
- Access the system through the management port, when, for some reason, the System Admin console is not working.
- Create new users by accessing the System Admin console 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.

Procedure

Step 1 **admin**

Example:

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

Enters 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.

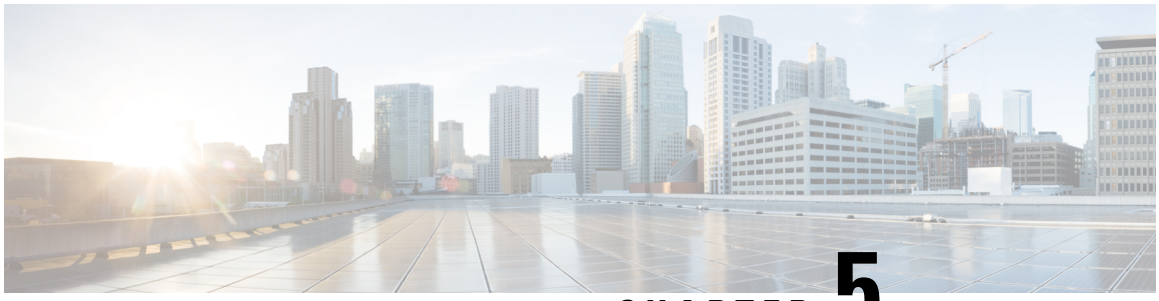
When you need to make use of the disaster recovery username, you need to enter it as *username***@localhost**.

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.



CHAPTER 5

Perform System Upgrade and Install Feature Packages

The system upgrade and package installation processes are executed using **install** commands on the router. The processes involve adding and activating the iso images (*.iso*) and feature packages 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 System

Note If an interface on a router does not have a configuration and is brought up by performing no-shut operation, then upon router reload, the interface state changes to **admin-shutdown** automatically.

Note Ensure that you have adequate disk space. Run the **fsck** command to check the status of the file system, for a successful IOS XR upgrade. You must run the **fsck** command in the System Admin EXEC mode to install a System Admin package, and in the XR EXEC mode to install the XR package. All install commands are applicable in both the System Admin EXEC mode and in XR EXEC mode. System Admin install operations are done from XR EXEC mode.

System upgrade is done by installing a base package–Cisco IOS XR Unicast Routing Core Bundle.

The filename for this bundle is *ncs540-mini-x.iso*.

Install this ISO image using **install** commands. For more information about the install process, see Workflow for Install Process, on page 31.

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

Do not reload the router during an upgrade operation.

Note Ensure that you perform a chassis reload to enable hardware programming if a chassis upgrade through ISSU to IOS XR Release 7.6.x and later from an earlier software version. The chassis reload is mandatory, if you must enable a maximum MTU value of 9646 on applicable interfaces.

Cisco IOS XR supports RPM signing and signature verification for Cisco IOS XR RPM packages in the ISO and upgrade images. All RPM packages in the Cisco IOS XR ISO and upgrade images are signed to ensure cryptographic integrity and authenticity. This guarantees that the RPM packages have not been tampered with and the RPM packages are from Cisco IOS XR. The private key, which is used for signing the RPM packages, is created and securely maintained by Cisco.

For more information on upgrading the system and the Cisco RPMS, see *Manage Automatic Dependency* chapter.

Upgrading Features

Upgrading features is the process of deploying new features and software patches on the router. Feature upgrade is done by installing package files, termed simply, packages. Software patch installation is done by installing Software Maintenance Upgrade (SMU) files.

Installing a package on the router installs specific features that are part of that package. Cisco IOS XR Software is divided into various software packages; this enables you to select the features to run on your router. Each package contains components that perform a specific set of router functions, such as routing, security, and so on.

For example, the components of the routing package are split into individual RPMs, such as BGP and OSPF. BGP is a mandatory RPM which is a part of the base software version and hence cannot be removed. Optional RPMs such as OSPF can be added and removed as required.

The naming convention of the package is `<platform>-<pkg>-<pkg version>-<release version>.<architecture>.rpm`. Standard packages are as follows:

- ncs540-isis-1.0.0.0-r701.x86_64.rpm
- ncs540-k9sec-1.1.0.0-r701.x86_64.rpm
- ncs540-li-1.0.0.0-r701.x86_64.rpm
- ncs540-mcast-1.0.0.0-r701.x86_64.rpm
- ncs540-mgbl-1.0.0.0-r701.x86_64.rpm
- ncs540-mini-x-7.0.1.iso
- ncs540-mpls-1.0.0.0-r701.x86_64.rpm
- ncs540-mpls-te-rsvp-1.0.0.0-r701.x86_64.rpm

- ncs540-ospf-1.0.0.0-r701.x86_64.rpm

Package and SMU installation is performed using **install** commands. For more information about the install process, see Install Packages, on page 32.

Note Ensure that you have adequate disk space. Run the **fsck** command to check the status of the file system, for a successful IOS XR upgrade. You must run the **fsck** command in the System Admin EXEC mode to install a System Admin package, and in the XR EXEC mode to install the XR package. All install commands are applicable in both the System Admin EXEC mode and in XR EXEC mode. System Admin install operations are done from XR EXEC mode.

