Which Device Software Versions Are Supported by Cisco EPN Manager?

All devices should be running a **certified** device software version. However, certain devices must be running the **minimum** device software version. Follow the instructions in the table below on how to find out about a device software version.

Cisco EPN Manager may report that a device is running an **uncertified** device software version. You will likely notice no differences in how Cisco EPN Manager manages devices running an uncertified device software version. It depends on whether the device software version contains fundamental changes (changes to XML interfaces, SNMP commands, MIBs, CLI commands, and so forth). In some cases, Cisco EPN Manager will recognize the device software version but may not provide full support for the device NEs such as new modules.

<table>
<thead>
<tr>
<th>To find this information:</th>
<th>Do the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A list of all certified device software versions</td>
<td>Refer to Cisco Evolved Programmable Network Manager Supported Devices.</td>
</tr>
<tr>
<td></td>
<td>Choose <strong>Help &gt; Supported Devices</strong> and hover over the &quot;i&quot; in the <strong>Software Version</strong> column to display a popup.</td>
</tr>
</tbody>
</table>
Choose **Monitor > Managed Elements > Network Devices**, locate the device, and hover your cursor over the "i" in the **Last Inventory Collection** column. Check if the popup displays **Uncertified Software Version**.

From the device's Device Details page, under the Device Details tab, choose **System > Summary**.

Check if the Inventory area displays **[Uncertified Software Version]**.

**Devices that require a minimum device software version**

Choose **Help > Supported Devices** and check the **Software Version** column for text similar to >=x.x (For example, >=12.2 would indicate that the device must run at least device software version 12.2).

---

**Generic Device Support**

Cisco EPN Manager provides management of generic Cisco and non-Cisco devices which are not officially supported (features), with limited inventory and fault functions.

*Table 1: Generic Device Support*

<table>
<thead>
<tr>
<th>Generic Device Type</th>
<th>Supported Features</th>
<th>Supported MIBs</th>
<th>Supported Faults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco device</td>
<td>System - Summary</td>
<td>SNMPv2</td>
<td>Linkup/ Linkdown</td>
</tr>
<tr>
<td></td>
<td>System - Power Options &amp; Fans</td>
<td>ENTITY-MIB</td>
<td>Warm start</td>
</tr>
<tr>
<td></td>
<td>System - Civic Location</td>
<td>IF-MIB</td>
<td>Cold start</td>
</tr>
<tr>
<td></td>
<td>System - Modules</td>
<td>LLDP-MIB</td>
<td>Authentication Failure</td>
</tr>
<tr>
<td></td>
<td>System - Physical Ports</td>
<td>CISCO-ENTITY-FRU-CONTROL-MIB</td>
<td>BDI interface down/ up (Link down/up localized to BDI) entSensorThresholdNotification</td>
</tr>
<tr>
<td></td>
<td>System - Sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interfaces - All Interfaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interfaces - Ethernet</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interfaces - Physical Links</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical Links</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Cisco device</td>
<td>System - Summary</td>
<td>SNMPv2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>System - Modules</td>
<td>ENTITY-MIB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>System - Physical Ports</td>
<td>IF-MIB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interfaces - All Interfaces</td>
<td>LLDP-MIB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical Links</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Add Devices to Cisco EPN Manager

Cisco Evolved Programmable Network Manager uses device, location, and port groups to organize elements in the network. When you view devices in a table or on a map (network topology), the devices are organized in terms of the groups they belong to. When a device is added to Cisco EPN Manager, it is assigned to a group named **Unassigned Group**. You can then move the device into the desired groups as described in *Create Groups of Devices for Easier Management and Configuration*, on page 29.

**Note**

- To add a Cisco WLC to Cisco EPN Manager, make sure it does not have any unsupported Access Points (APs), otherwise Cisco EPN Manager will not discover any APs from that WLC.

---

**Table 2: Methods for Adding Devices**

<table>
<thead>
<tr>
<th>Supported Methods for Adding Devices</th>
<th>See:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add multiple devices by discovering the neighbors of a seed device using:</td>
<td>Add Devices Using Discovery, on page 4.</td>
</tr>
<tr>
<td>• Ping sweep and SNMP polling (Quick Discovery)</td>
<td>• Run Quick Discovery, on page 5</td>
</tr>
<tr>
<td>• Customized protocol, credential, and filter settings (useful when you will be repeating the discovery job)</td>
<td>• Run Discovery With Customized Discovery Settings, on page 6</td>
</tr>
<tr>
<td>Add multiple devices using the settings specified in a CSV file</td>
<td>Import Devices Using a CSV File, on page 8.</td>
</tr>
<tr>
<td>Add a single device (for example, for a new device type)</td>
<td>Add Devices Manually (New Device Type or Series), on page 9</td>
</tr>
</tbody>
</table>

These topics provide examples of how to add a Carrier Ethernet and an Optical device to Cisco EPN Manager:

- *Example: Add a Single Cisco NCS 2000 or NCS 4000 Series Device*, on page 10
- *Example: Add a Network Element as an ENE Using Proxy Settings*, on page 10

---

**Add Cisco ME1200 devices in Cisco EPN Manager**

Follow these settings while adding Cisco ME1200 devices in Cisco EPN Manager:

- **SNMP** - Use the same SNMP settings as that of other devices.
- **CLI** - Ensure that the protocol setting is set to SSH2. Though the device can be reached via telnet using a port, it is recommended to use SSH protocol. If telnet is used, then the custom telnet port used must be 2323.
- **HTTP** - Ensure you specify the right http credentials.
• Remember that configuration changes to Cisco ME1200 devices are not automatically discovered by Cisco EPN Manager. After making a change, you must manually sync the device. To do this, select the required device(s) in the Network Devices table and click Sync.

Add Devices Using Discovery

Cisco EPN Manager supports two discovery methods:

• Ping sweep from a seed device (Quick Discovery). The device name, SNMP community, seed IP address and subnet mask are required. This method is not supported for discovering optical devices. See Run Quick Discovery, on page 5

• Using customized discovery methods (Discovery Settings)—This method is recommended if you want to specify settings and rerun discovery in the future. If you want to discover optical devices, use this method. See Run Discovery With Customized Discovery Settings, on page 6.

Note

• If a discovery job rediscovers an existing device and the device's last inventory collection status is Completed, Cisco EPN Manager does not overwrite the existing credentials with those specified in the Discovery Settings. For all other statuses (on existing devices), Cisco EPN Manager overwrites the device credentials with those specified in the Discovery Settings.

• Service discovery might take longer than usual when a large number of devices is added during database maintenance windows. Therefore, we recommend that you avoid large-scale operations during the night and on weekends.

• Autonomous APs are filtered out of the discovery process to optimize the discovery time. You need to manually add Autonomous APs using Import Devices or Credential Profile.

The discovery process of a device is carried out in the sequence of steps listed below. As Cisco EPN Manager performs discovery, it sets the reachability state of a device, which is: Reachable, Ping Reachable, or Unreachable. A description of the states is provided in Device Reachability and Admin States, on page 24.

1. Cisco EPN Manager determines if a device is reachable using ICMP ping. If a device is not reachable, its reachability state is set to Unreachable.

2. Server checks if SNMP communication is possible or not.
   • If a device is reachable by ICMP but its SNMP communication is not possible, its reachability state is set to Ping Reachable.
   • If a device is reachable by both ICMP and SNMP, its reachability state is Reachable.

3. Verifies the device's Telnet and SSH credentials. If the credentials fail, details about the failure are provided in the Network Devices table in the Last Inventory Collection Status column (for example, Wrong CLI Credentials). The reachability state is not changed.

4. Modifies the device configuration to add a trap receiver so that Cisco EPN Manager can receive the necessary notifications (using SNMP).

5. Starts the inventory collection process to gather all device information.

6. Displays all information in the web GUI, including whether discovery was fully or partially successful.
When Cisco EPN Manager verifies a device’s SNMP read-write credentials, the device log is updated to indicate that a configuration change has been made by Cisco EPN Manager (identified by its IP address).

**Note**
For Cisco NCS 2000 devices, verify the TL1 credentials, in addition (or instead) of SNMP credentials.

### Verify SNMP Communication

Follow these steps if the reachability state of a device is set as **Ping Reachable**.

