System Setup and Software Installation Guide for Cisco NCS 4000 Series

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Preface

This preface contains these sections:

Communications, Services, and Additional Information

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

Cisco NCS 4016 System Features

The topics covered in this chapter are:

Cisco NCS 4016 Product Overview

Cisco Network Convergence System 4000 Series

The Cisco Network Convergence System (NCS) 4000 Series System is a converged optical service platform and provides dense wavelength-division multiplexing (DWDM), Optical Transport Network (OTN), Multiprotocol Label Switching Transport Profile (MPLS-TP), Carrier Ethernet, and label switch router (LSR) or IP multi service capabilities. It facilitates:

- massive scale through a state-of-the-art silicon and system design.
- network efficiency and simplification.

In order to facilitate packet-optical integration, the form factor of the Cisco NCS 4000 is compliant with typical carrier environments, with a notably shallow footprint to address ANSI and ETSI transport equipment requirements. You can deploy the system in 19 inch or 23 inch width ANSI footprints and 300 mm width ETSI footprints.

Cisco Network Convergence System 4016 System

The Cisco NCS 4016 System, part of the Cisco NCS 4000 Series System, is the next generation converged optical service platform. The system has a 24-rack-unit (24RU), rack-mountable solution with 16 service line-card slots, each with a full-duplex bandwidth of 200 Gbps. It has different cards for packet forwarding, OTN switching, and coherent DWDM transponder or trunk capability. Depending on the specific card configuration, the NCS 4016 supports numerous capabilities, including:

- Packet switching and routing
- OTN switching
- DWDM transponding and muxponding

The Cisco NCS 4016 System can be used as a converged packet-optical platform by simultaneously combining all of these capabilities.

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.

Implementation of Virtualized IOS XR on Cisco NCS Series Router

- The hypervisor creates and manages individual VM environments.
- On every route processor (RP) 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 4000 Series system 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:hostname#`

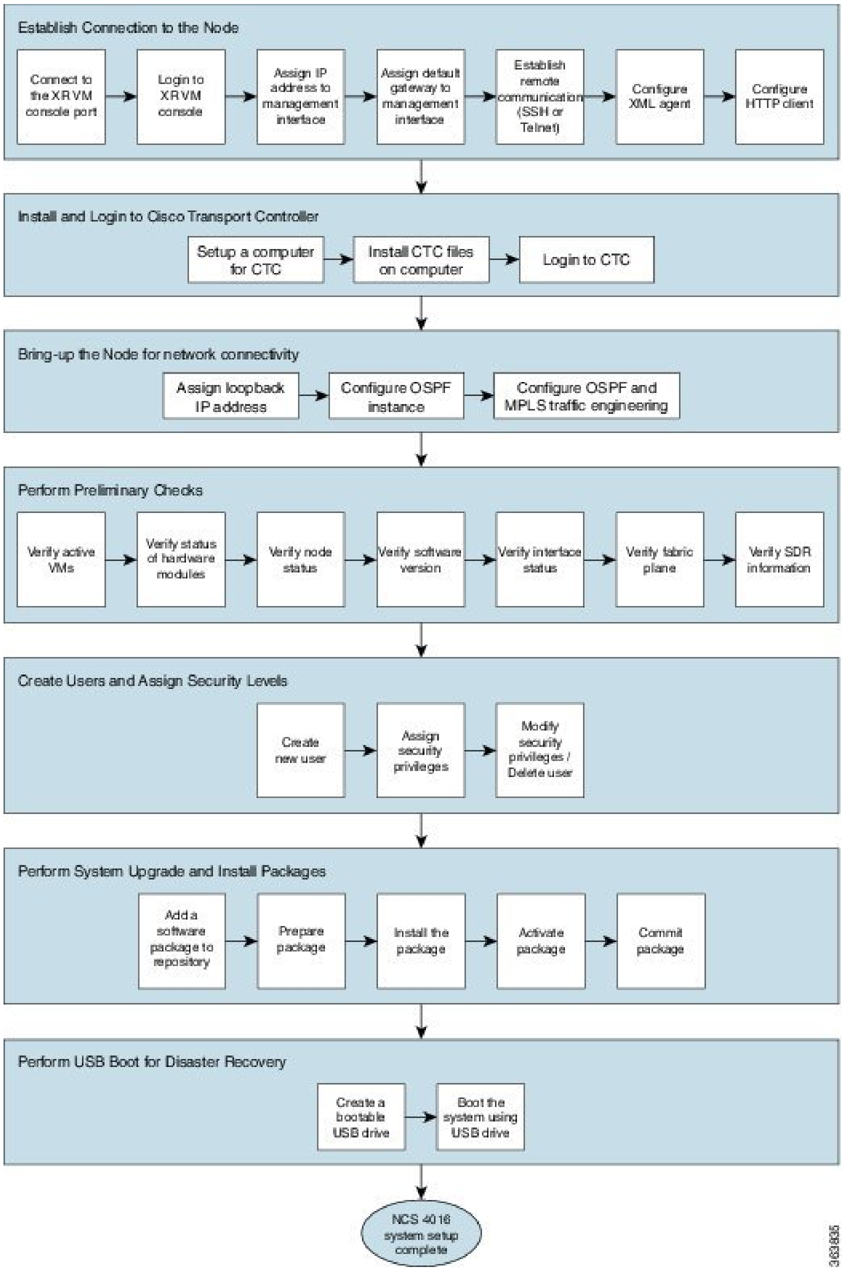
XR Config mode
(XR VM configuration mode)
	Perform security, routing, and other XR feature configurations on the XR VM.
	Example:
	`RP/0/RP0:hostname#`**`configure`**
	`RP/0/RP0:hostname(config)#`

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:hostname#`**`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:hostname#`**`admin`**
	`sysadmin-vm:0_RP0#`**`config`**
	`sysadmin-vm:0_RP0(config)#`

System Setup Workflow

The system setup of the Cisco NCS 4016 Series system involves these stages:


Establish Connection to the Node
Connect to the XR VM console port
Login to XR VM console
Assign IP address to management interface
Assign default gateway to management interface
Establish remote communication (SSH or Telnet)
Configure XML agent
Configure HTTP client
Install and Login to Cisco Transport Controller
Setup a computer for CTC
Install CTC files on computer
Login to CTC
Bring-up the Node for network connectivity
Assign loopback IP address
Configure OSPF instance
Configure OSPF and MPLS traffic engineering
Perform Preliminary Checks
Verify active VMs
Verify status of hardware modules
Verify node status
Verify software version
Verify interface status
Verify fabric plane
Verify SDR information
Create Users and Assign Security Levels
Create new user
Assign security privileges
Modify security privileges / Delete user
Perform System Upgrade and Install Packages
Add a software package to repository
Prepare package
Install the package
Activate package
Commit package
Perform USB Boot for Disaster Recovery
Create a bootable USB drive
Boot the system using USB drive
NCS 4016 system setup complete
363835

1. Establish Connection to a Node, on page 7—Connect to the console port and boot-up the system. After booting is complete, bring-up the node by establishing a connection to the node using the console port.

2. Install and Login to Cisco Transport Controller, on page 17— Setup a computer for Cisco Transport Controller (CTC) and login to CTC. CTC is used to perform operations, administration, maintenance and provisioning activities of the system.

3. Bring-up the Node for Network Connectivity, on page 21— Configure the node to connect to the network.

4. Perform Preliminary Checks, on page 25—Perform basic verification of the default setup of the system. This ensures that, if any setup issue is detected, corrective action is taken at an early stage.

5. Create User Profiles and Assign Privileges, on page 35—Create users and assign privileges, as needed. Users are either permitted, or denied, the use of certain commands based on assigned privileges.
6. Perform System Upgrade and Install Feature Packages, on page 39—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 system.
7. Perform Disaster Recovery, on page 47—In the event of a system boot failure due to image corruption, boot the system using an external bootable USB drive.

