Configure Devices

This chapter provides the following topics:

Ways to Configure Devices Using Cisco Evolved Programmable Network Manager

Cisco EPN Manager provides two ways to change the physical devices in your network. The actions you can perform depend on your user account privileges and the types of devices in your network.

Launch Points for Configuring Devices	Use this method to:
Configuration menu from left-side navigation menu	Perform common network management tasks on *one or more devices* using system templates—for example, adding a hostname or configuring a routing protocol. You can also create your own templates to fit your deployment needs. Because they can be applied to multiple devices, templates normally apply to specific device operating systems or device types. When you use a configuration template, Cisco EPN Manager only displays devices that meet the template criteria.

Note You can also edit device properties from the Network Devices table (**Configuration** > **Network** > **Network Devices**) by choosing a device and clicking **Edit**. This launches the device Edit Wizard. However, changes you make using the wizard are limited to device credentials, and any changes you make do not affect the physical device; they only update device information that is stored in the database.

For optical devices, you can also configure devices using Cisco Transport Controller, which you can launch from Cisco EPN Manager . See Launch Cisco Transport Controller to Manage Cisco NCS and Cisco ONS Devices, on page 113

After you make your changes, save your changes to the database and optionally collect the device's physical and logical inventory. For more information, see Collect a Device's Inventory Now (Sync), on page 3.

Which Devices Support the Configuration Operations?

Configuration operations are supported on a device if:

- The device model is supported by Cisco EPN Manager .
- The device operating system is supported by Cisco EPN Manager .
- The applicable technology or service is supported by c *and* is enabled on the device.

To find out what is supported, see Cisco Evolved Programmable Network Manager Supported Devices.

Identify the Commands Used In a CLI Configuration Template

Use this procedure to view the exact commands that are used by any of the commands you launch from the **CLI Templates** drawer.

Step 1 Choose **Configuration** > **Templates** > **Features and Technologies**, then choose **CLI Templates**. For example:

- Out-of-the-box templates are under **System Templates - CLI**.
- Customized templates are under **My Templates**.

Step 2 Double-click the template in the left sidebar **Templates** menu.

Step 3 In the Template Detail area, choose the **CLI Content** tab. The commands are displayed in that tab.

Save Your Device Changes

After you make a change to a device, save your changes to the database and, if desired, collect the device's physical and logical inventory. See these topics for more information:

- Save Device Configuration Changes to the Database (Update), on page 3
- Collect a Device's Inventory Now (Sync), on page 3

Save Device Configuration Changes to the Database (Update)

After making a change to your devices, you should save those changes to the database by clicking **Update** in the configuration window. If an Update button is not provided, perform a manual *sync* which will save your changes, but also collect the device's physical and logical inventory and save it to the database. See Collect a Device's Inventory Now (Sync), on page 3

Collect a Device's Inventory Now (Sync)

The Sync operation performs an immediate inventory collection for a device. When it performs a Sync, Cisco EPN Manager collects the selected device's physical and logical inventory and synchronizes the database with any updates. If you do not perform a Sync operation after making a change to a device, your change will not be saved to the database until the daily inventory collection.

Note The Sync operation is different from the Update operation. Update saves configuration changes without performing an inventory collection. If you want to use Update instead of Sync, see Save Device Configuration Changes to the Database (Update), on page 3.

Note This Sync operation is different from working with *out-of-sync device configuration files*. An out-of-sync device is a device that has a startup configuration files that is different from its running configuration file. For more information, see Synchronize Running and Startup Device Configurations.

Use one of these methods perform a manual Sync.

To collect the inventory for:	Do the following:
A single device	• From the device's Device 360 view, choose **Actions** > **Sync Now**; or • From the Network Devices table, check the device's check box, then click **Sync**.
Multiple devices	From the Network Devices table, select the devices (by checking their check boxes), then click **Sync**.

Change a Device's Credentials and Protocol Settings

Use the following procedure to update device credentials and protocol settings. When you save the settings to the database, you can also perform an inventory collection to gather all physical and logical device changes and save those changes to the database, rather than wait for the daily inventory collection.

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

Step 2 Select the device you want to edit, and click **Edit**. You can also choose several devices and make bulk changes.