**Note**

For Cisco NCS 2000 devices, verify the TL1 credentials, in addition (or instead) of SNMP credentials.

---

**Step 1** Ensure that the credentials used by Cisco EPN Manager for device verification are correct.

**Step 2** Verify that SNMP is enabled on the device and that the SNMP credentials configured on the device match those configured on Cisco EPN Manager.

**Step 3** Check whether SNMP packets are being dropped due to configuration errors or due to your security settings (default behavior) in all the network devices that are participating in transporting SNMP packets between the managed devices and the Cisco EPN Manager server.

### Specify the Management IP Address Type (IPv4/IPv6) for Discovered Devices

For discovered dual-home (IPv4/IPv6) devices, specify whether you want Cisco EPN Manager to use IPv4 or IPv6 addresses for management IP addresses.

**Step 1** Choose Administration > Settings > System Settings, then choose Inventory > Discovery.

**Step 2** From the IPv4/IPv6 Preference for Management Address drop-down list, choose either V4 or V6.

**Step 3** Click Save.

### Run Quick Discovery

Use this method when you want to perform a ping sweep using a single seed device. Only the device name, SNMP community, seed IP address and subnet mask are required. If you plan to use the configuration management features, you must provide the protocol, user name, password, and enable password.

**Before you begin**

See Configure Devices So They Can Be Modeled and Monitored, on page 12 to make sure your devices are configured correctly.

**Step 1** Choose Inventory > Device Management > Discovery, then click the Quick Discovery link at the top right of the window.

**Step 2** At a minimum, enter the name, SNMP community, seed IP address, and subnet mask.
Step 3  Click **Run Now**.

---

**What to do next**

Click the job hyperlink in the **Discovery Job Instances** area to view the results.

---

**Run Discovery With Customized Discovery Settings**

Cisco EPN Manager can discover network devices using discovery profiles. A discovery profile contains a collection of settings that instructs Cisco EPN Manager how to find network elements, connect to them, and collect their inventory. For example, you can instruct Cisco EPN Manager to use CDP, LLDP, OSPF to discover devices, or just perform a simple ping sweep (an example of the results of a ping sweep is provided in **Sample IPv4 IP Addresses for Ping Sweep**, on page 6.) You can also create filters to fine-tune the collection, specify credential sets, and configure other discovery settings. You can create as many profiles as you need.

After you create a profile, create and run a discovery job that uses the profile. You can check the results of the discovery job on the Discovery page. You can also schedule the job to run again at regular intervals.

**Before you begin**

See **Configure Devices So They Can Be Modeled and Monitored**, on page 12 to make sure your devices are configured correctly so that Cisco EPN Manager can discover them.

---

**Sample IPv4 IP Addresses for Ping Sweep**

The following table provides an example of the results of a ping sweep.

<table>
<thead>
<tr>
<th>Subnet Range</th>
<th>Number of Bits</th>
<th>Number of IP Addresses</th>
<th>Sample Seed IP Address</th>
<th>Start IP Address</th>
<th>End IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>255.255.240.0</td>
<td>20</td>
<td>4094</td>
<td>205.169.62.11</td>
<td>205.169.48.1</td>
<td>205.169.63.254</td>
</tr>
</tbody>
</table>
Example: Add Optical Devices Using Discovery

The following example shows how to use a seed device and the OTS protocol to discover Cisco NCS 2000 devices.

Step 1 Check Configure Devices So They Can Be Modeled and Monitored, on page 12 to make sure the optical devices are configured correctly.

Step 2 Choose Inventory > Device Management > Discovery, then click Discovery Settings at the top right of the window.

Step 3 In the Discovery Settings window, click New to create a new discovery profile.

a) Enter a discovery profile name—for example, NCS2k_3_OTS.

b) Enter the seed device and hop count information for the OTS protocol.

1. In the Protocol Settings area, click the arrow next to Advanced Protocols to open the discovery protocols list.

2. Click the arrow next to OTS to open the OTS protocol window.

3. Check the Enable OTS check box.

4. Click the Add Row ("+") icon.

5. Enter the seed device IP address and hop count (for example, 209.165.200.224 and 3), then click Save to add the seed device information.

6. Click Save in the OTS protocol window to close the window. If necessary, click outside of the OTS Protocol window to close it.

c) Enter the TL1 device credentials for the Cisco NCS 2000 seed device.

1. In the Credential Settings area, click the arrow next to TL1 to open the TL1 credentials window.

2. Click the Add Row ("+") icon.
3. Enter the seed device IP address, username, password, and (if required) proxy IP address.

4. For Secure TL1 access choose Enable from the SSH drop-down list, for Unsecured TL1 choose Disabled.

5. Click Save to add the credential information.

6. Click Save in the TL1 Credentials window to close the window. If necessary, click outside of the TL1 Credentials window to close it.

---

**Step 4** Click Save to save the new discovery profile. The new NCS2k_3_OTS profile is added to the Discovery Settings window.

**Note** If you receive an error message, make sure you have enabled the protocols. (This is a common error.)

**Step 5** Select NCS2k_3_OTS, then click Run Now to begin the discovery job.

**Step 6** Check the results of the job by choosing Inventory > Device Management > Discovery.

---

**Import Devices Using a CSV File**

Use a CSV file to add devices if you have an existing management system from which you want to import devices, or you want to specify different values in a spreadsheet.

- Create the CSV File, on page 8
- Import the CSV File, on page 8

**Create the CSV File**

Follow this procedure to create the CSV file.

**Step 1** Create the bulk import CSV file using the template that is available from the Bulk Import dialog box. To open the dialog box, choose Inventory > Device Management > Network Devices, click the icon above the Network Devices table, and choose Bulk Import. Use the bulk device add sample template.

**Step 2** To find out what the different fields mean and which fields are required, use the information that is in the web GUI. The information is the same for adding a single device or adding devices in bulk. To get this information, choose Inventory > Device Management > Network Devices, click the icon above the Network Devices table, then choose Add Device. Mandatory fields are indicated by an asterisk; fields that require an explanation display a question mark next to them (hover your mouse cursor over the question mark to view the field details).

**Step 3** When you are done, save your changes and note the location of the file so you can import it as described in Import the CSV File, on page 8.

**Import the CSV File**

Follow this procedure to import devices using a CSV file.

**Before you begin**

See Configure Devices So They Can Be Modeled and Monitored, on page 12 to make sure your devices are configured correctly.
Step 1 Choose Inventory > Device Management > Network Devices.
Step 2 Click the + icon above the Network Devices table, then choose Bulk Import.
Step 3 In the Bulk Import dialog:
   a) Make sure Device is chosen from the Operation drop-down list.
   b) Click Browse, navigate to the CSV file, then click Import.
      Note       Choose the CSV file that you have exported already as part of bulk device add sample template download.
                  Do not edit the csv file manually.
Step 4 Check the status of the import by choosing Administration > Dashboards > Job Dashboard.
Step 5 Click the arrow to expand the job details and view the details and history for the import job. If you encounter any problems, see Validate Added Devices and Troubleshoot Problems, on page 25.

Add Devices Manually (New Device Type or Series)

Use this procedure to add a new device type and to test your settings before applying them to a group of devices.

Before you begin
See Configure Devices So They Can Be Modeled and Monitored, on page 12 to make sure your devices are configured correctly.

Step 1 Choose Inventory > Device Management > Network Devices.
Step 2 Click the + icon above the Network Devices table, then choose Add Device.
Step 3 In the Add Device dialog box, complete the required fields. Click the "?" next to a field for a description of that field.
      Note       Telnet/SSH information is mandatory for devices such as most Cisco NCS devices.
Step 4 (Optional) Click Verify Credentials to validate the credentials before adding the device.
Step 5 Click Add to add the device with the settings you specified.
      Note       For NCS 2000 devices, provide a TL1 user with SuperUser profile, otherwise the devices will go to Completed with Warning status and the Configuration > Security tab will not be available in Chassis View.
      Note       For NCS 2000 devices, the "Enable Single Session TL1" setting takes effect only for devices running release 11.0 onwards.
Cisco EPN Manager, by default, does not accept UCS with self-signed certification. User can enable it manually by adding the following lines in the `/opt/CSCOlumos/xmp_inventory/xde-home/inventoryDefaults/ncsCIMC.def` file.

```xml
<default attribute="HTTPS_TRUST_CONDITION">always</default>
<default attribute="HTTPS_HOSTNAME_VERIFICATION_STRATEGY">allow_all</default>
```

**Example: Add a Single Cisco NCS 2000 or NCS 4000 Series Device**

Cisco NCS 2000 series devices are TL1-based devices, and Cisco EPN Manager uses the TL1 protocol to communicate with these devices. Cisco NCS 4000 series devices, on the other hand, are Cisco IOS-XR devices, and Cisco EPN Manager uses the SNMP and Telnet/SSH protocols to communicate with these devices.