CHAPTER 2

Establish Connection to a Node

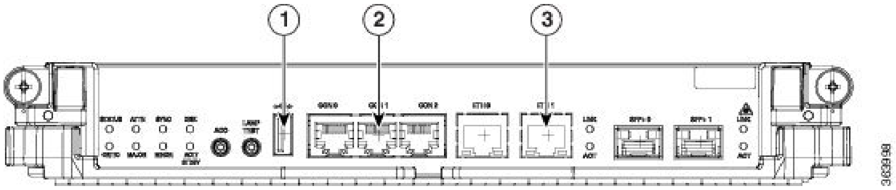
After installing the hardware, boot the Cisco NCS 4016 Series System. Connect to the XR VM console port and power on the system. The system completes the boot process using the pre-installed operating system (OS) image. If no image is available within the system, the system can be booted using an external bootable USB drive. For more details on booting the system using USB drive, see Perform Disaster Recovery, on page 47

After booting is complete, establish a connection to the node.

Connect to the XR VM Console Port and Power the System

Use the XR VM console port on the Route Processor (RP) to connect to Network Convergence System (NCS) 4016 system. 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.



1	External USB Port
2	XR VM Console Port
3	XR VM Management Port

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 system.

Press the power switch up to turn on the power shelves. As the system 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 system 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 system 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 48 and Boot the Router Using USB, on page 50.

What to do next

Specify the root username and password.

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), configure the network subnet or host route to the default gateway.

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/instanceport*
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** *subnet or host route default-gateway*
8. Use the **commit** or **end** command.

DETAILED STEPS

Step 1 **configure**

Example:

```
RP/0/RP0:hostname# configure
```

Enters XR Config mode.

Step 2 **interface MgmtEth** *rack/slot/instanceport*

Example:

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

Places the interface in an "up" state.

Step 6 **exit**

Example:

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

Exits the Management interface configuration mode.

Step 7 **router static address-family ipv4 unicast** *subnet or host route default-gateway*

Example:

```
RP/0/RP0:hostname(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 10.

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	

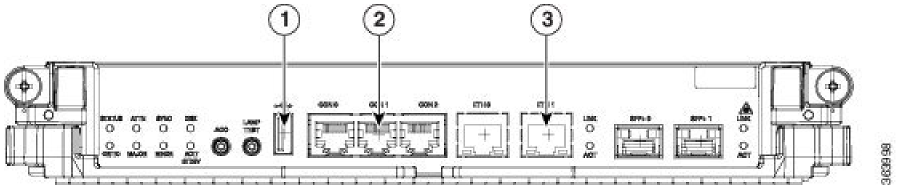
Before you begin

Configure the management port. See Configure the XR VM Management Port, on page 8.

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.



1	External USB Port
2	XR VM Console Port
3	XR VM Management Port

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 8.

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 *ncs4k-k9sec* package must be installed on the router. For details about package installation, see the Install Packages section.

Setting up Remote Connection

Setup remote access to establish a connection to a system remotely over the network. With a terminal emulation program, establish a SSH or telnet connection to the management interface port using its IP address.

Configuring SSH

Complete this task to setup a remote connection using Secure Shell Connection (SSH). If you want to setup a remote connection using Telnet, complete Configuring Telnet, on page 14.

Before you begin

Connect to the XR VM console port on the Route processor.

SUMMARY STEPS

1. **configure**
2. **hostname** *hostname*
3. **domain name** *domain-name*
4. **commit**
5. Perform one of the following steps based on the requirement:

    - Generate an RSA key pair.

        - To delete the RSA key pair, use the **crypto key zeroize rsa** command.

        - This command is used for SSHv1 only.

    crypto key generate rsa [**usage keys** | **general-keys**] [*keypair-label*]For example,

    ```
    RP/0/RP0:hostname# crypto key generate rsa general-keys
    ```

- Enables the SSH server for local and remote authentication on the system.
    - The recommended minimum modulus size is 1024 bits.
    - Generates a DSA key pair.

      To delete the DSA key pair, use the **crypto key zeroize dsa** command.
    - This command is used only for SSHv2.

crypto key generate dsa

For example,