There are separate packages and SMUs for the XR VM and the System Admin VM. They can be identified by their filenames. The XR and System Admin packages and SMUs can be activated from XR and System Admin VMs.

You can alternatively perform a cross VM operation, by activationg or deactivating the System Admin packages and SMUs from XR.

For more information on upgrading the system and the RPMs, see *Cisco IOS XR Flexible Packaging Configuration Guide*.

Third-Party SMUs

Consider these points while activating and deactivating third-party SMUs:

- To activate a third-party SMU, you should have a corresponding base package.
- When you activate a third-party SMU, the corresponding third-party base package state is inactive, this is an expected behavior.
- To deactivate a third-party SMU, ensure that you activate the corresponding third-party base package. Third-party SMUs deactivated explicitly might lead to triages to the install team.

Note All SMUs are bundled together with the base package in a TAR file

Note All Cisco RPMs have the platform name in the filename. For example, **ncs540**-sysadmin.

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 32. For uninstalling a package, see Uninstall Packages, on page 39.

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. You can also include SMUs in an upgrade operation along with mini ISO.

This task is also used to install *.rpm* files. The *.rpm* file contains multiple packages and SMUs that are merged into a single file. The packaging format defines one RPM per component, without dependency on the card type.

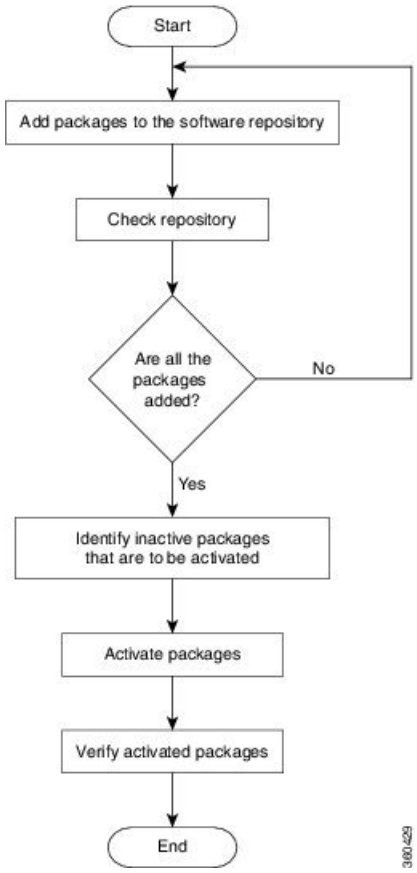
Note Ensure that you have adequate disk space. Run the **fsck** command to check the status of the file system, for a successful IOS XR upgrade. You must run the **fsck** command in the System Admin EXEC mode to install a System Admin package, and in the XR EXEC mode to install the XR package. All install commands are applicable in both the System Admin EXEC mode and in XR EXEC mode. System Admin install operations are done from XR EXEC mode.

Note

- The system upgrade is supported only from XR EXEC mode.
- While the System Admin package can be executed using **install** commands in the System Admin EXEC mode and XR EXEC mode, the XR package can only be executed using the install commands in XR EXEC mode. All **install** commands are applicable in both these modes.
- While the System Admin SMUs can be installed in System Admin EXEC mode and XR EXEC mode, the XR SMUs can only be installed through the XR EXEC mode.
- Install operation over IPv6 is not supported.

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

Figure 2: Installing Packages Workflow



Before you begin

- Configure and connect to the management port. The installable file is accessed through the management port. For details about configuring the management port, see Configure the Management Port, on page 5.
- Copy the package to be installed either on the router's hard disk or on a network server to which the router has access.

Procedure

Step 1 Execute one of these:

- **install add source** *<http or shttp transfer protocol>/package_path/ filename1 filename2 ...*
- **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:/ncs540-mpls-te-rsvp-1.0.0.0-<release-number>.x86_64.rpm
ncs540-mgbl-1.0.0.0-<release-number>.x86_64.rpm
```

or

```
RP/0/RP0/CPU0:router#install add source sftp://root@8.33.5.15:/auto/ncs/package/
```

```
RP/0/RP0/CPU0:router#install add source
/harddisk:/ncs540-mpls-te-rsvp-1.0.0.0-<release-number>.x86_64.rpm
ncs540-mgbl-1.0.0.0-<release-number>.x86_64.rpm
```

or

```
RP/0/RP0/CPU0:router#install add source sftp://root@8.33.5.15:/auto/ncs/package/
ncs540-mcast-1.0.0.0-<release-number>.x86_64.rpm
 ncs540-mpls-1.0.0.0-<release-number>.x86_64.rpm
```

Note A space must be provided between the *package_path* and *filename*.

The software files are unpacked from the package, validated, and then 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.

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 operation ID can be later used to execute the **activate** command.

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

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.

Step 4 **show install inactive**

Example:

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

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 ncs540-mcast-1.0.0.0-<release-number>.x86_64.rpm
ncs540-mpls-1.0.0.0-<release-number>.x86_64.rpm
```

The *operation_id* is that of the **install add** operation. This command can also be run from System Admin mode. 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, as this is the default. The **install activate** command runs in the background, and the EXEC prompt is returned.