**Step 1** Check Configure Devices So They Can Be Modeled and Monitored, on page 12 to make sure the Cisco NCS devices are configured correctly.

**Step 2** Click the + icon above the Network Devices table, then choose Add Device.

**Step 3** In the Add Device dialog box, complete the required fields. Click the "?" next to a field for a description of that field.

- Cisco NCS 2000 series and Cisco ONS 15454—Enter TL1 parameters
- Cisco NCS 4000 series—Enter SNMP and Telnet/SSH parameters

**Step 4** Click Verify Credentials to validate that Cisco EPN Manager can reach the device.

**Step 5** Click Add to add the device to Cisco EPN Manager.

**Example: Add a Network Element as an ENE Using Proxy Settings**

Messages sent to a particular network element must pass through other NEs in the network. To pass messages, one or more nodes can be a Gateway Network Element (GNE) and connect other NEs in your network. A node becomes a GNE when you establish a TL1 session and enter a command that must be sent to another node. The node that receives the TL1 message from another node for processing is an End-point Network Element (ENE). Messages from an ENE are transmitted through a GNE to other NEs in the network.

**Step 1** Check Configure Devices So They Can Be Modeled and Monitored, on page 12 to make sure your devices are configured correctly.

**Step 2** Click the + icon above the Network Devices table, then choose Add Device.

**Step 3** In the Add Device dialog box, under the General Parameters, enter the IP address or the DNS name of the ENE that you want to add. Click the "?" next to a field for a description of that field.

**Step 4** Under the TL1 Parameters, enter the primary and secondary proxy IP address for the node that you are using as an ENE.

**Note** The secondary proxy IP address is optional, and will be activated only in the event of failure of the primary proxy.

**Step 5** Click Verify Credentials to validate that Cisco EPN Manager can connect to the device.
Step 6  Click **Add** to add the device to Cisco EPN Manager.

---

**Example: Enabling a Single Session on Cisco NCS 2000 Series Devices**

Cisco NCS 2000 series devices are TL1-based devices, and Cisco EPN Manager uses the TL1 protocol to communicate with these devices. You can edit a newly added device or configure an existing NCS 2000 devices to limit the machine (EMS) account with single session.

---

**Step 1**  Choose **Inventory > Device Management > Network Devices**.

**Step 2**  Select a device and then click the **Edit** icon. The **Edit Device** window appears.

**Step 3**  To edit a single session on a new device or on existing device, set the following parameters:

a) Check the **Enable Single Session TL1** check box

b) Enter the required parameters

c) Do one of the following:

   • Click **Update** to update the single session settings only on the database.

   • Click **Update & Sync** to update both the database and device with the single session settings.

**Step 4**  (Optional) You can also edit the single session through Bulk Import and Bulk Edit operations.

**Note**  By default, the single session is disabled for the bulk edit. You must check the **Enable Single Session TL1** check box to enable it for all the devices to be imported. Selecting the Bulk Import option might affect the single session flag.

---

**What to do next**

To verify the enabled single session

1. Launch the Cisco Transport Controller and select the device for which the single session is enabled.

2. Choose **Provisioning > Security > Active Logins** to view all the active devices with single sessions. The devices for which the single session is disabled will not be displayed.

**Note**  The credentials check is the only exception while performing the single session task.

---

**How Is Inventory Collected?**

After devices are added and discovered, Cisco EPN Manager will collect physical and logical inventory information and save it to the database. The following table describes how inventory collection is triggered.
### Inventory Collection Trigger

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>In response to incoming events</td>
</tr>
<tr>
<td>Cisco EPN Manager receives an incoming NE SNMP trap, syslog, or TL1 message that signals a change on the NE. These incoming events include:</td>
</tr>
<tr>
<td>• Configuration change events that signal a change in the device configuration. These events are normally syslogs or traps.</td>
</tr>
<tr>
<td>• Other inventory events, such as tunnel up/down, link up/down, module in/out, and so forth.</td>
</tr>
<tr>
<td>Cisco EPN Manager reacts to these incoming events by collecting NE inventory and state information to make sure that information in its database conforms to that of the NE. Most events trigger granular inventory collection, where Cisco EPN Manager only collects data relevant to the change event; other events will trigger a complete collection (sync) of the NE physical and logical inventory. The data that Cisco EPN Manager collects is determined by information in the incoming event, along with metadata that is defined in Cisco EPN Manager. The metadata in Cisco EPN Manager uses a combination of mechanisms—expedited events, reactive inventory, and granular polling—to fine-tune what is collected.</td>
</tr>
<tr>
<td>For example, if Cisco EPN Manager receives a GMPLS Tunnel State Change event, it will collect ODU tunnel inventory information to discover midpoints and the Z endpoint of the tunnel.</td>
</tr>
<tr>
<td>On demand</td>
</tr>
<tr>
<td>Users can perform an immediate inventory collection (called Sync) from:</td>
</tr>
<tr>
<td>• Network Devices page—Select one or more devices (by checking check boxes) and click Sync.</td>
</tr>
<tr>
<td>• Device 360 view—Choose Actions &gt; Sync Now.</td>
</tr>
<tr>
<td>See Collect a Device's Inventory Now (Sync).</td>
</tr>
<tr>
<td>Scheduled (daily)</td>
</tr>
<tr>
<td>Normal inventory collection is usually performed overnight. Users with sufficient privileges can check when inventory is collected and the status of collection jobs by choosing Administration &gt; Dashboards &gt; Job Dashboard and choosing System Jobs &gt; Inventory and Discovery Jobs.</td>
</tr>
</tbody>
</table>

---

**Configure Devices So They Can Be Modeled and Monitored**

- Configure Devices To Forward Events To Cisco EPN Manager, on page 13
- Required Settings—Cisco IOS and IOS-XE Device Operating System, on page 13
- Required Settings—Cisco IOS XR Device Operating System, on page 14
- Required Settings—Cisco NCS Series Devices, on page 17
- Required Settings—Cisco ONS Device Operating System, on page 21
- Required Configuration for IPv6 Devices, on page 21
Configure Devices To Forward Events To Cisco EPN Manager

To ensure that Cisco EPN Manager can query devices and receive events and notifications from them, you must configure devices to forward events to the Cisco EPN Manager server. For most devices, this means you must configure the devices to forward SNMP traps and syslogs.

For other devices (such as some optical devices), it means you must configure the devices to forward TL1 messages.

If you have a high availability deployment, you must configure devices to forward events to both the primary and secondary servers (unless you are using a virtual IP address; see Using Virtual IP Addressing With HA).

In most cases, you should configure this using the `snmp-server host` command. Refer to the topics in this document that list the prerequisites for the different device operating systems.

---

**Required Settings—Cisco IOS and IOS-XE Device Operating System**

```
snmp-server host server_IP
snmp-server community public-cmty RO
snmp-server community private-cmty RW
snmp-server ifindex persist

logging server_IP
logging on
logging buffered 64000 informational

logging source-interface interface_name
logging trap informational
logging event link-status default

Disable domain lookups to avoid delay in Telnet/SSH command response:

no ip domain-lookup

Enable SSH

crypto key generate rsa
ip ssh rsa keypair-name keypair-name
crypto key generate rsa usage-keys label key-label modulus modulus-size
ip ssh version [1 | 2]

Set up VTY options:
```
line vty <number of vty>
exec-timeout
session-timeout
transport input ssh (required only if ssh is used)
transport output ssh (required only if ssh is used)

For SNMPv2 only, configure the community string:
```bash
snmp-server community ReadonlyCommunityName RO
```

For SNMPv3 only, configure the following settings:
```bash
snmp-server user User Group v3 auth sha Password priv des Password
snmp-server view Group 1.3.6 included
snmp-server group Group v3 priv notify Group read Group
snmp-server group Group v3 priv read v1default write v1default notify v1default
snmp-server group Group v3 priv
snmp-server group Group v3 priv notify epnm read epnm
```

Note

- For the device to work seamlessly in Cisco EPN Manager, the SNMP EngineID generated/configured in the device should be unique in the network.
- For the credentials to work, SNMP users should be re-created if the SNMP EngineID is re-configured in the device.