```
RP/0/RP0:hostname# crypto key generate dsa
```

6. **configure**
7. **ssh timeout** *seconds*
8. Do one of the following:
    - **ssh server** [**vrf** *vrf-name*]
    - **ssh server v2**
9. **commit**
10. **show ssh**
11. **show ssh session details**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RP0:hostname# configure`	Enters XR Config mode.
Step 2	**hostname** *hostname* **Example:** `RP/0/RP0:hostname(config)# hostname system1`	Configures a hostname for your Network Convergence System (NCS) 4016 system.
Step 3	**domain name** *domain-name* **Example:** `RP/0/RP0:hostname(config)# domain name cisco.com`	Defines a default domain name that the software uses to complete unqualified host names.
Step 4	**commit**	Saves the configuration changes and remains within the configuration session.
Step 5	Perform one of the following steps based on the requirement: • Generate an RSA key pair.	

	Command or Action	Purpose

	• To delete the RSA key pair, use the **crypto key zeroize rsa** command.
	• This command is used for SSHv1 only.
	crypto key generate rsa [**usage keys** | **general-keys**] [*keypair-label*]For example,
	`RP/0/RP0:hostname# crypto key generate rsa general-keys`
	• Enables the SSH server for local and remote authentication on the system.
	• The recommended minimum modulus size is 1024 bits.
	• Generates a DSA key pair.
	To delete the DSA key pair, use the **crypto key zeroize dsa** command.
	• This command is used only for SSHv2.
	crypto key generate dsa
	For example,
	`RP/0/RP0:hostname# crypto key generate dsa`	

Step 6	**configure** **Example:** `RP/0/RP0:hostname# configure`	Enters XR Config mode.
Step 7	**ssh timeout** *seconds* **Example:** `RP/0/RP0:hostname(config)# ssh timeout 60`	(Optional) Configures the timeout value for user authentication to AAA. • If the user fails to authenticate itself to AAA within the configured time, the connection is cancelled. • If no value is configured, the default value of 30 seconds is used. The range is from 5 to 120.
Step 8	Do one of the following: • **ssh server** [**vrf** *vrf-name*] • **ssh server v2** **Example:** `RP/0/RP0:hostname(config)# ssh` or	• (Optional) Brings up an SSH server using a specified VRF of up to 32 characters. If no VRF is specified, the default VRF is used. To stop the SSH server from receiving any further connections for the specified VRF, use the **no** form of this command. If no VRF is specified, the default is assumed.

	Command or Action	Purpose
	`RP/0/RP0:hostname(config)# ssh server v2`	**Note** The SSH server can be configured for multiple VRF usage. • (Optional) Forces the SSH server to accept only SSHv2 clients if you configure the SSHv2 option by using the **ssh server v2** command. If you choose the **ssh server v2** command, only the SSH v2 client connections are accepted.
Step 9	**commit**	Saves the configuration changes and remains within the configuration session.
Step 10	**show ssh** **Example:** `RP/0/RP0:hostname# show ssh`	(Optional) Displays all of the incoming and outgoing SSHv1 and SSHv2 connections to the system.
Step 11	**show ssh session details** **Example:** `RP/0/RP0:hostname# show ssh session details`	(Optional) Displays a detailed report of the SSHv2 connections to and from the system.

The remote connection is configured using SSH.

What to do next

After the connection with the remote host is established, configure the XML agent.

Configuring Telnet

Complete this task if you want to establish a remote connection using Telnet. Is you choose to establish a remote connection using Secure Shell Connection (SSH), complete Configuring SSH, on page 11

Before you begin

Connect to the XR VM console port on the Route processor.

SUMMARY STEPS

1. **configure**
2. **vty-pool default** *value* **line-template vty**
3. **telnet** *IPv4 address*
4. **telnet vrf default ipv4 server max-servers** *number*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RP0:hostname# configure`	Enters XR Config mode.
Step 2	**vty-pool default** *value* **line-template vty** **Example:** `RP/0/RP0:hostname(config)# vty-pool default 0 99 line-template vty`	Configures the VTY lines to control inbound telnet connections.
Step 3	**telnet** *IPv4 address* **Example:** `RP/0/RP0:hostname(config)# telnet 10.0.0.1`	Enables the Telnet server. The default is disabled.
Step 4	**telnet vrf default ipv4 server max-servers** *number* **Example:** `RP/0/RP0:hostname(config)# telnet vrf default ipv4 server max-servers 5`	Sets the number of allowable telnet sessions to the router before establishing a telnet session. Starts a Telnet session to a remote device using IPv4. The default port number is 23. The range is from 1 to 65535. The default Virtual Routing and Forwarding (VRF) is the default VRF.

The remote connection is configured using Telnet.

What to do next

After the connection with the remote host is established, configure the XML agent.

Configuring XML Agent

Cisco Transport Controller (CTC) is used for operations, administration, maintenance and provisioning activities of the Network Convergence System (NCS) 4016 system. CTC communicates with the system using an Extensible Markup Language (XML) interface agent on the system. Before an XML session is established, use the console and enable the XML agent on the system.

To enable XML requests over Secure Shell (SSH) and Telnet, use the *xml agent tty* command in global configuration mode. To disable XML requests over SSH and Telnet, use the no form of this command.

Before you begin

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

SUMMARY STEPS

1. **configure**
2. **xml agent tty**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RP0:hostname# configure`	Enters XR Config mode.
Step 2	**xml agent tty** **Example:** `RP/0/RP0:hostname(config)#xml agent tty`	The agent receives XML requests from external clients and returns XML responses.

What to do next

After enabling the XML agent, configure HTTP server for non-secure connection and HTTPS for secure connection.

Configure HTTP

To download the Cisco Transport Controller (CTC) application to the client workstation, and to establish initial connection between CTC and the network elements, use a standard HTTP server or a secure HTTPS server protocol.

SUMMARY STEPS

1. **configure**
2. **http server**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RP0:hostname# configure`	Enters XR Config mode.

Step 2	**http server**
	Example:
	`RP/0/RP0:hostname(config)#http server`
	`RP/0/RP0:hostname(config)#http server ssl`
		Note The http server and http server ssl are mutually exclusive
		The HTTP or HTTPS server is enabled.

What to do next

The system is configured to use CTC to access the node. Login to CTC and establish a connection to the node.

CHAPTER 3

Install and Login to Cisco Transport Controller

After you have established a connection to the node using the console port of the system, setup a computer for Cisco Transport Controller (CTC) and login to CTC. CTC is used to perform operations, administration, maintenance and provisioning activities of the system.

Setup Computer for CTC

Component	Specification
Hardware	Intel Core i5, i7, or faster processor. A minimum of 4 GB RAM, 100 GB hard disk with 250 MB of available hard drive space.
Operating Systems	One of the following: • Windows: • Windows 7 • Windows Server 2008, or later • Apple Mac OS X • UNIX workstation with Solaris Version 9 or 10 on an UltraSPARC-III or faster processor, with a minimum of 1 GB RAM and a minimum of 250 MB of available hard drive space. • Ubuntu 12.10
Java Runtime Environment	JRE 1.6 with support for European languages
Browser	One of the following: • Internet Explorer • Mozilla Firefox • Safari • Google Chrome

Before you begin

Ensure that the basic configuration required to establish a connection to the node is complete. See Establish Connection to a Node, on page 7.

What to do next

Login to CTC and establish network connection to the node.

Login to CTC

Before you begin

Table 1: Feature History

Feature Name	Release Information	Feature Description
DUO Two-Factor Log In	Cisco IOS XR Release 6.5.32	DUO Two-Factor Log In feature enables the CTC to authenticate the user with a secure DUO password. The Two-Factor authentication requires the user to enter a combination of DUO passcode and node password to access a node in the network. This log in feature does not support Automatic Network Discovery.

- Ensure that you have setup a computer that meets the hardware and software requirements to use Cisco Transport Controller (CTC).
- Ensure you have complete image installed. If you have mini.iso image installed, then the ncs4k-mgbl.pkg must be installed on the NCS 4000 system.
- Complete the "Configuring XML Agent" task.
- Complete "Configure HTTP" task.
- Run the **snmp-server ifindex persist** command for Generalized Multi-Protocol Label Switching (GMPLS) to retain its links over a reload.

Step 1 From the computer connected to the NCS 4016 shelves, start Windows Internet Explorer or Mozilla Firefox web browser.

Step 2 In the browser URL field, enter the NCS 4016 IPv4 or IPv6 virtual address.

Step 3 Press **Enter**. The browser displays a window with a Delete CTC Cache field and information about the Cisco Transport Controller Java and System environments.

Note

- The Delete CTC Cache field deletes the CTC JAR (Java Archive) files that are downloaded to your computer when you log into NCS 4000. You perform this action if connectivity problems occur or you want to delete older CTC JAR file versions from your computer.
- If you are logging into NCS 4000 nodes in an operation network that are running different releases of CTC software, log into the node running the most recent release. If you log into a node running an older release, you will receive an INCOMPATIBLE–SW alarm for each node in the network running a new release, and CTC will not be able to manage these nodes. To check the software version of a node, select **About CTC** from the CTC Help menu. This will display the software version for each node visible on the network view. If the node is not visible, the software version can be read from the LCD display.

Step 4 If a Java Plug-in Security Warning dialog box appears, install the public-key security certificate.

The first time you connect to NCS 4000, this process can take several minutes. After the download, a warning message window appears.

Step 5 Click **OK**.

Step 6 In the CTC login window, type a user name and DUO password (both are case-sensitive).

Note DUO password is a combination of the node password and DUO passcode (OTP). For example, if the node password is Abcd123eS and passcode is 123456, then the DUO Password is Abcd123eS123456.

Step 7 Each time you login to CTC, you can select the following login options:

- Additional Nodes — Displays a list of current login node groups.
- Disable Network Discovery — Check this box to view only the NCS 4000 (and additional nodes within the login node group, if any) entered in the Node Name field. Nodes linked to this node through Data Communication Channels (DCC) are not discovered and will not appear in CTC network view. Using this option, you can decrease the CTC startup time in networks with many DCC–connected nodes, and can reduce memory consumption. If Disable Network Discovery is unchecked, CTC attempts to upgrade the CTC software by downloading more recent versions of the JAR files it finds during the network discovery. Click **Yes** to allow CTC to download the newer JAR files, or **No** to prevent CTC from downloading the JAR files.

  Note Upgrading the CTC software will overwrite your existing software. You must restart CTC after the upgrade is complete.

  Note DUO Two-Factor login does not support automatic discovery of other nodes in the network.
- Disable Circuit Management — Check this box to disable discovery of existing circuits. Using this option, you can decrease the CTC initialization time in networks with many existing circuits and reduce memory consumption. After you are logged in, you can enable circuit discovery at any time by choosing the **Enable Circuit Discovery** button on the Circuits tab.
- SSH or Telnet - Select an option to establish a remote connection with the node.

  Note For Duo Two-Factor login, select the **SSH** radio button.

Step 8 Click **Login**.

CTC is displayed with three views: Home Page, Network View, and Node View.

Step 9 To create a NETCONF session, perform the following substeps:

a) In node view, select a NETCONF functional pane. For example, click **Provisioning** > **Timing**.

A confirmation dialog box appears.

b) Click **Yes**.

Admin-Plane Configuration dialog box appears.

c) Enter a user name and DUO password (both are case-sensitive).

Note DUO password is a combination of the node password and DUO passcode (OTP). For example, if the node password is Abcd123eS and passcode is 123456, then the DUO Password is Abcd123eS123456.

d) Click **Login**.

Note Log in to a CLI terminal and use the `show ssh` command to check the creation of the NETCONF session.