Step 3 Double-click the parameters you want to change. Depending on the device type, you can edit:

- Credential profile being used by device
- Group the device belongs to
- SNMP port, retries, timeout, credentials, and SNMPv3 authentication information
- Telnet/SSH2 credentials and timeout
- HTTP/HTTPS credentials, port, timeout
- IPSec parameters
- TL1 credentials and proxy IP address (for GNE/ENEs)

Step 4 Check that the new credentials are the same as those on the physical device by clicking **Verify Credentials**.

Step 5 Save your changes:

- **Update** saves your changes in the database.

- **Update & Sync** saves your changes to the database, but also collects device physical and logical inventory and saves all changes to the database.

Change Basic Device Properties

Cisco EPN Manager provides command templates that you can use to make basic property changes on your physical devices. To use these templates, choose **Configuration** > **Templates** > **Features & Technologies**, then choose **CLI Templates** > **System Templates – CLI** from the Templates pane on the left.

Note The operations you perform here are different from those you perform with the Edit wizard (which you can launch from the Network Devices table). The Edit wizard changes the device property information that is saved in the database. It does not change properties on physical devices.

CLI Configuration Template Name	Use it to:	Required Input Values
Add-Host-Name-IOS *and* -IOS-XR	Configure the client host name	Host name
Remove-Host-Name-IOS *and* -IOS-XR		
Syslog-Host-Logging-IOS and -IOS-XR	Specify host to which messages of a certain level will be logged	Host name
Add-Tacacs-Server-IOS *and* -IOS-XR	Configure the TACACS or TACACS+ server to use for authentication	Host address, key value, authentication list name, group name
Remove-Tacacs-Server-IOS *and* -IOS-XR		
Add-Tacacs-Plus-Server-IOS *and* -IOS-XR		
Remove-Tacacs-Plus-Server-IOS *and* -IOS-XR		
Add-SNMP-Configuration-IOS *and* -IOS-XR	Configure SNMP version, password, password encryption, server and group settings, UDP port, and so forth	Host name, community name
Remove-SNMP-Configuration-IOS *and* -IOS-XR		

CLI Configuration Template Name	Use it to:	Required Input Values
Enable-Traps-ASR903	Enable and disable traps on the Cisco ASR 903	Trap name (a list is provided)
Disable-Traps-ASR903		
Enable-Traps-IOS *and* -IOS-XR	Enable and disable traps on Cisco IOS and Cisco IOS XR devices	
Disable-Traps-IOS *and* -IOS-XR		
Enable-Traps-ME3600 *and* -ME3800	Enable and disable traps on the Cisco ME3600 and ME3800	
Disable-Traps-ME3600 *and* -ME3800		
Enable-Trap-Host-IOS *and* IOS-XR	Set a target host for SNMP traps	Host IP address, community string
Show-Users-on-Device-IOS and -IOS-XR	Display user session information for Cisco IOS and Cisco IOS XR devices	(Executed from selected device; no input required)

Enable and Disable Interfaces

Use the Interface 360 view to quickly enable and disable an interface. While you can perform these same actions from a Device Details page, using the Interface 360 view may be more efficient (for example, when responding to an alarm). The top right of the Interface 360 view provides an **Actions** menu that provides enable and disable options.

To launch an Interface 360 view, see Get a Quick Look at a Device Interface: Interface 360 View.

To enable and disable an interface from a device's Device Details page, see the interface configuration topics (Ethernet, Loopback, Tunnel, and so forth).

Configure Physical Attributes of Device Interfaces

Using Cisco EPN Manager , you can configure the physical attributes of your device's interfaces. Attributes such as card operating modes, bandwidth allocation per slot, slot pluggable types (such as VCoP), and AINS settings are configurable.

To configure the physical attributes of interfaces:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's name hyperlink.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 To configure the interfaces, navigate to the paths described in the table below.

Step 5 To make your changes, click the controller/card name hyperlink and click the Edit icon at the top right corner of the page. Make your changes and click **Save**.