Configure the cache settings at a global level to improve the SNMP interface response time using the configuration:
```bash
snmp-server cache
```

Syslogs are used by Cisco EPN Manager for alarm and event management. NTP settings ensure that Cisco EPN Manager receives the correct timestamps for events. To configure syslogs on the device, add the following settings:
```bash
clock timezone TimeZone
service timestamps log datetime show-timezone msec year
ntp server NTP_Server
update-calendar
logging facility local7
logging Server_IP vrf default severity info [port default]
```

### Required Settings—Cisco IOS XR Device Operating System

- `snmp-server community community_name SystemOwner`
- `snmp-server community community_name RO`
- `snmp-server entityindex persist`
- `snmp-server ifindex persist`
- `logging server_IP`
- `logging on`
- `logging buffered <307200-125000000>`
- `logging source-interface interface_name`
- `logging trap informational`
- `logging events level informational`
logging events link-status
logging events link-status software-interfaces

no cli whitespace completion
domain ipv4 host server_name server_IP

Set up VTY options:
line default
  exec-timeout 10 0
  session-limit 10
  session-timeout 100
  transport input ssh
  transport output ssh
  vty-pool default 0 99 line-template default

Telnet and SSH Settings:
telnet ipv4 server max-servers no-limit
telnet vrf default ipv4 server max-servers 100
  ssh server v2
  ssh server rate-limit 60
cinetd rate-limit 60

Configure the Netconf and XML agents:
xml agent tty
netconf agent tty

Monitor device with Virtual IP address:
ipv4 virtual address use-as-src-addr
ipv4 virtual address Virtual_IP_Address/Subnet_Mask

For SNMPv2 only, configure the community string:
snmp-server community ReadonlyCommunityName RO SystemOwner

For SNMPv3 only, configure the following settings:
snmp-server user User Group v3 auth sha encrypted Password priv des56 encrypted Password SystemOwner
snmp-server view Group 1.3.6 included
snmp-server view Group 1.0.8802.1.1.2 included
snmp-server group Group v3 priv notify Group read Group
snmp-server group Group v3 priv read v1default write v1default notify v1default

Alternatively, you can navigate to Configuration > Templates > Features & Technologies. From the Templates tab on the left side, select CLI Templates > System Templates - CLI and deploy the Default_Manageability_Config- IOS-XR template to configure the IOS-XR device settings required for Cisco EPN Manager discovery.

- For the device to work seamlessly in Cisco EPN Manager, the SNMP EngineID generated/configured in the device should be unique in the network.
- For the credentials to work, SNMP users should be re-created if the SNMP EngineID is re-configured in the device.

Configure the following to improve the SNMP interface stats response time:
snmp-server ifmib stats cache

Configure SNMP traps for virtual interfaces to ensure that link-down scenarios are captured:

```
snmp-server interface subset 2 regular-expression Forty*
notification linkupdown
!
snmp-server interface subset 3 regular-expression Ten*
notification linkupdown
!
snmp-server interface subset 1 regular-expression Hun*
notification linkupdown
!
snmp-server interface subset 1 regular-expression TwoHun*
notification linkupdown
!
snmp-server interface subset 1 regular-expression FourHun*
notification linkupdown
```

Syslogs are used by Cisco EPN Manager for alarm and event management. NTP settings ensure that Cisco EPN Manager receives the correct timestamps for events. To configure syslogs on the device, add the following settings:

```
clock timezone TimeZone
service timestamps log datetime show-timezone msec year
ntp server NTP_Server
logging facility local7
logging Server_IP vrf name
```

Enable performance management on all optical data unit (ODU) controllers:

```
controller oduX R/S/I/P
per-mon enable
```

Enable performance management for Tandem Connection Monitoring (TCM):

```
tcm id {1-6}
perf-mon enable
```

To open Cisco Transport Controller (CTC) from Cisco EPN Manager, enable the HTTP/HTTPS server:

```
http server ssl
```

If you plan to use the Configuration Archive, devices must be configured as secured. To configure devices from CTC:

1. Choose **Provisioning > Security > Access**.

2. Set **EMS Access** to secure.

---

**Note**

- Ensure that both the MPLS and K9 packages are installed on the device.
- Install the Cisco IOS XR Manageability Package (MGBL).
- Alternatively, all the above pre-requisite can also be applied through CLI Templates. Navigate to **Configuration > Templates > Features&Technologies**. From the **Templates** tab on the left pane, select **CLI Templates > System Templates-CLI** and deploy the **Default_Manageability_Config template**.
- For more information see, **Supported Traps** and **Supported Syslogs**.
Required Settings—Cisco NCS Series Devices

- Required Settings—Cisco NCS 4000 Series Devices, on page 17
- Required Settings—Cisco NCS 4200 Series Devices, on page 19

Required Settings—Cisco NCS 4000 Series Devices

Ensure that both the MPLS and K9 packages are installed on the device before completing the following steps.

- Cisco EPN Manager uses SSH to secure communication with Cisco NCS 4000 series devices. To enable SSH, apply the following configuration settings on the device:
  
  ```
  ssh server v2
  ssh server rate-limit 600
  ```

- In MPLS traffic engineering configuration mode, enable event logging:
  
  ```
  mpls traffic-eng logging events all
  ```

- Set the VTY options:
  
  ```
  line default
  exec-timeout 10 0
  session-limit 10
  session-timeout 100
  transport input ssh
  transport output ssh
  vty-pool default 0 99 line-template default
  ```

- Configure the LMP link:
  
  ```
  router-id ipv4 unicast local IP address
  ```
  where local IP address is the IP address of the device.

- Configure the Netconf and XML agents:
  
  ```
  xml agent tty
  netconf agent tty
  ```

- Configure SNMP on the device:
  
  ```
  snmp-server host server_IP
  snmp-server community public RO SystemOwner
  snmp-server community private RW SystemOwner
  snmp-server ifindex persist
  ```

  You can use either SNMPv2 or SNMPv3:

  - For SNMPv2 only, configure the community string:
    
    ```
    snmp-server community ReadonlyCommunityName RO SystemOwner
    ```

  - For SNMPv3 only, configure the following settings:
    
    ```
    snmp-server user User Group v3 auth sha encrypted Password priv des56 encrypted Password SystemOwner
    snmp-server view Group 1.3.6 included
    snmp-server group Group v3 priv notify Group read Group
    ```
For configuring the polling and configuration view, choose one of the following configuration options:

- SNMPv3 default configuration (used for SNMPv3 polling and viewing of the default configuration):

  ```
  snmp-server group Group v3 priv read v1default write v1default notify v1default
  ```

- SNMPv3 specific configuration:

  - For SNMPv3 polling only:
    ```
    snmp-server group Group v3 priv
    ```

  - For viewing configuration for SNMPv3 set, polling, and for traps/informs notifications:
    ```
    snmp-server group Group v3 priv notify epnm read epnm write epnm
    ```

  - For viewing SNMPv3 - LLDP MIB OID configuration:
    ```
    snmp-server view Group 1.0.8802.1.1.2 included
    ```

For viewing the LAG link, add the following configuration on device:

```
snmp-server view all 1.0.8802 included
```

**Note** In the first line, *User* and *Group* are two distinct variables that you need to enter values for.

- Configure the stats command to improve the SNMP interface stats response time using the configuration

```
Snmp-server ifmib stats cache
```

- Configure SNMP traps for virtual interfaces to ensure that link-down scenarios are captured:

```
snmp-server interface subset 1 regular-expression Hun* notification linkupdown
! snmp-server interface subset 2 regular-expression Forty* notification linkupdown
! snmp-server interface subset 3 regular-expression Ten* notification linkupdown
```

- Syslogs are used by Cisco EPN Manager for alarm and event management. NTP settings ensure that Cisco EPN Manager receives the correct timestamps for events. To configure syslogs on the device, add the following settings:

```
clock timezone TimeZone
service timestamps log datetime show-timezone msec year
ntp server NTP_Server
logging facility local7
logging Server_IP vrf name
```

**Note** the following:

- When specifying the time zone, enter the time zone's acronym and its difference (in hours) from Coordinated Universal Time (UTC). For example, to specify the time zone for a device located in Los Angeles, you would enter `clock timezone PDT -7`. 
• Replace Server_IP with the IP address of the host Cisco EPN Manager is installed on.