```
#show ssh
Mon Jul 12 18:50:15.120 IST
SSH version : Cisco-2.0

id chan pty location state userid host ver authentication connection type
------------------------------------------------------------------------------------------------
Incoming sessions
1248 1 vty1 0/RP0 SESSION_OPEN root 10.xxx.xx.xxx v2 password Command-Line-Interface
1248 2 vty2 0/RP0 SESSION_OPEN root 10.xxx.xx.xxx v2 password Command-Line-Interface
1249 1 XXXXX 0/RP0 SESSION_OPEN root 10.xxx.xx.xxx v2 password Netconf-Subsystem
```

Note In the terminal, two channels with IDs 1 and 2 are created for one session and one channel (admin-plane) is created for another (NETCONF) session.

What to do next

Use CTC to bring up the node for network connectivity.

CHAPTER 4

Bring-up the Node for Network Connectivity

After logging in to Cisco Transport Controller (CTC), bring up the node for network connectivity. This includes assigning a loopback IP address for the node, configure an Open Shortest Path Firth (OSPF) instance, and configuring the OSPF and Multiprotocol Label Switching (MPLS) traffic engineering parameters.

Assign Loopback IP Address

After logging in to CTC, configure loopback interface. The loopback interface is a software-based logical interface, and is not associated with any physical interface, and are always in the up state. The packets routed to the loopback interface are rerouted back to the system and processed locally. The router ID must be same as the loopback address of the node.

Before you begin

Login to Cisco Transport Controller (CTC).

Step 1 In node view, click **Provisioning** > **Network** > **Loopback IP** tab.

Step 2 In Interface ID field, set the loopback interface ID.

Example:

For example, set the ID as `Loopback0`.

Step 3 In IP Address field, enter the IP address for the loopback interface.

Step 4 In NetMask field, enter the subnet mask for the loopback interface.

Example:

For example, set the subnet mask as `255.255.255.255`.

What to do next

Configure Open Shortest Path First (OSPF) instance to establish a network topology.

Configure OSPF Instance

Configure an OSPF instance to include Network Convergence System (NCS) in OSPF-enabled networks. OSPF is used to discover the network. To enable OSPF, you need to create an OSPF routing process, specify the range of IP address associated with the routing process, and assign area IDs associated with that range of IP addresses.

An Area ID is an administrative identifier and has no relation to an IP address or IP network ID. Area IDs are not used to reflect routing data. Area 0 is the default. The area number can be changed to other number. All the nodes in the network can use the same area ID. You cannot have multiple areas inside the same instance.

Before you begin

You must have an Open Shortest Path First (OSPF) Area ID.

Step 1 In node view, click **Provisioning** > **Network** > **OSPF** tab.

Step 2 In the Router ID field, select the address of the router.

Example:

For example, `1.0.0.44`

This step defines the IP addresses on which OSPF runs.

Step 3 In the OSPF interfaces field, set the interface and area ID for the instance.

This defines the area ID for that interface. Areas allow the subdivision of an AS into smaller, more manageable networks or sets of adjacent networks. OSPF hides the topology of an area from the rest of the AS. An area's network topology is visible only to routers inside that area; it is not visible to routers outside that area. If you changed the Area ID, the control cards reset, one at a time. The reset takes approximately 10 to 15 minutes. The router ID is determined as the highest active loopback address.

What to do next

Configure the OSPF and Multiprotocol Label Switching (MPLS) traffic engineering parameters.

Configure OSPF and MPLS Traffic Engineering

To discover network topology and allocate resources, the node implements a routing protocol to distribute and maintain the topology and resource information. To reliably propagate the information, use standard IP routing protocols, such as Open Shortest Path First (OSPF) with Multiprotocol Label Switching (MPLS)-Traffic Engineering (TE) extensions. Using a common MPLS-based control plane, all network elements work as peers to dynamically establish optical paths through the network. To achieve this functionality, MPLS is assigned an ID that is same as the loopback ID and router ID. TE is enabled within a single OSPF area.

The network traffic engineering is configured using:

- OSPF-Traffic Engineering (OSPF-TE), an extension of OSPF, is a control plane protocol used to manage MPLS-based networks. OSFP-TE manages the traffic engineering information of all the nodes that are part of the same area. Any change in bandwidth availability or disruption is instantly shared between all the nodes. This helps to manage the network with accurate information.

- MPLS-TE maps traffic flows to a particular path based on the available resources. Since the router has to have the complete information about the topology and resources available in a network, OSPF is required for use with MPLS-TE. MPLS-TE builds uni-directional tunnels from a source to the destination in the form of Label Switched Paths (LSPs), which is then used for forwarding traffic.

Configure the area for which TE is enabled by issuing the mpls traffic-eng area x command, where refers to the area number Configure an IP address on the tunnel interface to forward IP packets. The IP address is configured as an unnumbered interface by using the address of a loopback interface.

To configure OSPF for OSPF-TE and MPLS-TE from Cisco Transport Controller (CTC), perform these steps:

Before you begin

Loopback ID is set, and is same as the router ID

Step 1 Configure MPLS-TE:

a) In node view, click **Provisioning** > **Network** > **MPLS-TE** tab.
b) To flood the GMPLS Traffic Engineering link into a specific OSPF area and instance, specify values for these fields:

   - Flooding-igp field as **OSPF**
   - OSPF Instance Name field as **OTN**
   - Area field as *Area ID*. For example, `0`.

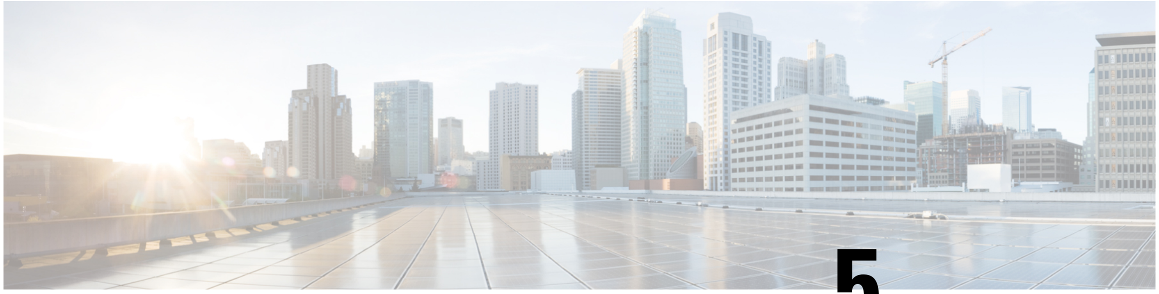
Step 2 Configure OSPF-TE:

a) In node view, click **Provisioning** > **Network** > **OSPF-TE** tab.
b) In MPLS_TE Router ID filed, select the loopback ID assigned to the system. For example, **`loopback0`**.
c) In Area ID field, specify the area ID for which the MPLS is configured.
d) In Autoconfig filed, select the checkbox to option to enable configuring Label Distribution Protocol (LDP) globally on each interface associated with a specific OSPF instance. LDP enables peer label switch routers (LSRs) to exchange label binding information for supporting hop-by-hop forwarding in an MPLS network.

Step 3 Click **Apply** to save the configuration.

What to do next

You have now setup the node for network connectivity. After the system is available for network connectivity, perform preliminary checks to verify that the system is setup correctly.



CHAPTER 5

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 25
- Verify Status of Hardware Modules, on page 28
- Verify Software Version, on page 28
- Verify Firmware Version, on page 29
- Verify Interface Status, on page 31
- Verify Fabric Plane, on page 31
- Verify SDR Information, on page 32

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. Complete this task to verify the VMs are active.

SUMMARY STEPS

1. **admin**
2. **show redundancy summary**
3. **show vm**

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0:hostname# admin
```

Enters System Admin EXEC mode.