Table 1: Physical Attributes Configuration for Interfaces

Physical Interface Configuration	Navigation	Comments/Descriptions	Supported Slots/Controllers
Configure card modes as 5G or 10G.	**Physical** > **Card Mode**	You can change the configuration from 10G to 5G but the other way around is not supported. Depending on the device you select, the default card mode is set to either 5G or 10G. For mode detailed information on the supported card modes, see Supported Devices for Cisco EPN Manager **Note** You cannot configure the card modes on slots that are part of active circuits.	For more information about the device slots and supported card mode types, see table below (*Device Slots and Supported Card Mode Types*).
Configure NCS4200-1T16G-PS cards on NCS42xx devices.	**Physical** > **Card Mode**	You can view all the card modes of NCS4200-1T16G-PS cards, irrespective of the slot numbers. **Note** Once you configure NCS4200-1T16G-PS card on some slots of NCS42xx devices, the configurations on those slots will be reset to the default values.	-
Configure the interface module type for Automatic In-Service (AINS)	**Physical** > **Automatic In-Service (AINS)**	Use this menu to configure the right controller types for AINS. In case of manual insertion and removal of cards, the AINS values are populated after a 20 min delay.	-
Configure bandwidth that must be reserved for the selected device slots.	**Physical** > **Bandwidth**	The bandwidth you specify is reserved for the selected slot and made available to the slot irrespective of whether the slot is operational or not. In cases when the selected slot/card is down, and then back online after sometime, the configured bandwidth will be available for use based on the values specified in this field.	You can reserve a pre-configured bandwidth value of 80 or 100 Gbps on NCS4200-1T16G-PS cards on NCS42xx devices.

Physical Interface Configuration	Navigation	Comments/Descriptions	Supported Slots/Controllers
Configure the interface pluggable type for virtual Container over Packet (VCoP).	**Physical** > **Pluggable Type**	Use this menu to select the right port types for VCoP enabled interfaces. For example, the port types can be OC3, OC12, or DS3. **Note** VCoP smart SFP provides an ability to forward the SONET signal transparently across the packet network. The VCoP smart SFP is a special type of optical transceiver which encapsulates SONET bit stream at STS1 or STS-3c or STS-12c level into packet format.	-

Conditions and Limitations: Following are the conditions and limitations for configuring controller modes on Cisco ASR 900 Series Route Switch Processor 2 (RSP2A) modules (A900-RSP2A-128) that are supported on Cisco ASR 920, Cisco NCS4202, and Cisco NCS 4206 devices:

- The maximum bandwidth that can be configured is OC-48. A maximum of 20 ports on the module can be configured:
  - Ports 0-11 are T1 ports
  - Ports 12-15 are T3/E3 ports
  - Ports 16-19 are OC3/OC12 ports.

  Note If a given port is configured as OC48, then only one of the given port can be configured since the maximum configurable bandwidth is OC48.

- Configuration limitations on the Cisco A900-RSP2A-128 modules:
  - You cannot configure SDH/E3/E1/DS0 controller modes.
  - Configuring Ethernet as the controller mode is not supported.
  - The protection type UPSR cannot be configured.
  - Once you deploy the controller mode configuration to the device, you cannot undo the configuration using Cisco EPN Manager .

Table 2: Device Slots and Supported Card Mode Types

Cisco NCS 4206 Devices	Cisco NCS 4216 Devices	Cisco ASR903 Devices	Cisco ASR907 Devices
• Slot 0, 1 - Not supported • Slot 2, 3, 4, 5 - Default Mode 10G	• Slot 0, 1 - Not supported • Slot 3, 4, 7, 8, 11, and 12 - Default Mode 10G • Slot 2, 5, 6, 9, 10, 13, 14 and 15 - Default Mode 5G	• Slot 0, 1 - Not supported • Slot 2, 3, 4, 5 - Default Mode 10G	• Slot 0, 1 - Not supported • Slot 3, 4, 7, 8, 11, and 12 - Default Mode 10G • Slot 2, 5, 6, 9, 10, 13, 14 and 15 - Default Mode 5G

Table 3: Controller Modes and Supported Port Types

Ethernet (0-7)	SONET (0-3)	SONET (4-7)
• 8G (each 1G port) • Not allowed in a port group if at least one port has OC48 configured.	• Max of 2.5G • Can support OC48/OC12/OC3 but total of 2.5G • Example if Port 0 configured with OC48, Port1/2/3 can't be used.	• Max of 2.5G • If a port group has OC12/OC3/1G it means OC48 can't be allowed

Configure Circuit Emulation

Cisco EPN Manager supports the provisioning of Circuit Emulation (CEM) which provides a bridge between traditional TDM network and packet switched network (PSN). CEM is a way to carry TDM (or PDH) circuits over packet switched network. Circuit Emulation (CEM) is the imitation of a physical connection. This feature allows you to use your existing IP network to provide leased-line emulation services or to carry data streams or protocols that do not meet the format requirements of other multiservice platform interfaces.