• Configure the Virtual IP address:
  
  \[
  \text{ipv4 virtual address NCS4K\_Virtual\_IP\_Address/Subnet\_Mask} \\
  \text{ipv4 virtual address use-as-src-addr NCS4K\_Virtual\_IP\_Address/Subnet\_Mask}
  \]

  **Note**: NCS4K\_Virtual\_IP\_Address and Subnet\_Mask are two distinct variables separated by a slash. Be sure to enter a value for both of these variables.

• Enable performance management on all optical data unit (ODU) controllers:
  
  \[
  \text{controller oduX R/S/I/P per-mon enable}
  \]

• Enable event logging of link status messages for optics controllers of Cisco NCS4000 devices running Cisco IOS release 6.1.42 or later:
  
  \[
  \text{controller Optics <x/y/z/w> logging events link-status}
  \]

• Enable performance management for Tandem Connection Monitoring (TCM):
  
  \[
  \text{tcm id \{1-6\} perf-mon enable}
  \]

• Configure the Telnet or SSH rate limit for accepting service requests:
  
  - For Telnet, set the number of requests accepted per *second* (between 1-100; the default is 1):
    
    \[
    \text{cinetd rate-limit 100}
    \]
  
  - For SSH, set the number of request accepted per *minute* (between 1-600; the default is 60):
    
    \[
    \text{ssh server rate-limit 600}
    \]

• To open Cisco Transport Controller (CTC) from Cisco EPN Manager (from a Device 360 view), enable the HTTP/HTTPS server:
  
  \[
  \text{http server ssl}
  \]

• If you plan to use the Configuration Archive feature, devices must be configured as secured. To do this from CTC:
  
  1. Choose **Provisioning > Security > Access**
  2. Set EMS Access to **secure**.

• If you notice any performance issues because multiple Cisco NCS 4000 Series devices are sending information simultaneously, increase the number of Telnet sessions per *second*:
  
  \[
  \text{cinetd rate-limit 100}
  \]

**Required Settings—Cisco NCS 4200 Series Devices**

• Cisco EPN Manager uses SSH to secure communication with Cisco NCS 4200 series devices. To enable SSH, apply one the following configuration settings on the device:
• enable
configure terminal
hostname name
ip domain-name name
crypto key generate rsa

• enable
configure terminal
ip ssh rsa keypair-name keypair-name
crypto key generate rsa usage-keys label key-label modulus modulus-size
ip ssh version [1 | 2]

• Set the VTY options:
  line vty <#>
  exec-timeout
  session-timeout
  transport input ssh
  transport output ssh

• Configure SNMP on the device:
  snmp-server host server_IP
  snmp-server community public RO
  snmp-server community private RW

  You can use either SNMPv2 or SNMPv3:

  • For SNMPv2 only, configure the community string:
    snmp-server community ReadonlyCommunityName RO

  • For SNMPv3 only, configure the following settings:
    snmp-server user User Group v3 auth sha Password priv des Password
    snmp-server view Group 1.3.6 included
    snmp-server group Group v3 priv notify Group

    For configuring the polling and configuration view, choose one of the following configuration options:

    • SNMPv3 default configuration (used for SNMPv3 polling and viewing of the default configuration):
      snmp-server group Group v3 priv read v1default write v1default notify v1default

    • SNMPv3 specific configuration:
      • For SNMPv3 polling only:
        snmp-server group Group v3 priv

      • For viewing configuration for SNMPv3 set, polling, and for traps/informs notifications:
        snmp-server group Group v3 priv notify epnm read epnm

      • For viewing SNMPv3 - LLDP MIB OID configuration:
        snmp-server view Group 1.0.8802.1.1.2 included

---

**Note**

In the first line, *User* and *Group* are two distinct variables that you need to enter values for.
• Configure the cache settings at a global level to improve the SNMP interface response time using the configuration Snmp-server cache

• Syslogs are used by Cisco EPN Manager for alarm and event management. NTP settings ensure that Cisco EPN Manager receives the correct timestamps for events. To configure syslogs on the device, add the following settings:
  
  ```
  clock timezone TimeZone
  service timestamps log datetime show-timezone msec year
  ntp server NTP_Server
  update-calendar
  logging facility local7
  logging Server_IP vrf default severity info [port default]
  mpls traffic-eng logging events all
  mpls traffic-eng logging lsp setups
  mpls traffic-eng logging lsp teardowns
  ```

  Note the following:

  • When specifying the time zone, enter the time zone's acronym and its difference (in hours) from Coordinated Universal Time (UTC). For example, to specify the time zone for a device located in Los Angeles, you would enter `clock timezone PDT -7`.

  • Replace `Server_IP` with the IP address of the host Cisco EPN Manager is installed on.

Required Settings—Cisco ONS Device Operating System

If you plan to use the Configuration Archive feature, devices must be configured as secured. You can do this from CTC:

1. From CTC, choose **Provisioning > Security > Access**.
2. Set EMS Access to secure.

Required Configuration for IPv6 Devices

If you want to access a device that uses IPv6 addresses, configure the IPv6 address and static route on the Cisco EPN Manager server (virtual machine) by performing these steps:

1. Remove the ipv6 address autoconfig from the interface.
2. Configure the IPv6 address on the Cisco EPN Manager server.
3. Add a static route to the Cisco EPN Manager server.

Enable Archive Logging on Devices

Follow these steps to enable archive logging on devices so that granular inventory can be enabled for those devices on Cisco EPN Manager:

For Cisco IOS-XR devices:

```
logging <epnm server ip> vrf default severity alerts
logging <epnm server ip> vrf default severity critical
logging <epnm server ip> vrf default severity error
logging <epnm server ip> vrf default severity warning
logging <epnm server ip> vrf default severity notifications
```
Apply Device Credentials Consistently Using Credential Profiles

Credential profiles are collections of device credentials for SNMP, Telnet/SSH, HTTP, and TL1. When you add devices, you can specify the credential profile the devices should use. This lets you apply credential settings consistently across devices.

If you need to make a credential change, such as changing a device password, you can edit the profile so that the settings are updated across all devices that use that profile.

To view the existing profiles, choose Inventory > Device Management > Credential Profiles.

Create a New Credential Profile

Use this procedure to create a new credential profile. You can then use the profile to apply credentials consistently across products, or when you add new devices.

Step 1 Select Inventory > Device Management > Credential Profiles.
Step 2 If an existing credential profile has most of the settings you need, select it and click Copy. Otherwise, click Add.
Step 3 Enter a profile name and description. If you will have many credential profiles, make the name and description as informative as possible because that information will be displayed on the Credential Profiles page.
Step 4 Enter the credentials for the profile. When a device is added or updated using this profile, the content you specify here is applied to the device.

The SNMP read community string is required.

Step 5 Click Save Changes.

Apply a New or Changed Profile to Existing Devices

Use this procedure to perform a bulk edit of devices and change the credential profile the devices are associated with. This operation overwrites any existing association between a device and a credential profile. You can also use this operation to synchronize device configurations with the new settings.

Note Make sure the profile’s credential settings are correct before following this procedure and selecting Update and Sync. That operation will synchronize the devices with the new profile.

Step 1 Configure the credential profile using one of these methods:
• Create a new credential profile by choosing Inventory > Device Management > Credential Profiles, and clicking Add.

• Edit an existing profile by choosing Inventory > Device Management > Credential Profiles, selecting the profile, and clicking Edit.

Step 2 When you are satisfied with the profile, choose Inventory > Device Management > Network Devices.

Step 3 Filter and select all of the devices you want to change (bulk edit).

Step 4 Click Edit, and select the new credential profile from the Credential Profile drop-down list.