Step 2 **show redundancy summary**

Example:

```
RP/0/RP0:hostname#show redundancy summary
Mon Mar 9 16:32:19.276 IST
Active Node Standby Node
----------- ------------
0/RP0 0/RP1 (Node Ready, NSR: Not Configured)
0/LC0 0/LC1 (Node Ready, NSR: Not Configured)
RP/0/RP0:hostname#
```

Displays the readiness of the VMs.

Step 3 **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.

```
sysadmin-vm:0_RP0# sh vm
Mon Mar 9 07:52:06.173 UTC
------ VMs found at location 0/RP0 ------
Id : sysadmin
Status : running
IP Addr: 192.0.44.1
HB Interval : NA
Last HB Sent: NA
Last HB Rec : NA
-------
Id : default-sdr
Status : running
IP Addr: 192.0.44.4
HB Interval : 0 s 500000000 ns
Last HB Sent: 663743
Last HB Rec : 663743
-------
Id : default-sdr
Status : running
IP Addr: 192.0.44.6
HB Interval : 10 s 0 ns
Last HB Sent: 33183
Last HB Rec : 33183
-------
------ VMs found at location 0/RP1 ------
Id : sysadmin
Status : running
IP Addr: 192.0.88.1
HB Interval : NA
Last HB Sent: NA
Last HB Rec : NA
-------
Id : default-sdr
Status : running
IP Addr: 192.0.88.4
HB Interval : 0 s 500000000 ns
Last HB Sent: 663749
Last HB Rec : 663749
-------
Id : default-sdr
Status : running
IP Addr: 192.0.88.6
HB Interval : 10 s 0 ns
Last HB Sent: 33183
Last HB Rec : 33183
-------
sysadmin-vm:0_RP0#
```

In the above result:

- Id—Name of the VM. "sysadmin" represents System Admin VM; "default-sdr" represents XR VM or LC 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.

SUMMARY STEPS

1. Login to Cisco Transport Controller (CTC). For information on logging into CTC, see Login to CTC, on page 18.
2. In the node view, click the **Inventory** tab.

DETAILED STEPS

Step 1 Login to Cisco Transport Controller (CTC). For information on logging into CTC, see Login to CTC, on page 18.

Step 2 In the node view, click the **Inventory** tab.
Displays the list of hardware modules detected on the system, their location, hardware type and state.

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 Software Version

The Cisco NCS 4018 system 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. Login to Cisco Transport Controller (CTC). For information on logging into CTC, see Login to CTC, on page 18.
2. In the node view, verify the **Navigation/Summary Pane** in the left panel.

DETAILED STEPS

	Command or Action	Purpose
Step 1	Login to Cisco Transport Controller (CTC). For information on logging into CTC, see Login to CTC, on page 18.	
Step 2	In the node view, verify the **Navigation/Summary Pane** in the left panel.	Displays the information on the CTC software and Cisco IOS XR versions installed on the system.

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 39.

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:hostname# 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.

```
FPD Versions
===============
Location    Card type   HWver    FPD device       ATR Status   Run Programd
-------------------------------------------------------------------------------
0/1      NCS4K-20T-O-S   0.1     CCC-FPGA         CURRENT      3.26  3.26
0/1      NCS4K-20T-O-S   0.1     CCC-Power-On     CURRENT      1.14 1.14
0/1      NCS4K-20T-O-S   0.1     Ethernet-Switch  CURRENT      1.40 1.40
0/1      NCS4K-20T-O-S   0.1     PLX-8618         CURRENT      0.09 0.09
0/3      NCS4K-20T-O-S   0.1     CCC-FPGA         CURRENT      3.26 3.26
0/3      NCS4K-20T-O-S   0.1     CCC-Power-On     CURRENT      1.14 1.14
0/3      NCS4K-20T-O-S   0.1     Ethernet-Switch  CURRENT      1.40 1.40
0/3      NCS4K-20T-O-S   0.1     PLX-8618         CURRENT      0.09 0.09
0/5      NCS4K-2H-O-K    0.1     CCC-FPGA         CURRENT      3.34 3.34
0/5      NCS4K-2H-O-K    0.1     CCC-Power-On     CURRENT      1.14 1.14
0/5      NCS4K-2H-O-K    0.1     Ethernet-Switch  CURRENT      1.40 1.40
0/5      NCS4K-2H-O-K    0.1     PLX-8618         CURRENT      0.09 0.09
0/8      NCS4K-24LR-O-S  0.1     CCC-FPGA         CURRENT      4.32 4.32
0/8      NCS4K-24LR-O-S  0.1     CCC-Power-On     CURRENT      1.14 1.14
0/8      NCS4K-24LR-O-S  0.1     Ethernet-Switch  CURRENT      1.37 1.37
0/8      NCS4K-24LR-O-S  0.1     PLX-8618         CURRENT      0.09 0.09
0/10     NCS4K-20T-O-S   0.1     CCC-FPGA         CURRENT      2.13 2.13
0/10     NCS4K-20T-O-S   0.1     CCC-Power-On     CURRENT      1.09 1.09
0/10     NCS4K-20T-O-S   0.1     Ethernet-Switch  CURRENT      1.40 1.40
0/10     NCS4K-20T-O-S   0.1     PLX-8618         CURRENT      0.09 0.09
0/13     NCS4K-2H-W      0.1     CCC-FPGA         CURRENT      4.29 4.29
0/13     NCS4K-2H-W      0.1     CCC-Power-On     CURRENT      1.14 1.14
0/13     NCS4K-2H-W      0.1     Ethernet-Switch  CURRENT      1.35 1.35
0/13     NCS4K-2H-W      0.1     PLX-8608         CURRENT      0.08 0.08
0/RP0    NCS4K-RP        0.1     Backup-BIOS BSP  CURRENT      14.01
0/RP0    NCS4K-RP        0.1     Backup-CCC-PwrOn BSP NEED UPGD 1.12
0/RP0    NCS4K-RP        0.1     Backup-EthSwitch BSP CURRENT 1.36hu
```

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.

SUMMARY STEPS

1. Login to Cisco Transport Controller (CTC). For information on logging into CTC, see Login to CTC, on page 18.
2. In the card view, click **Provisioning** > **Controllers**.

DETAILED STEPS

	Command or Action	Purpose
Step 1	Login to Cisco Transport Controller (CTC). For information on logging into CTC, see Login to CTC, on page 18.	
Step 2	In the card view, click **Provisioning** > **Controllers**.	Displays the admin and service state for each controller.

Verify Fabric Plane

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

```
Plane Admin Plane up->dn up->mcast
Id State State counter counter
--------------------------------------
0 UP UP 0 0
1 UP UP 0 0
2 UP UP 0 0
3 UP UP 0 0
sysadmin-vm:0_RP0#
```

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 4000 system, 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.

SUMMARY STEPS

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

DETAILED STEPS

Step 1 **admin**

Example:

```
RP/0/RP0:hostname# admin
```

Enters System Admin EXEC mode.