Cisco EPN Manager supports the following CEM modes:

- Structure-Agnostic time-division multiplexing (TDM) over Packet (SAToP)—This is the unstructured mode in which the incoming TDM data is considered as an arbitrary bit stream. It disregards any structure that may be imposed on the bit stream. SAToP encapsulates the TDM bit streams as pseudowire (PWs) over PSN.

- Circuit Emulation over Packet (CEP)—This mode is used to emulate Synchronous Optical Network/Synchronous Digital Hierarchy (SONET/SDH) circuits and services over MPLS. To transport SONET/SDH circuits through a packet-oriented network, the Synchronous Payload Envelope (SPE) or Virtual Tributary (VT) is broken into fragments. A CEP header and optionally an RTP header are prepended to each fragment.

For more information about CEM in Cisco EPN Manager , see, Supported Circuit Emulation Services.

When a line is channelized, it is logically divided into smaller bandwidth channels called higher-order paths (HOP) and lower-order paths (LOP). These paths carry the SONET payload. When a line is not channelized, the full bandwidth of the line is dedicated to a single channel that carries broadband services. Cisco EPN Manager enables you to channelize the T3 or E3 channels into T1s, and channelize the T1s further into DS0 time slots. Before you provision CEM services using Cisco EPN Manager, you must first configure the parameters for the HOP and LOP by configuring the interfaces for CEM.

A channelized SONET interface is a composite of STS streams, which are maintained as independent frames with unique payload pointers. The frames are multiplexed before transmission. SONET uses Synchronous Transport Signal (STS) framing while SDH uses Synchronous Transport Mode (STM) framing. An STS is the electrical equivalent to an optical carrier 1 (OC-1) and an STM-1 is the electrical equivalent to 3 optical carrier 1s (OC-1s).

This section describes how you can use Cisco EPN Manager to first configure your interfaces for CEM. You can then provision CEM services using these interfaces configured with appropriate controller modes and protection groups.

Pre-requisites for Configuring CEM Services

Before you provision a CEM service (see Provision Circuit Emulation Services), ensure that the following pre-requisites are met:

- Configure the required loopback settings for CEM on the device. See, Configure Loopback Interfaces, on page 30.
- Configure the required CEM parameters on SONET, SDH, PDH, HOP, and HOP controllers. See, Configure Interfaces for CEM, on page 10.
- Configure the working and backup interface groups to provide APS protection. See, View Protection Groups, on page 13.

Configure Interfaces for CEM

Using Cisco EPN Manager , you can configure your interfaces with Circuit Emulation (CEM). To do this, you must first set appropriate controller modes on your interfaces and then configure the PDH (E1, T1, E3, T3) , SONET, and SDH controllers for CEM. After you configure the interfaces with CEM, you can then use the interfaces for provisioning CEM services. See Provision Circuit Emulation Services.

To configure the interfaces for CEM:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's name hyperlink.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 To configure CEM parameters, navigate to the configuration options as described in the table below.

Step 5 To make your changes, click the controller/card name hyperlink and click the Edit icon at the top right corner of the page. Make your changes and click **Save**.