Step 5 Save your changes:

• Update saves your changes to the Cisco EPN Manager database.

• Update and Sync saves your changes to the Cisco EPN Manager database, collects the device physical and logical inventory, and saves all inventory changes to the Cisco EPN Manager database.

Delete a Credential Profile

This procedure deletes a credential profile from Cisco EPN Manager. If the profile is currently associated with any devices, you must disassociate them from the profile.

Step 1 Check whether any devices are using the profile.
   a) Go to Inventory > Device Management > Credential Profiles.
   b) Select the credential profile to be deleted.
   c) Click Edit, and check if any devices are listed on the Device List page. If any devices are listed, make note of them.

Step 2 If required, disassociate devices from the profile.
   a) Go to Inventory > Device Management > Network Devices.
   b) Filter and select all of the devices you want to change (bulk edit).
   c) Click Edit, and choose --Select-- from the Credential Profile drop-down list.
   d) Disassociate the devices from the old profile by clicking OK in the warning dialog box.

Step 3 Delete the credential profile by choosing Inventory > Device Management > Credential Profiles, selecting the profile, and clicking Delete.

Check a Device's Reachability State and Admin Status

Use this procedure to determine whether Cisco EPN Manager can communicate with a device (reachability state) and whether it is managing that device (admin status). The admin status also provides information on whether the device is being successfully managed by Cisco EPN Manager.

Step 1 Choose Inventory > Device Management > Network Devices.

Step 2 Locate your device in the Network Devices table.
a) From the Show drop-down list (at the top right of the table), choose Quick Filter.
b) Enter the device name (or part of it) in the text box under the Device Name column.

**Step 3** Check the information in the Reachability and Admin Status columns. See Device Reachability and Admin States, on page 24 for descriptions of these states.

---

**Device Reachability and Admin States**

**Device Reachability State**—Indicates whether Cisco EPN Manager can communicate with the device using all configured protocols.

*Table 3: Device Reachability State*

<table>
<thead>
<tr>
<th>Icon</th>
<th>Device Reachability State</th>
<th>Description</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>Reachable</td>
<td>Cisco EPN Manager can reach the device using SNMP, or the NCS 2K device using ICMP.</td>
<td>—</td>
</tr>
<tr>
<td>⚠</td>
<td>Ping reachable</td>
<td>Cisco EPN Manager can reach the device using Ping, but not via SNMP.</td>
<td>Although ICMP ping is successful, check for all possible reasons why SNMP communication is failing. Check that device SNMP credentials are the same in both the device and in Cisco EPN Manager, whether SNMP is enabled on the device, or whether the transport network is dropping SNMP packets due to reasons such as mis-configuration, etc. See Change Basic Device Properties.</td>
</tr>
<tr>
<td>✗</td>
<td>Unreachable</td>
<td>Cisco EPN Manager cannot reach the device using Ping.</td>
<td>Verify that the physical device is operational and connected to the network.</td>
</tr>
<tr>
<td>?</td>
<td>Unknown</td>
<td>Cisco EPN Manager cannot connect to the device.</td>
<td>Check the device.</td>
</tr>
</tbody>
</table>

**Device Admin State**—Indicates the configured state of the device (for example, if an administrator has manually shut down a device, as opposed to a device being down because it is not reachable by Ping).

*Table 4: Device Admin State*

<table>
<thead>
<tr>
<th>Icon</th>
<th>Device Admin State</th>
<th>Description</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>Managed</td>
<td>Cisco EPN Manager is actively monitoring the device.</td>
<td>Not Applicable.</td>
</tr>
</tbody>
</table>
Move a Device To and From Maintenance State

When a device's admin status is changed to Maintenance, Cisco EPN Manager will not poll the device for inventory changes, nor will it process any traps or syslogs that are generated by the device. However, Cisco EPN Manager will continue to maintain existing links and check the device for reachability.

See Device Reachability and Admin States, on page 24 for a list of all admin states and their icons.

**Step 1**
From the Network Devices table, choose **Admin State > Set to Maintenance State**.

**Step 2**
To return the device to the fully managed state, choose **Admin State > Set to Managed State**.

 Validate Added Devices and Troubleshoot Problems

To monitor the discovery process, follow these steps:

**Step 1**
To check the discovery process, choose **Inventory > Device Management > Discovery**.
Step 2
Expand the job instance to view its details, then click each of the following tabs to view details about that device’s discovery:

- **Reachable** - Devices that were reached using ICMP. Devices may be reachable, but not modeled, this may happen due to various reasons as discussed in Add Devices Using Discovery, on page 4. Check the information in this tab for any failures.

- **Filtered** - Devices that were filtered out according to the customized discovery settings.

- **Ping Reachable** - Devices that were reachable by ICMP ping but could not be communicated using SNMP. This might be due to multiple reasons: invalid SNMP credentials, SNMP not enabled in device, network dropping SNMP packets, etc.

- **Unreachable** - Devices that did not respond to ICMP ping, with the failure reason.

- **Unknown** - Cisco EPN Manager cannot connect to the device by ICMP or by SNMP.

**Note** For devices that use the TL1 protocol, make sure that node names do not contain spaces. Otherwise, you will see a connectivity failure.

Step 3
To verify that devices were successfully added to Cisco EPN Manager, choose **Inventory > Device Management > Network Devices**. Then:

- Verify that the devices you have added appear in the list. Click a device name to view the device configurations and the software images that Cisco EPN Manager collected from the devices.

- View details about the information that was collected from the device by hovering your mouse cursor over the Inventory Collection Status field and clicking the icon that appears.

- Check the Device Reachability Status and Admin Status columns. See Device Reachability and Admin States, on page 24.

If you need to edit the device information, see Change Basic Device Properties.

To verify that Cisco EPN Manager supports a device, refer to Cisco Evolved Programmable Network Manager Supported Devices.

To verify that Cisco EPN Manager supports a device, click the Settings icon ( ), then choose .

---

**Find Devices With Inventory Collection or Discovery Problems**

Use the quick filter to locate devices that have discovery or collection problems.

**Step 1** Choose **Monitor > Device Management > Network Devices** to open the Network Devices page.

**Step 2** Make sure **Quick Filter** is listed in the **Show** drop-down at the top left of the table.

**Step 3** Place your cursor in the quick filter field above the **Collection Status** and select a status from the drop-down list that is displayed. The devices are filtered according to that status. For troubleshooting steps, see Validate Added Devices and Troubleshoot Problems, on page 25.
Retry Job for Device Modeling

During device discovery, certain transient conditions can cause a device to have the **Last Inventory Collection Status** value as *Completed with Warning*. In such cases, the failed features of these devices will be automatically recovered using the **Failed Feature Sync**.

---

**Note**

*Completed with Warning* state is indicated when a device has become completed and usable from Cisco EPN Manager, but has certain features that have failed and are unusable. These failed features are specifically listed and can be recovered by the user by performing the recommended action.

---

**Note**

- The **Failed Feature Sync** job will be used only for devices with *Completed with Warning* status, for certain recoverable failures (for example, a timeout error). Permanent or system-based errors (for example, user authentication error or unknown error) cannot be auto-recovered. For more information on the error scenarios, please contact the administration team.

- The **Failed Feature Sync** job works only in the Cisco EPN Manager 3.0 version. For devices that were already in *Completed with Warning* state in previous versions of Cisco EPN Manager and upgraded to 3.0 version, user needs to perform a manual resync of the device before enabling the **Failed Feature Sync** job. As an alternative to manual resync, user can also wait for the daily sync job where the resync will automatically happen. For more information, see Switch Inventory job in **About System Jobs**.

---

The **Failed Feature Sync** job (Go to **Administration** > **Dashboard** > **Job Dashboard**). In the left sidebar, choose **System Jobs** > **Inventory and Discovery Jobs** is disabled by default, to prevent system overloading and needs to be manually enabled by the user. The default job interval (30 minutes) can be edited using the **Edit Schedule** option, though it is not recommended to run the job at a reduced interval, unless in case of emergency.

---

**Note**

If you have more number of devices with *Completed with Warning* status, it is recommended to run the **Failed Feature Sync** job as least often as possible.