Step 2 **sh sdr**

Example:

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

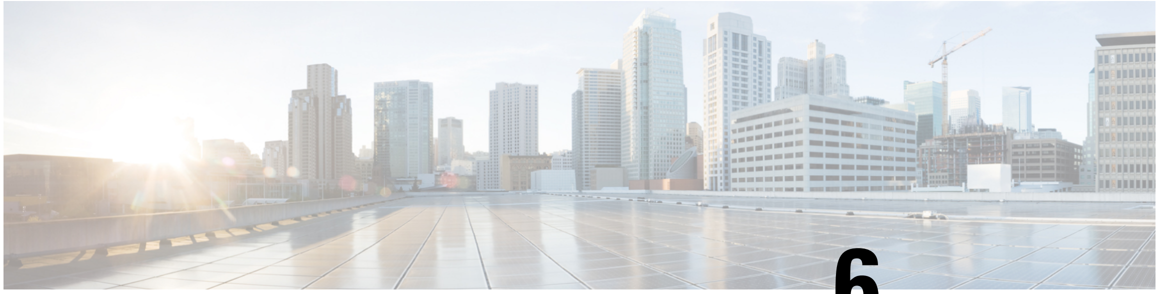
Displays the SDR information for every node.

```
sdr default-sdr
location 0/RP0/VM1
sdr-id 2
IP Address of VM 192.0.44.4
MAC address of VM BE:CD:2B:84:5A:06
VM State RUNNING
start-time 2015-03-05T11:37:29.28203+00:00
Last Reload Reason CARD_SHUTDOWN
Reboot Count 1
location 0/RP0/VM2
sdr-id 2
IP Address of VM 192.0.44.6
MAC address of VM BE:CD:2B:84:5A:06
VM State RUNNING
start-time 2015-03-05T11:38:19.966782+00:00
Last Reload Reason CARD_SHUTDOWN
Reboot Count 1
location 0/RP1/VM1
sdr-id 2
IP Address of VM 192.0.88.4
MAC address of VM BE:CD:2B:84:58:06
VM State RUNNING
start-time 2015-03-05T11:37:27.430983+00:00
Last Reload Reason CARD_SHUTDOWN
Reboot Count 1
location 0/RP1/VM2
sdr-id 2
IP Address of VM 192.0.88.6
MAC address of VM BE:CD:2B:84:58:06
VM State RUNNING
start-time 2015-03-05T11:38:19.048927+00:00
Last Reload Reason CARD_SHUTDOWN
Reboot Count 1
sysadmin-vm:0_RP0#
```

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.



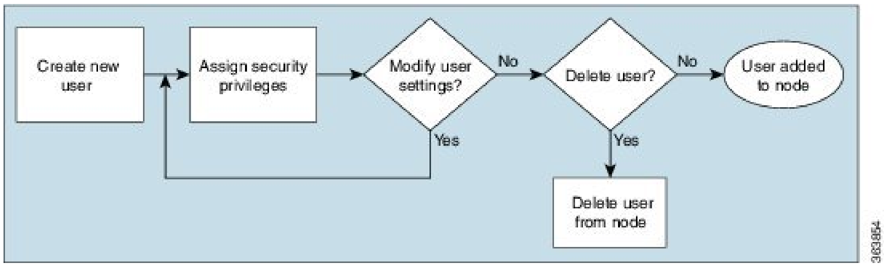
CHAPTER 6

Create User Profiles and Assign Privileges

To provide controlled access to the System Admin configurations on the Cisco NCS 4016 system, user profiles are created with assigned security levels. The security levels are specified based on the operations that user is expected to perform. Users are authenticated using username and password. Authenticated users are entitled to perform operations based on their assigned security levels.

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

Figure 1: Workflow for creating user profiles



The topics covered in this chapter are:

- Create a New User, on page 35
- Modify User Settings and Security Levels, on page 36
- Delete a User, on page 37
- Recover Password using PXE Boot, on page 38

Create a New User

To enable access to the node for multiple users, create new users and assign security levels. The user with username *root* can be used to set up other users.

Before you begin

Login to Cisco Transport Controller (CTC). You must log in as a Superuser to create additional users.

Step 1 Log into the node where you need to create users.

Step 2 In node view, click the **Provisioning** > **Security** > **Users** tab.

Step 3 In the Users window, click **Create**.

Step 4 In the Create User dialog box, enter the following:

a) Name: Type the user name. The name must be a minimum of two and a maximum of 20 alphanumeric (a-z, A-Z, 0-9) characters.

b) Password: Type the user password.

Note

- The password length, by default, is set to a minimum of six and a maximum of 20 characters.
- You can configure the default values in node view using the **Provisioning** > **NE Defaults** > **Node** > **security** > **passwordComplexity** tabs. The minimum length can be set to two, four, eight, ten or twelve characters, and the maximum length to 80 characters.
- The password must be a combination of alphanumeric (a-z, A-Z, 0-9) and special (+, #,%) characters, where at least two characters are not alphabetic and at least one character is a special character; or the password can contain any character.
- The password must not contain the user name.

c) Confirm Password: Type the password again to confirm it.

d) Security Level: Choose a security level for the user - RETRIEVE, MAINTENANCE, PROVISIONING, or SUPERUSER.

Each security level has a different idle time. The idle time is the length of time that CTC can remain idle before the password must be reentered. The defaults are: Retrieve user = unlimited, Maintenance user = 60 minutes, Provisioning user = 30 minutes, and Superuser = 15 minutes.

e) Click **OK**.

Step 5 To create new user on multiple nodes:

Note All nodes where you want to add users must be accessible in network view.

a) Go to the **Network View**, and click **Provisioning** > **Security** > **Users**.

b) Follow steps 3 and 4.

c) In the Select Applicable Nodes area, deselect any nodes where you do not want to add the user (all network nodes are selected by default).

d) In the User Creation Results dialog box, verify that the user was added to all the nodes chosen in Step 5c. If not, click **OK** and repeat steps 2 to 6.

Step 6 Click **OK**.

The user is created on the node.

What to do next

If you want to modify the user settings, you can change the settings.

Modify User Settings and Security Levels

You can change the user settings of an existing user at one node or at multiple nodes. The modifications that you make will only be applicable when the user logs out and logs back into Cisco Transport Controller (CTC).

Before you begin

Login to CTC. You must log in as a Superuser to modify user privileges.

Step 1 To change user setting on a single node:

a) In node view, click the **Provisioning** > **Security** > **Users** tab.

b) Click the user whose settings you want to modify, and click **Edit**.

c) In the Change User dialog box, you can:

- Change a user password
- Modify the user security level

d) Click **OK**.

Step 2 To change user settings on multiple nodes:

a) From the View menu, choose **Go to Network View**.

b) Click the **Provisioning** > **Security** > **Users** tab. Verify that you can access all the nodes where you want to change the user settings.

c) Click the user whose settings you want to modify, and click **Change**.

d) Change the settings.

e) In the Select Applicable Nodes area, uncheck any nodes where you do not want to change the user settings. All network nodes are selected by default.

Note The Select Applicable Nodes area does not appear for users who are provisioned for only one node.

f) Click **OK**.

The user settings on the node is changed.

What to do next

If you want to delete a user from a single node or multiple nodes, you can delete the user.

Delete a User

You can delete a user at one node or at multiple nodes. The modifications that you make will only be applicable when the user logs out and logs back into Cisco Transport Controller (CTC). You cannot delete a user who is currently logged in.

Note CTC will allow you to delete a user with superusers security level only if another superuser is present. For example, you can delete the superuser with user name *root*, if you have created another superuser. Use this option with caution.

Before you begin

Login to CTC. You must log in as a Superuser to delete users.

Step 1 To delete a user from single node:

a) In node view, click the **Provisioning** > **Security** > **Users** tab.

b) Click the user you want to delete, and click **Delete**.
c) In the Delete User dialog box, verify that the user name displayed is the one that you want to delete.
d) Click **Logout before delete** if the user is currently logged in.
e) Click **OK**.