Table 4: CEM Interface Configuration Options

CEM Interface Configuration	Navigation	Comments/Description	Supported Slots/Controllers
Configure controller modes as SONET, SHD, Ethernet, T3, or E3.	**Circuit Emulation** > **Controller Mode**	The controller mode options displayed for selection are based on the selected media type.	–
Configure PDH (E1, T1, E3, and T3) controllers	**Circuit Emulation** > **PDH**	For a description of the different PDH parameters, see CEM Interface (PDH, SONET, and SDH) Field Descriptions, on page 15	-

CEM Interface Configuration	Navigation	Common Descriptions	Supported Slots/Controllers
Configure SONET and SDH controllers for CEM	**Circuit Emulation** > **SONET and SDH**	For a description of the different SONET and SDH parameters, see CEM Interface (PDH, SONET, and SDH) Field Descriptions, on page 15	For more information about the device ports and supported controller types, see table below (*Controller Modes and Supported Port Types*).
Configure a working and protecting member interface for CEM provisioning.	**Circuit Emulation** > **Protection Group**	See View Protection Groups, on page 13	-

Table 5: Controller Modes and Supported Port Types

Ethernet (0-7)	SONET (0-3)	SONET (4-7)
• 8G (each 1G port) • Not allowed in a port group if at least one port has OC48 configured.	• Max of 2.5G • Can support OC48/OC12/OC3 but total of 2.5G • Example if Port 0 configured with OC48, Port1/2/3 can't be used.	• Max of 2.5G • If a port group has OC12/OC3/1G it means OC48 can't be allowed

CEM Interface Configuration Example:

The following example show the sample CEM interface configuration that is deployed to the device for CEM framing type 'unframed', c-11 mode, clock source of type 'internet', and ACR values associated with the Protection Group 'acr 255':

```
NCS4206-120.32#show running-config | section 0/4/0
controller MediaType 0/4/0
 mode sonet
controller SONET 0/4/0
 rate OC3
 no ais-shut
 framing sonet
 clock source line
 loopback network
```

```
 !
 sts-1 1
  clock source internal
  mode unframed
  cem-group 1 cep
 !
 sts-1 2
  clock source internal
  loopback network
  mode unframed
  cem-group 2 cep
 !
 sts-1 3
  clock source internal
  mode vt-15
  vtg 1 vt 1 protection-group 15 working
  vtg 1 vt 3 protection-group 16 working
  vtg 1 vt 4 protection-group 17 working
 !
 aps group acr 255
 aps protect 1 6.6.6.6 / aps working 1
!
interface CEM0/4/0
 no ip address
 cem 1
 !
 cem 2
 !
connect sam CEM0/4/0 1 CEM0/4/0 2
 !
NCS4206-120.32#
```

View Protection Groups

Viewing the protection groups for CEM helps you understand the enabled Automatic Protection Switching (APS) interfaces for your devices. APS refers to the mechanism of using a protect interface in the SONET network as the backup for the working interface. Associating your CEM interfaces with APS or protection groups, ensures that when the working interface fails, the protect interface quickly assumes its traffic load. The working interfaces and their protect interfaces together make up a Protection Group. SONET Protection Groups offer recovery from fiber (external) or equipment (interface and internal) failures at the SONET line layer. Using Cisco EPN Manager , you can view the working member for a SONET controller which acts as the main functioning controller for the CEM circuit. The Protecting Member acts as a backup for the main working controller. To view these details, ensure that the interfaces have been set with the required controller modes as explained in Configure Interfaces for CEM, on page 10.

To view Protection Groups for your CEM interfaces:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Select the device that is configured with protection groups, by clicking the device's name hyperlink.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Circuit Emulation** > **Protection Group**.

Step 5 You can view the following fields. Click the protection group hyperlink to view additional details about each group:

- The **Protection Group** field represents the unique numerical value for easy identification of the Protection Group.
- The **Protection Group** field represents the unique numerical value for easy identification of the Protection Group.

- The **Working Member** shows the SONET controller which acts as the main functioning controller for the CEM circuit.
- The **Protecting Member** is the SONET controller which acts as the backup for the working member.

Configure Clocking for CEM

Clocking modes define multiple ways to achieve the same clock in the transmitting and receiving ends of a CEM circuit. Cisco EPN Manager enables you to configure clock recovery and distribution in these ways:

- Synchronous Clocking — with synchronous clocking, PDH (TDM) lines on the source and destination are synchronized to the same clock delivered by some means of physical clock distribution (SONET, SDH, and so on). The clock on the particular TDM line can be delivered from
  - Line: the transmit clock is from the receiver of the same physical line.
  - Internal: the controller will clock its sent data using the internal clock.
  - Free Running: the transmit clock is taken from line card and can be derived from an internal free running oscillator.
  - Recovered: the transmit clock is derived from an in-band pseudowire-based activeclock recovery on a CEM interface.