You can run the activate operation either through the synchronous mode or by selecting the `sync` option from the CLI.

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 does not happen instantaneously, but takes some time. Upon activation completion, the system reloads automatically. For restart SMU activation, the SMU takes effect once the processes impacted by the SMU are restarted.

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 **show install active**

Example:

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

Displays packages that are active.

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

Step 7 **install commit**

Example:

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

Commits the Host, XR, and System Admin newly active software.

Note On Multi-SDR mode, you can use the **install commit sdr** to commit just the sdr from where the CLI is being triggered.

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.

Related Commands	Purpose
show install prepare	Displays the list of package that have been prepared and are ready for activation.

What to do next

- Ensure that you commit the upgrade using **install commit**.
- 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 39.

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

Install Prepared Packages

- 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 less time. As a result, the router downtime is reduced.

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, preactivation 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 less time. As a result, the router downtime is considerably reduced.
- Performs disk-space check that is required for a successful operation. This quantifies the disk-space deficit, and provides you possible alternatives to free up space in the filesystem.

- Performs package compatibility check. This ensures that all the required installation packages are available. For any package compatibility check error, details of the package and version are logged.

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. System Admin install operations can be done from XR mode.

Procedure

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

For details, see Install Packages, on page 32.

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.

Step 3 Execute one of these:

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

Example:

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. 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.

Activations 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.

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

Step 7 **install commit**

Example:

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

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 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.

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

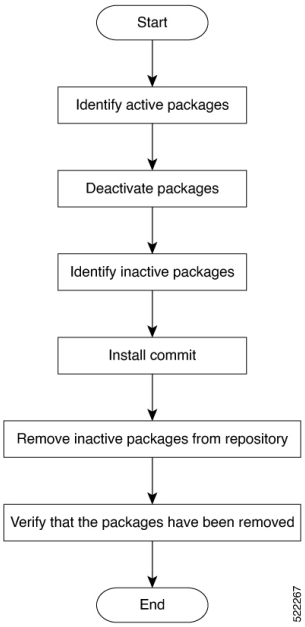
Uninstall Packages

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. However, the cross VM operation allows System Admin packages to be deactivated from XR as well.

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 3: 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.

Procedure

Step 1 **show install active**

Example:

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

Displays active packages. Only active packages can be deactivated.

Step 2 Execute one of these:

- **install deactivate** *package_name*

- **install deactivate id** *operation_id*

Example:

The *operation_id* is the ID from **install add** operation. 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. If System admin packages were added as a part of the **install add** operation (of the ID used in deactivate) then those packages will also be deactivated.

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.

Step 4 **install commit**

Step 5 **install remove** *package_name*

Example:

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.

You can also use the **install remove inactive all** to remove all inactive packages from XR and System Admin.