Step 2 To change user settings on multiple nodes:

a) From the View menu, choose **Go to Network View**.
b) Click the **Provisioning** > **Security** tab.
c) Select the name of the user you want to delete, and click **Delete**.
d) In the Select Applicable Nodes area, uncheck any nodes where you do not want to delete the user settings.

Note The Select Applicable Nodes area does not appear for users who are provisioned for only one node.

e) Click **OK**.

The selected user is deleted from the node.

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.

Reset the password.

CHAPTER 7

Perform System Upgrade and Install Feature Packages

In Cisco NCS 4016 systems, the system upgrade and package installation processes are run using Cisco Transport Controller (CTC). The processes involve adding and activating the iso images (*.iso*), feature packages (*.pkg*), and software maintenance upgrade files (*.smu*) on the system. These files are accessed from a network server and then activated on the system. If the installed package or SMU causes any issue on the router, it can be deactivated.

Upgrading the OS and Features

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. Standard XR VM packages are:

- ncs4k-mpls.pkg
- ncs4k-mgbl.pkg
- ncs4k-k9sec.pkg
-
-

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

Do not reload the router during an upgrade operation.

Package and SMU installation is performed using Cisco Transport Controller (CTC).

There are separate packages and SMUs for the XR VM and the System Admin VM. They can be identified by their filenames. The XR VM package has *ncs4k* as part of its filename, whereas the System Admin VM package has *ncs4k-sysadmin* as part of its filename. The XR VM packages or SMUs are activated from the XR VM, whereas the System Admin VM packages or SMUs are activated from the System Admin VM.

Note Check the type of SMU before installing it in CTC.

Related Topics

install prepare

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.

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- ncs4k-mpls.pkg
- ncs4k-mgbl.pkg
- ncs4k-k9sec.pkg
-
-

Package and SMU installation is performed using Cisco Transport Controller (CTC).

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Note Check the type of SMU before installing it in CTC.

Install Packages

Complete this task to upgrade or install a patch. The patch installation is done using packages and Software Maintenance Updates (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.

In-Service Software Upgrade (ISSU) is used to perform planned software upgrades without affecting the traffic. You can use the ISSU Upgrade wizard to upgrade the XR and SysAdmin installation type without affecting the traffic. You cannot run ISSU upgrade if a package is present in prepare mode in the Prepare, Active and Commit packages area. You can either clean the prepared package or Activate the prepared packages before running ISSU upgrade. ISSU Upgrade wizard options are displayed according to the selected installation type.

Note ISSU option is not available for System installation type but is available for XR and SysAdmin installation types only.

Before you begin

- Two route processors (RP), one active and one stand-by must be installed in the system.
- Ensure both the RPs are in operational mode, active and running using the command **show platform**. For example:

```
RP/0/RP0:J_59_60#show platform
Thu Jan 5 03:24:20.535 UTC
Node name     Node type     Node state     Admin state      Config state
-----------------------------------------------------------------------------------
0/6           NCS4K-20T-O-S  OPERATIONAL      UP             NSHUT
0/RP0         NCS4K-RP       OPERATIONAL      UP             NSHUT
0/RP1         NCS4K-RP       OPERATIONAL      UP             NSHUT
0/FC0         NCS4016-FC-M   OPERATIONAL      UP             NSHUT
0/FC1         NCS4016-FC-M   OPERATIONAL      UP             NSHUT
0/FC2         NCS4016-FC-M   OPERATIONAL      UP             NSHUT
0/FC3         NCS4016-FC-M   OPERATIONAL      UP             NSHUT
0/FT0         NCS4K-FTA      OPERATIONAL      UP             NSHUT
0/FT1         NCS4K-FTA      OPERATIONAL      UP             NSHUT
0/PT0         NCS4K-AC-PEM   FAILED           UP             NSHUT
0/PT1         NCS4K-AC-PEM   OPERATIONAL      UP             NSHUT
0/EC0         NCS4K-ECU      OPERATIONAL      UP             NSHUT
RP/0/RP0:J_59_60#show redundancy summary
Thu Jan 5 03:24:24.956 UTC
Active Node Standby Node
----------- ------------
0/RP0 0/RP1 (Node Ready, NSR: Not Configured)
0/LC0 0/LC1 (Node Ready, NSR: Not Configured)
RP/0/RP0:J_59_60#
```

Step 1 In node view, click the **Maintenance** > **Software** tabs.

Step 2 Select the installation type and click **Add** to add new packages in the Inactive Packages area. XR installation type is selected by default.

Step 3 Type the location of the package in the Package Path field.

Step 4 Click **Add to Install List** to add the package to the Select Packages area.
The Select Packages area displays a list of all the packages added for the installation.

Step 5 Select the packages.

Step 6 Continue with step 7 to install packages using ISSU, or step 8 to install packages using non-ISSU:

Step 7 Install package using ISSU:

a) Click **Extract (Required for ISSU)**.
b) Click **Install Add**.
A message to confirm whether to proceed with ISSU upgrade is displayed.
c) Click **Yes** to continue with ISSU upgrade.

Note If you click **No**, the ISSU upgrade is discontinued. The XR ISO image is displayed in XR panel and SysAdmin and Host ISO images are displayed in SysAdmin panel.

An ISSU Upgrade wizard is displayed. This wizard includes the installation on both XR and Sysadmin packages with the complete package information.

d) Follow the ISSU Upgrade wizard to complete the installation of XR and Sysadmin packages using ISSU.

The SysAdmin installation is completed first followed by the XR installation.

Note When the SysAdmin installation is completed, the node view is closed and the network view is displayed. Open the node view and go to the installation pane, a message `System ISSU upgrade has not completed, do you want to proceed?` is displayed. Click **Yes** to proceed with the ISSU XR installation.

Step 8 Install package using non-ISSU:

a) Click **Install Add** to add the selected packages to the Inactive Packages area **Software** tab.
b) Click **Close** in the Add Package dialog.
c) From the Installation Type drop-down list, choose **XR**.
d) Select the image and click **Activate**.
The system reloads with the new full image.
e) Click **Commit** to commit the activated package.

Note For SysAdmin or System installation, in step c, select **SysAdmin** or **System** respectively. Complete steps d and e.

The committed package is displayed in green color in the right panel.

The package is installed.

What to do next

- Verify that the upgrade is successful by viewing the logs. To see the logs, click the **Install Log** button. The logs can be filtered based on date, time, operation type and so on. Three types of logs are available:
    - Current - Displays log for current install operation.
    - All - Displays logs for all sessions.
    - Last - Enter the number for which you want to view the logs run recently. For example, if you enter 5, the logs for the last 5 sessions are displayed.

Prepare and Install Package

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 install packages after preparing the package:

Step 1 In node view, click the **Maintenance** > **Software** tabs.

Step 2 From the Installation Type drop-down list, choose **XR**, or **SysAdmin** based on installation type.

The packages that can be installed depend on the chosen installation type.

Step 3 Click **Add** to add new packages in the Inactive Packages area.

The Add Package dialog appears.

a) Type the location of the package in the Package Path field.
b) Click **Add to Install List** to add the package to the Select Packages area. The package is added locally.
c) The Select Packages area displays a list of all the packages added for the installation.
d) Check the required check boxes in the Select Packages area to select the packages.
e) Click **Install Add** to add the selected packages to the Inactive Packages area of the **Maintenance** > **Software** tabs. The package is added to the router.
f) Click **Close** in the Add Package dialog.

Step 4 Check the required packages in the Inactive Packages area and click **Prepare>>** to prepare the packages and move the selected packages from the Inactive Packages area to the Prepare, Active and Commit Packages area.

All the packages in the prepare mode are highlighted in grey color.

Note If a package is in Prepare state, the options available are to:

- Activate the prepared package.
- Clean the install prepare operation.