---

Alternately, Cisco EPN Manager provides additional instructions for devices in *Completed with Warning* state that can be followed by the user to resolve failures and move the device to the **Completed** state. In the Network Devices table, locate the device and click the *i* icon next to the data in the **Last Inventory Collection Status** column. The popup window will provide details and troubleshooting tips (Failures, Impact, Possible Causes, and Recommended Actions). After user performs the recommended actions, the device can be moved to **Completed** state through a manual sync (applicable for errors such as Wrong CLI credentials), or automatically recovered in the next iteration of the **Failed Feature Sync** job.

Here are some of the *Completed with Warning* scenarios and the corresponding recommended actions:

**Table 5: Completed with Warning state scenarios**

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection to the device failed</td>
<td>Verify that the device accepts incoming CLI/ SNMP connections and retry.</td>
</tr>
<tr>
<td>Possible Cause</td>
<td>Recommended Action</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Connection to the device is closed</td>
<td>Verify that the device accepts incoming CLI/ SNMP connections and retry.</td>
</tr>
<tr>
<td>Data cap exceeded</td>
<td>Collection Error: Please contact the administrator with inventory logs.</td>
</tr>
<tr>
<td>Unexpected condition in the TL1 protocol</td>
<td>Verify that the device accepts incoming TL1 connections and retry.</td>
</tr>
<tr>
<td>General unexpected condition in the HTTP protocol</td>
<td>Verify that the device accepts incoming HTTP connections and retry.</td>
</tr>
<tr>
<td>Error retrieving from NETCONF/XML</td>
<td>Verify that NETCONF/XML is configured and retry.</td>
</tr>
<tr>
<td>NETCONF reported an RPC error</td>
<td>Collection Error: Please contact the administrator with inventory logs.</td>
</tr>
<tr>
<td>Error in the CLI_SESSION_SCRIPT document</td>
<td>Verify that the device can accept a new CLI session and retry.</td>
</tr>
<tr>
<td>A pattern was matched indicating an error during session setup or tear down</td>
<td>Verify that the device can accept a new CLI session and retry.</td>
</tr>
<tr>
<td>Device not reachable</td>
<td>Please contact the administrator with inventory logs.</td>
</tr>
<tr>
<td>Failsafe timeout occurred when trying to communicate with the device</td>
<td>Verify device responsiveness and load.</td>
</tr>
<tr>
<td>A timeout occurred when trying to communicate with the device</td>
<td>Verify that the timeouts configured on the device do not stop CLI connections and retry.</td>
</tr>
<tr>
<td>No response for SNMP get request</td>
<td>Verify that the device can accept incoming SNMP requests and retry.</td>
</tr>
<tr>
<td>Failed to perform SNMP get request</td>
<td>Verify that the device can accept incoming SNMP requests and retry.</td>
</tr>
<tr>
<td>Response error for SNMP get request</td>
<td>Verify that the device can accept incoming SNMP requests and retry.</td>
</tr>
</tbody>
</table>

### Export Device Information to a CSV File

When you export the device list to a file, all device information is exported into a CSV file. The file is then compressed and encrypted using a password you select. The exported file contains information about the device's SNMP credentials, CLI settings, and geographical coordinates. The exported file includes device credentials but does not include credential profiles.
Exercise caution while using the CSV file as it lists all credentials for the exported devices. You will want to ensure that only users with special privileges can perform a device export.

---

**Step 1** Choose **Inventory > Device Management > Network Devices.**

**Step 2** Select the devices that you want to export, then click [ ] and choose **Export Device.**

**Step 3** In the **Export Device** dialog box, enter a password that will be used to encrypt the exported CSV file. Users will need to supply this password to open the exported file.

**Step 4** Confirm the encryption password and click **Export.** Depending on your browser configuration, you can save or open the compressed file.

---

**Create Groups of Devices for Easier Management and Configuration**

- **How Groups Work, on page 29**
- **Create User-Defined Device Groups, on page 32**
- **Create Location Groups, on page 33**
- **Create Port Groups, on page 35**
- **Make Copies of Groups, on page 35**
- **Hide Groups That Do Not Have Any Members, on page 36**
- **Delete Groups, on page 36**

Organizing your devices into logical groupings simplifies device management, monitoring, and configuration. Because you can apply operations to groups, grouping saves time and ensures that configuration settings are applied consistently across your network. In smaller deployments where all devices can be configured with the same settings, you may only need to create one general device group. The grouping mechanism also supports subgroups. You will see these groups in many of the Cisco EPN Manager GUI windows.

When a device is added to Cisco EPN Manager, it is assigned to a location group named **Unassigned.** If you are managing a large number of devices, be sure to move devices into other groups so that the Unassigned Group membership does not become too large.

**How Groups Work**

Groups are logical containers for network elements, such as devices and ports. You can create groups that are specific to your deployment—for example, by device type or location. You can set up a group so that new devices are automatically added if they match your criteria, or you may want to add devices manually.

For information on the specific types of groups, see the related topics **Network Device Groups, on page 30** and **Port Groups, on page 30.**
For information on how elements are added to groups, see How Elements Are Added to Groups: Dynamic, Manual, and Mixed Groups, on page 31.

Network Device Groups

The following table lists the supported types of network device groups. The device groups can be accessed from the Inventory.

<table>
<thead>
<tr>
<th>Network Device Group Type</th>
<th>Membership Criteria</th>
<th>Can Be Created or Edited By Users?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Type</td>
<td>Devices are grouped by family (for example, Optical Networking, Routers, Switches and Hubs, and so forth). Under each device family, devices are further grouped by series. New devices are automatically assigned to the appropriate family and series groups. For example, a Cisco ASR 9006 would belong to Routers (family) and Cisco ASR 9000 Series Aggregation Services Routers (series). Note the following: • You cannot create a device type group; these are dynamic groups that are system-defined. Instead, use device criteria to create a user-defined group and give it an appropriate device name. • Device type groups are not displayed in Network Topology maps. • Unsupported devices discovered by Cisco EPN Manager are automatically assigned the Generic Cisco Device device type and are listed under Device Type &gt; Generic Cisco Device Family.</td>
<td>No</td>
</tr>
<tr>
<td>Location</td>
<td>Location groups allow you to group devices by location. You can create a hierarchy of location groups (such as theater, country, region, campus, building, and floor) by adding devices manually or by adding devices dynamically. A device should appear in one location group only, though a higher level “parent” group will also contain that device. For example, a device that belongs to a building location group might also indirectly belong to the parent campus group. By default, the top location of the hierarchy is the All Locations group. All devices that have not been assigned to a location appear under the Unassigned group under All Locations.</td>
<td>Yes</td>
</tr>
<tr>
<td>User Defined</td>
<td>Devices are grouped by a customizable combination of device and location criteria. You can customize group names and use whatever device and location criteria you need.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Port Groups

The following table lists the supported types of port groups.
<table>
<thead>
<tr>
<th>Port Group Type</th>
<th>Membership Criteria</th>
<th>Can be created or edited by users?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Type</td>
<td>Grouped by port type, speed, name, or description. Ports on new devices are automatically assigned to the appropriate port group. You cannot create Port Type groups. Instead, use device criteria to create a user-defined group, and create subgroups under the user-defined group.</td>
<td>No; instead create a User Defined Group</td>
</tr>
<tr>
<td>System Defined</td>
<td>Grouped by port usage or state. Ports on new devices are automatically assigned to the appropriate port group. Link Ports—Ports that are connected to another Cisco device or other network devices and are operating on “VLAN” mode and are assigned to a VLAN. Trunk Ports—Ports that are connected to a Cisco device or other network devices (Switch/Router/Firewall/Third party devices) and operating on “Trunk” mode in which they carry traffic for all VLANs. If the status of a port goes down, it is automatically added to Unconnected Port group. You cannot delete the ports in this group, and you cannot re-create this group as a sub group of any other group. Wireless and Data Center devices use the other System Defined port groups: AVC Configured Interfaces, UCS Interfaces, UCS Uplink Interfaces, WAN Interfaces, and so forth. You cannot create System Defined Port groups. Instead, use device criteria to create a user-defined group, and create subgroups under the user-defined group.</td>
<td>No; instead create a User Defined Group</td>
</tr>
<tr>
<td>User Defined</td>
<td>Grouped by a customizable combination of port criteria, and you can name the group. If the group is dynamic and a port matches the criteria, it is added to the group.</td>
<td>Yes</td>
</tr>
</tbody>
</table>

How Elements Are Added to Groups: Dynamic, Manual, and Mixed Groups

How elements are added to a group depends on whether the group is dynamic, manual, or mixed.