Step 6 **show install repository**

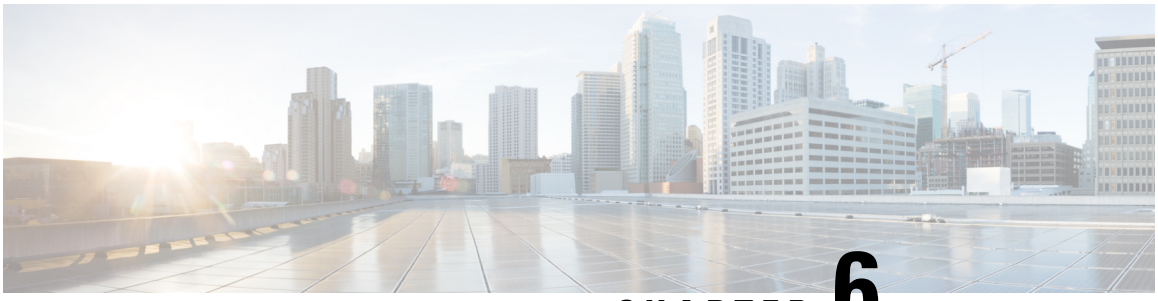
Example:

```
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.

What to do next

Install required packages. .

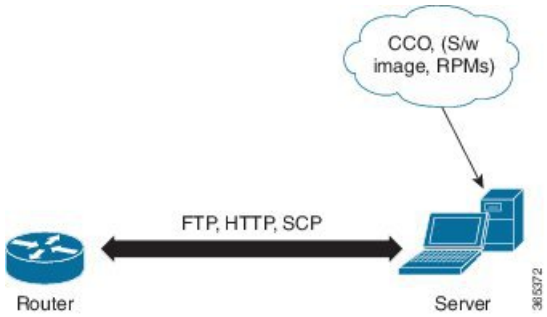


CHAPTER 6

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 4: 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** and **install upgrade**. The **install update** command identifies and updates dependent packages. The command does not update the base package. The **install upgrade** command upgrades the base package.

The rest of this chapter contains these sections:

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** command. When the **install update** 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** command is:

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

Four scenarios in which you can use the **install update** 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 [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]**

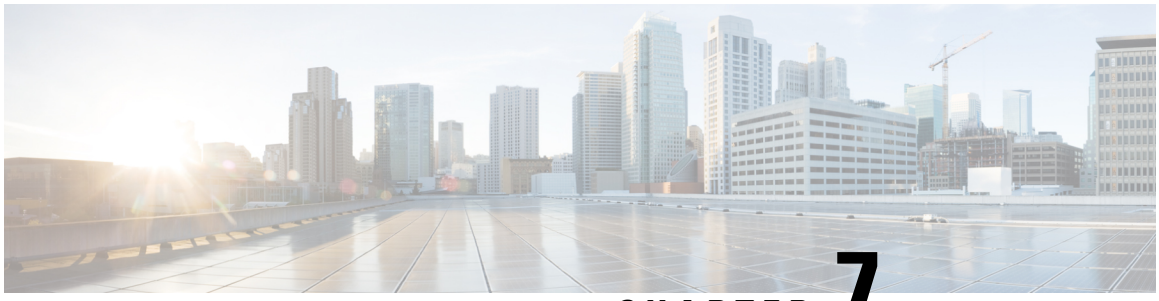
Note VRF and TPA on dataport is not supported. If the server is reachable only through non-default VRF interface, the file must already be retrieved using ftp, sfp, scp, http or https protocols.

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>*

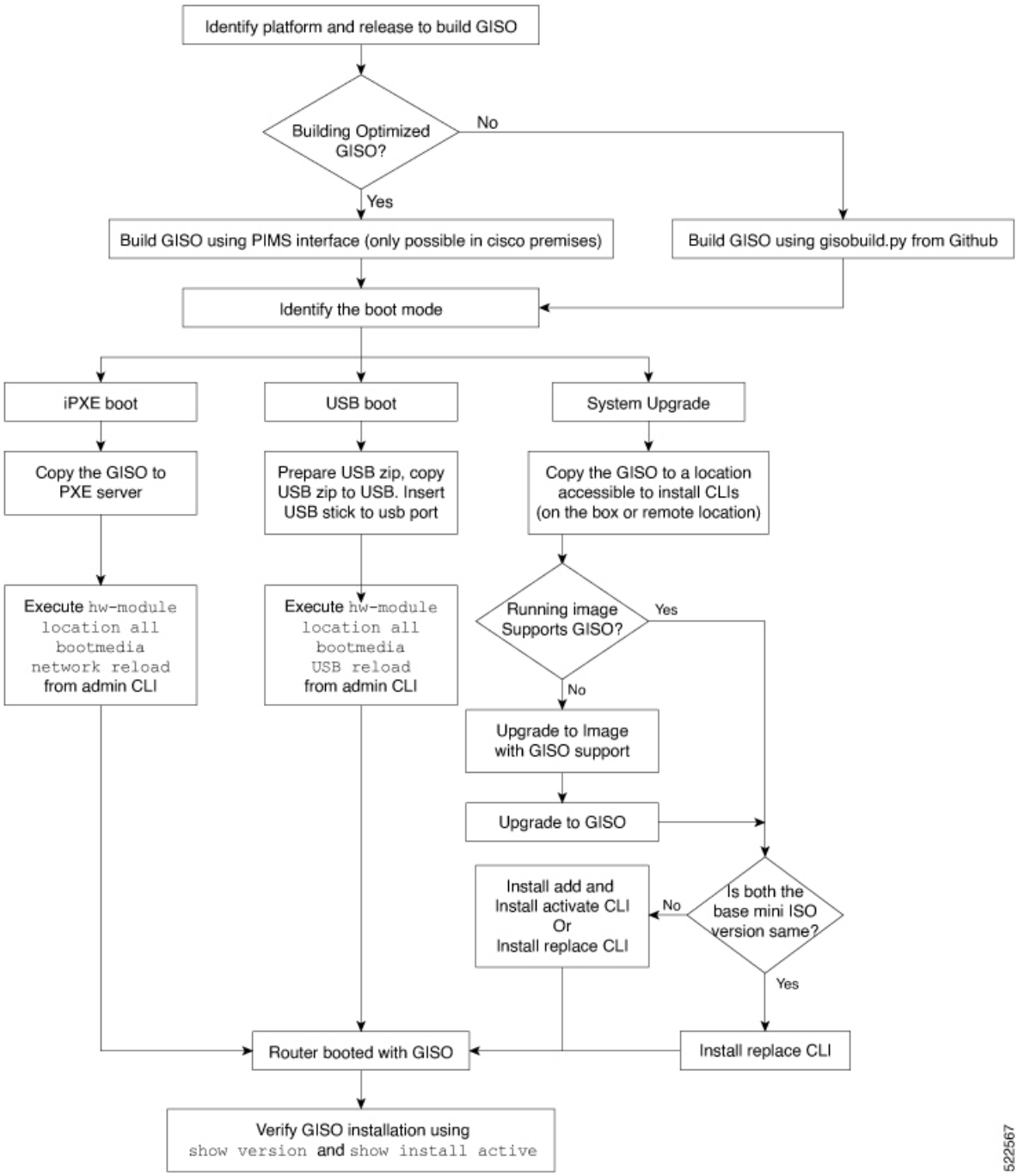


CHAPTER 7

Golden ISO Workflow

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

Figure 5: Golden ISO Workflow



- Build Golden ISO Using Script, on page 45
- Install Golden ISO, on page 46
- Install Replace with Golden ISO, on page 48

Build Golden ISO Using Script

To build GISO, provide the following input parameters to the script:

- Base mini-x.iso (mandatory)
- XR configuration file (optional)
- one or more Cisco-specific SMUs for host, XR and System admin (optional)
- one or more third-party SMUs for host, XR and System admin (optional)
- Label for golden ISO (optional)
- Optional RPMs

Note To successfully add k9sec RPM to GISO, change the permission of the file to `644` using the **chmod** command.