Step 5 Check the required packages in the prepare mode in the Prepare, Active and Commit Packages area and click **Activate** to activate the packages.

All the packages in the active mode are highlighted in Orange. The Activate button is enabled only when at least one prepare mode package exists in the Prepare, Active and Commit Packages area.

Note
- Only one boot image can be in committed state at point of time, but there can be multiple boot images in active state.
- Boot image cannot be deactivated.
- If a package is in Active state, and if the system is rebooted, the active package will not appear in the Prepare, Active, and Commit Packages area, but will be moved to the Inactive packages list. So before reboot, the Active package must be committed for the changes to take effect.

Step 6 Click **Commit** to install the active packages in Prepare, Active and Commit Packages area on the router.

All the packages in the commit mode are highlighted in Green. The boot image always appear in Prepare, Active and Commit Packages area in commit mode and cannot be deactivated.

The package in active mode moves to the Inactive Packages after the reboot of the system. The package in commit mode remains in the Prepare, Active and Commit Packages even after the reboot of the system.

Step 7 Click **Install Log** to view the log details of the installed software packages.

The package is prepared and installed.

What to do next

Verify that the package is installed successfully using the **Install Log** button. Select the type of logs: Current, All or Last. The logs display the information about the package installation.

Install SMU using TAR

Complete this task to install a patch. The patch installation is done using packages and SMUs. This task is 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.

Before you begin

Copy the *.tar* to be installed either on the router's hard disk or on a network server to which the router has access.

Step 1 To add the package:

a) In node view, click the **Maintenance > Software** tabs.
b) In Installation Type field, select **XR** and click **Add**.
c) Type the location of the *.tar* file in the Package Path field.

Note Do not select the **Active package after the add operation** when adding *.tar* file.

d) Click **Install Add**.
e) Click **Refresh**.
The package is displayed in the Inactive Packages area.

Step 2 To activate the package:

a) In Installation Type field, select **XR** for XR installation and select all inactive packages.

Note Activation must first be done on XR and then on SysAdmin.

b) Click **Activate** and click **Yes** to confirm activation.

Note

- In XR installation, the System or SDR will reload if there is a reload SMU.
- In SysAdmin installation, SysAdmin and XR will reload.
- The connection to the Node view will be lost due to the reload. After the reload, go to the node view and click **Maintenance > Software** tabs.

The active packages are displayed in Prepare, Active and Commit Packages section in orange color.

c) Select all active packages and click **Commit**.
The committed package is displayed in green color in the right pane.

d) In the Installation Type field, select **SysAdmin** for SysAdmin installation and select all inactive packages.

e) Follow steps b and c.

What to do next

- Verify that the upgrade is successful by viewing the logs. To see the logs, click the **Install Log** button.
- Verify the output of **show platform** from both XR and SysAdmin. Ensure that all cards are in operational state.

```
RP/0/RP0:20#sh platform
Mon May 25 08:50:22.380 UTC
Node name         Node type             Node state        Admin state   Config state
-----------------------------------------------------------------------------------
0/0               NCS4K-24LR-O-S        OPERATIONAL       UP            NSHUT
0/1               NCS4K-2H-O-K          OPERATIONAL       UP            NSHUT
0/3               NCS4K-20T-O-S         OPERATIONAL       UP            NSHUT
0/6               NCS4K-20T-O-S         OPERATIONAL       UP            NSHUT
```

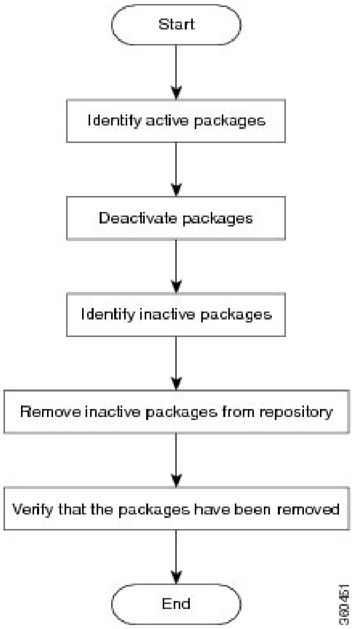
Uninstall Packages

Complete this task to uninstall a package. All router functions 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 2: Uninstalling Packages Workflow


Start
Identify active packages
Deactivate packages
Identify inactive packages
Remove inactive packages from repository
Verify that the packages have been removed
End
360451

Step 1 In node view, click the **Maintenance** > **Software** tabs.

Step 2 In Prepare, Active and Commit Packages section, select the Active package to be deactivated. The Active package is displayed in orange color.

Step 3 Click **Deactivate**.
All features and software patches associated with the package are deactivated. You can deactivate multiple packages simultaneously.

The deactivated packages are now listed in the Inactive Packages area. Only inactive packages can be removed from the repository.

Step 4 To remove the inactive package from the repository, select the package from the Inactive Packages area.

Step 5 Click **Remove**.

The package is removed from the Inactive panel.

What to do next

Install required packages. For details, see the "Install Packages" section.

CHAPTER 8

Perform Disaster Recovery

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

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

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 *ncs4k-usb-boot-<release_number>.zip*. For example, *ncs4k-usb-boot-5.2.3.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. Unzip the compressed boot file inside the USB drive.

4. The contents of the compressed boot file ("EFI" and "Boot" directories) should be extracted to the root of the USB drive. If they are extracted to a separate folder, move them to the root of the USB 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 Unzip the compressed boot file inside the USB drive.

Step 4 The contents of the compressed boot file ("EFI" and "Boot" directories) should be extracted to the root of the USB drive. If they are extracted to a separate folder, move them to the root of the USB drive.

USB drive is bootable when the "EFI" and "Boot" directories are in the 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 50
- Perform System Upgrade Using USB, on page 52

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* **disk1:***destination*
2. **dir /disk1:**
3. **run ls /usr/bin/usb-install.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* **disk1:***destination*

Example:

```
RP/0/RP0:hostname# copy tftp://223.255.254.254/image/ncs4k-mini-x.iso disk1\:/ncs4k-mini-x.iso
```

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

Step 2 **dir /disk1:**

Example:

```
RP/0/RP0:hostname#dir /disk1:
```

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

```
Directory of /disk1:/

    12 -rw-r--r-- 1  7864320 Jun 27 20:30 ncs4k-mini-x.iso
```

Step 3 **run ls /usr/bin/usb-install.sh**

Example:

```
RP/0/RP0:hostname# run ls /usr/bin/usb-install.sh
```

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

```
run ls /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:hostname# 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 /disk1:/ncs4k-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 50
- Perform System Upgrade Using USB, on page 52

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.

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.

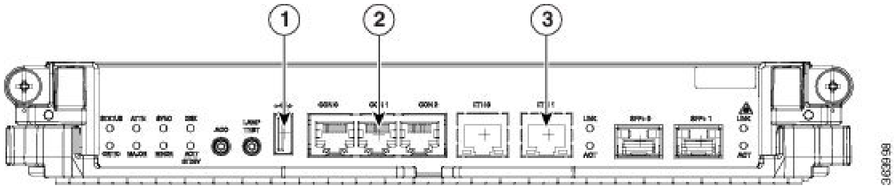
When the USB boots to a new image, the second RP must be physically unplugged or must be powered off. Else, while reloading after installation of new image, the system will pickup the old image from the other card.

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.



1	External USB Port
2	XR VM Console Port
3	XR VM Management Port

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 USB drive is the first boot source. Because the USB device is already connected, the router automatically boots from it. During the boot process, the OS image is installed on the router so that in future the router boots without the 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 Remove the USB drive.

After the initial boot sequences are completed, 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 7 Press **Enter** to get the host prompt.

Step 8 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 9 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 10 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.

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 , 14.xx 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.