<table>
<thead>
<tr>
<th>Method for Adding Devices</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic</td>
<td>Cisco EPN Manager automatically adds a new element to the group if the element meets the group criteria. While there is no limit to the number of rules that you can specify, the performance for updates may be negatively impacted as you add more rules.</td>
</tr>
<tr>
<td>Manual</td>
<td>Users add the elements manually when creating the group or by editing the group.</td>
</tr>
<tr>
<td>Mixed</td>
<td>Elements are added through a combination of dynamic rules and manual additions.</td>
</tr>
</tbody>
</table>
The device inheritance in parent-child user defined and location groups are as follows:

- **User Defined Group**—When you create a child group:
  - If the parent and child groups are both dynamic, the child group can only access devices that are in the parent group.
  - If the parent group is static and the child group is dynamic, the child group can access devices that are outside of the parent group.
  - If the parent and child groups are dynamic and static, the child group “inherits” devices from the parent device group.

- **Location Group**—The parent group inherits the child group devices.

### Groups and Virtual Domains

While groups are logical containers for elements, access to the elements is controlled by virtual domains. This example shows the relationship between groups and virtual domains.

- A group named **SanJoseDevices** contains 100 devices.
- A virtual domain named **NorthernCalifornia** contains 400 devices. Those devices are from various groups and include 20 devices from the **SanJoseDevices** group.

Users with access to the **NorthernCalifornia** virtual domain will be able to access the 20 devices from the **SanJoseDevices** group, but not the other 80 devices in the group. For more details, see "Create Virtual Domains to Control User Access to Devices".

### Create User-Defined Device Groups

To create a new device type group, use the user-defined group mechanism. You must use this mechanism because device type groups are a special category used throughout Cisco EPN Manager. The groups you create will appear in the **User Defined** category.

**Note**

Cisco ASR satellites can only belong to location groups. For more information, see Satellite Considerations in Cisco EPN Manager.

To create a new group, complete the following procedure:

**Step 1**
Choose **Inventory > Group Management > Network Device Groups**.

**Step 2**
In the **Device Groups** pane, click the + (Add) icon and then choose **Create User Defined Group**.

**Step 3**
Enter the group's name and description. If other user-defined device type groups already exist, you can set one as the parent group by choosing it from the **Parent Group** drop-down list. If you do not select a parent group, the new group will reside in the **User-Defined** folder (by default).

**Step 4**
Add devices to the new group:

If you want to add devices that meet your criteria automatically, enter the criteria in the **Add Devices Dynamically** area. To group devices that fall within a specific range of IP addresses, enter that range in square brackets. For example, you can specify the following:
Create Location Groups

Note Cisco ASR satellites can only belong to Location Groups. For more information, see Satellite Considerations in Cisco EPN Manager.

To create a location group, follow these steps:

Step 1 Choose Inventory > Group Management > Network Device Groups.
Step 2 In the Device Groups pane on the left, click the Add icon, then choose Create Location Group.
Step 3 Enter the name and description, and choose a group from the Parent Group drop-down list. By default, the group will be an All Locations subgroup (that is, displayed under the All Locations folder).
Step 4 If you are creating a device group based on geographical location, for example, all devices located in a building at a specific address, select the Geographical Location check box and specify the GPS coordinates of the group or click the View Map link and click on the required location in the map. The GPS coordinates will be populated automatically in this case. Note that location groups defined with a geographic location are represented by a group icon in the geo map. The devices you add to the group will inherit the GPS coordinates of the group. See Device Groups in the Geo Map for more information. Note that if geographical location is the primary reason for grouping a set of devices, it is recommended that the devices you add to the group do not have their own GPS coordinates that are different from the group's.
Step 5 If you want devices to be added automatically if they meet certain criteria, enter the criteria in the Add Device Dynamically area. Otherwise, leave this area blank.
While there is no limit on the number of rules that you can specify for a dynamic group, as the number of rules increases, the group update performance could become slower.

**Step 6**  
If you want to add devices manually:

a) Under **Add Devices Manually**, click **Add**.

b) In the **Add Devices** dialog box, locate devices you want to add, then click **Add**.

**Step 7**  
Click the **Preview** tab to see the group members.

**Step 8**  
Click **Save**, and the new location group appears under the folder you selected in Step 3 (**All Locations**, by default).
Create Port Groups

To create a port group, follow these steps:

**Step 1** Choose **Inventory > Group Management > Port Groups**.

**Step 2** From **Port Groups > User Defined**, hover your mouse over the "i" icon next to **User Defined** and click **Add SubGroup** from the popup window.

**Step 3** Enter the name and description, and choose a group from the **Parent Group** drop-down list. By default, the port group will be under the **User Defined** folder.

**Step 4** Choose the devices a port must belong to in order to be added to the group. From the **Device Selection** drop-down list, you can:

- **Device**—To choose devices from a flat list of all devices.
- **Device Group**—To choose device groups (Device Type, Location, and User Defined groups are listed).

**Step 5** If you want ports to be added automatically if they meet your criteria, enter the criteria in the **Add Port Dynamically** area. Otherwise, leave this area blank.

While there is no limit on the number of rules that you can specify for a dynamic group, as the number of rules increases, the group update performance could become slower.

**Step 6** If you want to add devices manually:

a) Under **Add Ports Manually**, click **Add**.

b) In the **Add Ports dialog** box, locate devices you want to add, then click **Add**.

**Step 7** Click the **Preview** tab to see the group members.

**Step 8** Click **Save**, and the new port group appears under the folder you selected in Step 3 (**User Defined**, by default).

---

Make Copies of Groups

When you create a duplicate of a group, Cisco EPN Manager names the group **CopyOfgroup-name** by default. You can change the name, if required.

To duplicate a group follow these steps:

**Step 1** Choose **Inventory > Group Management > Network Device Groups**.

**Step 2** Choose the group from the Device Groups pane on the left.

**Step 3** Locate the device group you want to copy, then click the "i" icon next to it to open the pop-up window.

**Step 4** Click **Duplicate Group** (do not make any changes yet) and click **Save**. Cisco EPN Manager creates a new group called **CopyOfgroup-name**.

**Step 5** Configure your group as described in **Create User-Defined Device Groups, on page 32** and **Create Location Groups, on page 33**.

**Step 6** Verify your group settings by clicking the **Preview** tab and examining the group members.

**Step 7** Click **Save** to save the group.
Hide Groups That Do Not Have Any Members

By default, Cisco EPN Manager will display a group in the web GUI even if the group has no members. Users with Administrator privileges can change this setting so that empty groups are hidden—that is, they are not displayed in the web GUI. (Hidden groups are not deleted from Cisco EPN Manager.)

Step 1  Choose Administration > Settings > System Settings, then choose Inventory > Grouping.
Step 2  Uncheck Display groups with no members, and click Save.

We recommend that you leave the Display groups with no members check box selected if you have a large number of groups and devices. Unselecting it can slow system performance.

Delete Groups

Make sure the group you want to delete has no members, otherwise Cisco EPN Manager will not allow the operation to proceed.

Step 1  Choose Inventory > Group Management > Network Device Groups.
Step 2  Locate the device group you want to delete in the Device Groups pane on the left, then click the "i" icon next to it to open the pop-up window.
Step 3  Click Delete Group and click OK.

Delete Devices

When you delete a device, Cisco EPN Manager will no longer model or monitor it.

Before you begin

If a device has services on it that were provisioned using Cisco EPN Manager, you must delete those services before deleting the device. However, you will be permitted to delete devices that have discovered or provisioned services on it (that is, services that were not created by Cisco EPN Manager). To find out which services are on a device, use the Device 360 view; see View a Specific Device's Circuits/VCs.

Step 1  Choose Inventory > Device Management > Network Devices to open the Network Devices page.
Step 2  Locate the device you want to delete. For example, navigate through the Groups list, or enter some text in the Quick Filter boxes.
Step 3  Select the device, and click Delete.