```
chmod 644 [k9 sec rpm]
```

To build GISO, perform the following steps:

Before you begin

- To upgrade from a release that did not support GISO to a release supporting GISO version, it is mandatory to first upgrade to mini ISO with GISO support.
- The system where GISO is built must meet the following requirements:
  - System must have Python version 3.6 and later.
  - System must have free disk space of minimum 12 GB.
  - Verify that the Linux utilities `mount`, `rm`, `cp`, `umount`, `zcat`, `chroot`, `mkisofs` are present in the system. These utilities will be used by the script. Ensure privileges are available to execute all of these Linux commands.
  - Kernel version of the system must be later than 3.16 or later than the version of kernel of Cisco ISO.
  - Verify that a `libyaml rpm` supported by the Linux kernel is available to successfully `import yaml` in the tool.
  - User should have proper permission for security rpm(k9sec-rpm) in rpm repository, else security rpm would be ignored for Golden ISO creation.
- The system from where the `gisobuild.py` script is executed must have root credentials.

Procedure

Step 1 Copy the script `gisobuild.py` from the Github location to an offline system or external server where the GISO will be built. Ensure that this system meets the pre-requisites described above in the *Before You Begin* section.

Step 2 Run the script `gisobuild.py` and provide parameters to build the golden ISO off the router.

Example:

```
[directory-path]$ gisobuild.py [-h] [-i <mini-x.iso>] [-r <rpm repository>]
[-c <config-file>] [-l <giso label>] [-m] [-v]
```

Note The `-i` option is mandatory, and either or both `-r` or `-c` options must be provided.

The corresponding GISO and build logs are available under the specified `out_directory` path. The default directory is `/output_gisobuild`.

where:

- -i is the path to mini-x.iso
- -r is the path to RPM repository
- -c is the path to XR config file
- -l is the golden ISO label
- -h shows the help message
- -v is the version of the build tool `gisobuild.py`
- -m is to build the migration tar to migrate from IOS XR to IOS XR 64 bit

Note It is recommended to build GISOs with a label name.

The corresponding GISO and build logs are available under the specified directory in `out_directory`. If a directory is not specified, the files are placed in `/output_gisobuild` directory.

Note The GISO script does not support verification of XR configuration.

What to do next

Install the GISO image on the router.

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.

Procedure

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.

Install Replace with Golden ISO

Procedure

Step 1 **install replace** *<GISO-location>* [**commit** | **noprompt**]

Example:

```
Router#install replace harddisk:/<dir>/<giso-image>.iso
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Install operation 11 started by root:
exec-timeout is suspended.
No install operation in progress at this moment
Label = More_Pkgs
ISO <giso-iso-image>.iso in input package list. Going to upgrade the system to

version <new-giso-image>.
System is in committed state
Current full-label: <giso-image>_R_Commit
Current only-label: R_Commit
Current label: R_Commit
Updating contents of golden ISO
Scheme : localdisk
Hostname : localhost
Username : None
SourceDir : /ws
Collecting software state..
Getting platform
Getting supported architecture
Getting active packages from XR
Getting inactive packages from XR
Getting list of RPMs in local repo
Getting list of provides of all active packages
Getting provides of each rpm in repo
Getting requires of each rpm in repo
Fetching .... <giso-image>.iso
Label within GISO: More_Pkgs
Skipping <platform>-mgbl-3.0.0.0-<release>.x86_64.rpm from GISO as it's active
Adding packages
        <platform>-golden-x-<release>-<Label>.iso
RP/0/RP0/CPU0:Jun 20 14:43:59.349 UTC: sdr_instmgr[1164]: %INSTALL-INSTMGR-2-OPERATION_SUCCESS
 :

Install operation 12 finished successfully
Install add operation successful
Activating <platform>-golden-x-<release>-<Label>
Jun 20 14:44:05 Install operation 13 started by root:
```

```
  install activate pkg <platform>-golden-x-<release>-<Label> replace noprompt
Jun 20 14:44:05 Package list:
Jun 20 14:44:05     <platform>-golden-x-<release>-<Label>.iso
Jun 20 14:44:29 Install operation will continue in the background
exec-timeout is resumed.
Router# Install operation 13 finished successfully
Router: sdr_instmgr[1164]: %INSTALL-INSTMGR-2-OPERATION_SUCCESS :

Install operation 13 finished successfully


Router#install replace <path-to-image> <platform-name-golden-x-<version>-<label>.iso
Tue Mar 17 08:07:15.176 UTC
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Mar 17 08:07:24 Install operation 46 started by root:
Mar 17 08:07:24   install replace source <path-to-image>
<platform-name-golden-x-<version>-<label>.iso
Mar 17 08:07:24 No install operation in progress at this moment
Mar 17 08:07:24 Checking system is ready for install operation
Mar 17 08:07:24 'install replace' in progress
Mar 17 08:07:24 Label = GISO_IMAGE_XRV9K_<version>
Mar 17 08:07:24 ISO xrv9k-goldenk9-x-<version>-<label>.iso in input package list. Going to
 upgrade the system to version <new-version>
Mar 17 08:07:25 Scheme : http
Mar 17 08:07:25 Hostname : 10.x.x.x
Mar 17 08:07:25 Collecting software state..
Mar 17 08:07:25 Getting platform
Mar 17 08:07:25 Getting supported architecture
Mar 17 08:07:25 Getting active packages from XR
Mar 17 08:07:25 Getting inactive packages from XR
Mar 17 08:07:28 Getting list of RPMs in local repo
Mar 17 08:07:28 Getting list of provides of all active packages
Mar 17 08:07:28 Getting provides of each rpm in repo
Mar 17 08:07:28 Getting requires of each rpm in repo
Mar 17 08:07:36 Fetching .... xrv9k-goldenk9-x-<version>-<label>.iso
Mar 17 08:08:02 Adding packages
        xrv9k-goldenk9-x-<version>-<label>.iso
Router:Mar 17 08:09:03.487 UTC: sdr_instmgr[1281]: %INSTALL-INSTMGR-2-OPERATION_SUCCESS :
Install operation 47 finished successfully
Mar 17 08:09:03 Install add operation successful
Mar 17 08:09:08 Activating xrv9k-goldenk9-x-<version>-<label>
Mar 17 08:09:10 Install operation 46 started by root:
  install activate pkg xrv9k-goldenk9-x-<version>-<label> replace
Mar 17 08:09:10 Package list:
Mar 17 08:09:10     xrv9k-goldenk9-x-<version>-<label>
This install operation will reload the system, continue?
 [yes/no]:[yes] yes
Mar 17 08:10:30 Install operation will continue in the background
Mar 17 08:10:30 Activate operation ID is: 46 for 'install source' ID:46

Router# Install operation 46 finished successfully
%INSTALL-INSTMGR-2-OPERATION_SUCCESS : Install operation 46 finished successfully
sdr_instmgr[1150]: %INSTALL-INSTMGR-2-SYSTEM_RELOAD_INFO : The whole system will be reloaded
 to complete install operation 46
```

Important For versions earlier than Cisco IOS XR Release 6.5.2, use the following command:

install update source *<absolute-path-of-Golden-ISO>* **replace**

For example,

```
Router#install update source harddisk:/ <giso-image>.iso replace
```

The version and label of the newly added GISO is compared with the version and label of the currently active version. If a mismatch is identified, a new partition is created and the full package is installed. After installation, the system reloads with the image and packages from the newly added GISO.

Note Activating or deactivating on a system that has a valid label invalidates the label. This action is irreversible. For example, running **show version** command on the system displays the label `6.3.3_633rev1005`. If any SMU is activated or deactivated on the system, the label `633rev1005` is invalidated, and the `show version` command displays only `6.3.3` as the label.

Step 2 **show version**

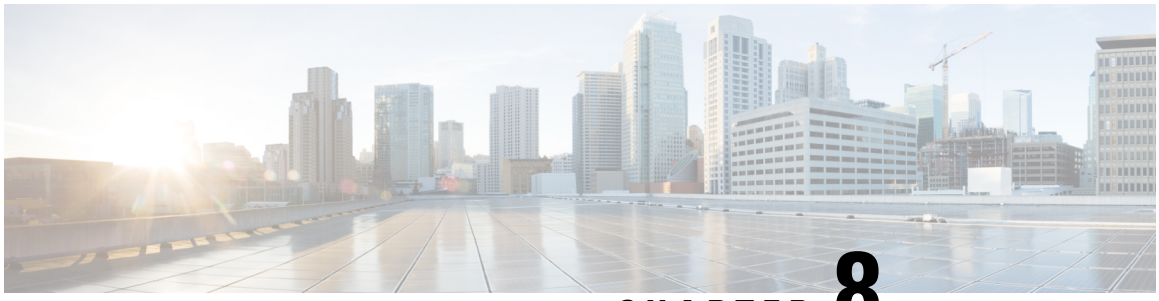
Example:

```
Router#show version
Wed Jun 20 15:06:37.915 UTC
Cisco IOS XR Software, Version <new-giso-image>
Copyright (c) 2013-2018 by Cisco Systems, Inc.

Build Information:
Built By     : <user>
Built On     : <date>
Build Host   : <host-name>
Workspace    : <workspace-name>
Version      : <version>
Location    : <path>
Label        : <label-name>

cisco <platform> () processor
System uptime is 3 hours 51 minutes
```

The system loads with the image and packages from the newly added GISO.



CHAPTER 8

Disaster Recovery

The topics covered in this chapter are:

Boot using USB Drive

The bootable USB drive is used to re-image the router for the purpose of system upgrade or boot the router in case of boot failure. The bootable USB drive can be created using a compressed boot file.

Create a Bootable USB Drive Using Compressed Boot File

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.

Note In case of failure to read or boot from USB drive, ensure that the drive is inserted correctly. If the drive is inserted correctly and still fails to read from USB drive, check the contents of the USB on another system.

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

- You have access to a USB drive with a storage capacity that is between 8GB (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 *ncs540-usb-boot-<release_number_zip>*.

Procedure

Step 1 Connect the USB drive to your local machine and format it with FAT32 or MS-DOS file system using the Windows Operating System or Apple MAC Disk Utility.

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.

Step 5 Eject the USB drive from your local machine.

What to do next

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

Boot the Router Using iPXE

iPXE is a pre-boot execution environment that is included in the network card of the management interfaces and works at the system firmware (UEFI) level of the router. iPXE is used to re-image the system, and boot the router in case of boot failure or in the absence of a valid bootable partition. iPXE downloads the ISO image, proceeds with the installation of the image, and finally bootstraps inside the new installation.

iPXE acts as a boot loader and provides the flexibility to choose the image that the system will boot based on the Platform Identifier (PID), the Serial Number, or the management mac-address. iPXE must be defined in the DHCP server configuration file.

Zero Touch Provisioning

Zero Touch Provisioning (ZTP) helps in auto provisioning after the software installation of the router using iPXE.

ZTP auto provisioning involves:

- **Configuration:** Downloads and executes the configuration file. The first line of the file must contain `!! IOS XR` for ZTP to process the file as a configuration.
- **Script:** Downloads and executes the script files. The script files include a programmatic approach to complete a task. For example, scripts created using IOS XR commands to perform patch upgrades. The first line of the file must contain `#! /bin/bash` or `#! /bin/sh` for ZTP to process the file as a script.

Setup DHCP Server

A DHCP server must be configured for IPv4, IPv6 or both communication protocols. The following example shows ISC-DHCP server running on Linux system.

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.
- Enable firewall to allow the server to process DHCP packets.
- For DHCPv6, a Routing advertisement (RA) message must be sent to all nodes in the network that indicates which method to use to obtain the IPv6 address. Configure Router-advertise-daemon (radvd, install using yum install radvd) to allow the client to send DHCP request. For example:

```
interface eth3
{
        AdvSendAdvert on;
        MinRtrAdvInterval 60;
        MaxRtrAdvInterval 180;
        AdvManagedFlag on;
        AdvOtherConfigFlag on;
        prefix 2001:1851:c622:1::/64
        {
                AdvOnLink on;
                AdvAutonomous on;
                AdvRouterAddr off;
        };
};
```

- The HTTP server can be in the same server as that of the DHCP server, or can be on a different server. After the IP address is assigned from DHCP server, the router must connect to the HTTP server to download the image.

Procedure

Step 1 Create the `dhcpd.conf` file (for IPv4, IPv6 or both communication protocols), `dhcpv6.conf` file (for IPv6) or both in the `/etc/` or `/etc/dhcp` directory. This configuration file stores the network information such as the path to the script, location of the ISO install file, location of the provisioning configuration file, serial number, MAC address of the router.

Step 2 Test the server once the DHCP server is running. For example, for IPv4:

- Use MAC address of the router:

  Note Using the `host` statement provides a fixed address that is used for DNS, however, verify that option `77` is set to iPXE in the request. This option is used to provide the bootfile to the system when required.

  Ensure that the above configuration is successful.
- Use serial number of the router: The serial number of the router is derived from the BIOS and is used as an identifier.

Step 3 Restart DHCP.

```
killall dhcpd
/usr/sbin/dhcpd -f -q -4 -pf /run/dhcp-server/dhcpd.pid
-cf /etc/dhcp/dhcpd.conf ztp-mgmt &
```

Example

The example shows a sample `dhcpd.conf` file:

```
allow bootp;
allow booting;
ddns-update-style interim;
option domain-name "cisco.com";
option time-offset -8;
ignore client-updates;
default-lease-time 21600;
max-lease-time 43200;
option domain-name-servers <ip-address-server1>, <ip-address-server2>;
log-facility local0;
 :
subnet <subnet> netmask <netmask> {
  option routers <ip-address>;
  option subnet-mask <subnet-mask>;
  next-server <server-addr>;
}
  :
host <hostname> {
  hardware ethernet e4:c7:22:be:10:ba;
  fixed-address <address>;
  filename "http://<address>/<path>/<image.bin>";
}
```

The example shows a sample `dhcpd6.conf` file:

```
option dhcp6.name-servers <ip-address-server>;
option dhcp6.domain-search "cisco.com";
dhcpv6-lease-file-name "/var/db/dhcpd6.leases";
option dhcp6.info-refresh-time 21600;
option dhcp6.bootfile-url code 59 = string;
subnet6 <subnet> netmask <netmask> {
       range6 2001:1851:c622:1::2 2001:1851:c622:1::9;
        option dhcp6.bootfile-url "http://<address>/<path>/<image.bin>";
```

What to do next

Invoke ZTP.

Invoke ZTP

ZTP runs within the XR namespace, and within the global VPN routing/forwarding (VRF) namespace for management interfaces and line card interfaces.

Before you begin

Ensure that a DHCP server is setup. For more information, see Setup DHCP Server, on page 53.

Procedure

Edit the dhcpd.conf file to utilize the capabilities of ZTP.

The following example shows a sample DHCP server configuration including iPXE and ZTP:

```
host <host-name>
{
hardware ethernet <router-serial-number or mac-id>;
fixed-address <ip-address>;
  if exists user-class and option user-class = "iPXE" {
  # Image request, so provide ISO image
  filename "http://<ip-address>/<directory>/";
  } else
{
  # Auto-provision request, so provide ZTP script or configuration
  filename "http://<ip-address>/<script-directory-path>/";
  #filename "http://<ip-address>/<script-directory-path>/
  }
}
```

Note Either the ZTP .script file or the .cfg file can be provided at a time for auto-provisioning.

With this configuration, the system boots using during installation, and then download and execute when XR VM is up.

Invoke ZTP Manually

ZTP can also be invoked manually with the modified one touch provisioning approach. The process involves:

Before you begin

A configuration file can be used to specify a list of interfaces that will be brought up in XR and DHCP will be invoked on. /pkg/etc/ztp.config is a platform specific file that allows the platform to specify which if any additional interfaces will be used.

```
#
# List all the interfaces that ZTP will consider running on. ZTP will attempt
# to bring these interfaces. At which point dhclient will be able to use them.
#
# Platforms may add dynamically to this list.
#
#ZTP_DHCLIENT_INTERFACES=" \
#    Gi0_0_0_0 \
#"
...
```

Procedure

Step 1 Boot the router.

Step 2 Login manually.

Step 3 Enable interfaces.

Step 4 Invoke a new ZTP DHCP session manually using the **ztp initiate** command.

```
Router#ztp initiate
```

For example, to send DHCP requests on the GigabitEthernet interface 0/0/0/0, run the command:

```
Router#ztp initiate debug verbose interface GigabitEthernet0/0/0/0
```

ZTP will run on the management port by default unless the platform has configured otherwise. The logs will be logged in `/disk0:/ztp/ztp/log` location.

Note To configure a 40G interface into 4 separate 10G interfaces, use the **ztp breakout nosignal-stay-in-breakout-mode** command.

Note To enable dataport breakouts and invoke DHCP sessions on all dataport and line card interfaces that are detected, use the **ztp breakout** command.

```
Router#ztp breakout debug verbose
Router#ztp initiate dataport debug verbose
Invoke ZTP?(this may change your configuration) [confirm] [y/n]:
```

To override the prompt:

```
Router#ztp initiate noprompt
Invoke ZTP?(this may change your configuration) [confirm] [y/n]:

ZTP will now run in the background.
Please use "show logging" or look at /disk0:/ztp/ztp/log to check progress.
```

ZTP runs on the management interfaces that are `UP` by default.

Step 5 To terminate the ZTP session, use the **ztp terminate** command.

What to do next

Boot the router using iPXE.

Boot the Router Using iPXE

Before you use the iPXE boot, ensure that:

- DHCP server is set and is running.
- You have logged in to the System Admin console using the **admin** command.

Run the following command to invoke the iPXE boot process to reimage the router:

```
hw-module location all bootmedia network reload
```

Example:

```
sysadmin-vm:0_RP0# hw-module location all bootmedia network reload
Wed Dec 23 15:29:57.376 UTC
Reload hardware module ? [no,yes]
```

The following example shows the output of the command:

```
iPXE 1.0.0+ (3e573) -- Open Source Network Boot Firmware -- http://ipxe.org
Features: DNS HTTP TFTP VLAN EFI ISO9660 NBI Menu
Trying net0...
net0: c4:72:95:a6:14:e1 using dh8900cc on PCI01:00.1 (open)
[Link:up, TX:0 TXE:0 RX:0 RXE:0]
Configuring (net0 c4:72:95:a6:14:e1)..................... Ok << Talking to DHCP/PXE server to
 obtain network information
net0: 10.37.1.101/255.255.0.0 gw 10.37.1.0
net0: fe80::c672:95ff:fea6:14e1/64
net0: 2001:1800:5000:1:c672:95ff:fea6:14e1/64 gw fe80::20c:29ff:fefb:b9fe
net1: fe80::c672:95ff:fea6:14e3/64 (inaccessible)
Next server: 10.37.1.235
Filename: http://10.37.1.235/


http://10.37.1.235/ ... 58% << Downloading file as indicated by DHCP/PXE server to boot
install image
```