  To set these clocking values in Cisco EPN Manager , see Configure CEM Interfaces.
- Adaptive Clocking — adaptive clocking is used when the routers do not have a common clock source. The clock is derived based on packet arrival rates based on dejitter buffer fill level. You can set the size of the Dejitter Buffer (in the range of 1-32) during provisioning of CEM services in Cisco EPN Manager . The size of the Dejitter Buffer determines the ability of the circuit to tolerate network jitter.
- Differential clocking — differential clocking is used when the cell site and aggregation routers have a common clock source but the TDM lines are clocked by a different source. The TDM clocks are derived from differential information in the RTP header of the packet with respect to the common clock. Differential clock recovery is based on time stamps received in the RTP header.

To configure clock recovery for CEM:

Step 1 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 2 Choose **Clock** > **Recovered Clock**.

Step 3 To add a new interface from which the clock source must be derived, click the Add ('+') icon.

Step 4 To edit the existing recovered clock configuration, click the Recovering Interface hyperlink and click the 'Edit' icon at the top right of the page.

Step 5 Specify the following recovered clock values:

1. Enter a unique numerical value for the **Recovered Clock ID** for easy identification of the recovered clock configuration. This ID can then be used to associate the CEM interfaces directly with this the recovered clock configuration.

2 From the **Recover Mode** drop-down list choose:

- **Adaptive—** when devices do not have a common clock source, the recovered clock is derived from packet arrival rate on the controller selected as the Protecting Member for the associated Protection Group.
- **Differential—** when the edge devices have a common clock source, the recovered clock is derived from timing information in packets and the related difference from the common clock.

3 Enter a unique numerical value for easy identification of the **CEM Group Number**. This identifies the CEM group associated with the clock.

4 Choose the required controller from the **Recovering Interface** drop-down list. This controller associated with the clock is the virtual CEM interface from which the clock is derived when a backup clock source is required.

Step 6 Click **Save**.
Your changes are saved and deployed to the device.

CEM Interface (PDH, SONET, and SDH) Field Descriptions

To configure the CEM parameters listed in the table below:

Step 1 Configure the required CEM parameters on SONET, PDH, HOP, and HOP controllers. See, Configure Interfaces for CEM, on page 10.

Step 2 Configure clock distribution and recovery for CEM. See Configure Clocking for CEM, on page 14.

Table 6: Table - CEM Interface (SONET, SDH, and PDH) Field Descriptions

Fields	Descriptions	Values	Descriptions	Applicable Controller Modes
Rate	Identifies the rate at which the bit-transparent data transport occurs. It is defined by the CEoP Shared Port Adapters (SPA) group that you choose.	LR_DSR_OC3_STM1	Indicates the layer rate supported on the channelized OC-3 line with STM level 1. OC-3 is an optical carrier network line with transmission data rate of up to 155.52 Mbit/s.	SONET
		LR_DSR_OC12_STM4	Indicates the layer rate supported on the channelized OC-12 line with STM level 4. OC-12 is an optical carrier network line with transmission data rate of up to 622.08 Mbit/s.	SONET
		LR_DSR_OC48_STM16	Indicates the layer rate supported on the channelized OC-48 line with STM level 16. OC-48 is an optical carrier network line with transmission data rate of up to 2.4Gbps.	SONET
		LR_DSR_OC192_STM64	Indicates the layer rate supported on the channelized OC-192 line with STM level 64. A channelized OC-192 line with STM level 64. OC-192 is an optical carrier network line with transmission data rate of up to 9.6Gbps.	SONET

Fields	Descriptions	Values	Descriptions	Applicable Controller Modes
Mode	Identifies the type of channelization, such as Synchronous Transport Signal of level n (STS-n), for high-order and low-order paths.	High- Order Path values: STS3C, STS12C, STS48C, STS192C, T3, UNFRAMED, VT15, VT12, CT3, and CT3_E1. Low Order Path values: VT15, VT2, T1, and E1.	• STS-n: Mode with Synchronous Transport Signal (STS) channelization of level n. • T1, E1, T3, and E3: Indicates the channelization mode used on the controller. T1 or E1 circuit has a transmission data rate of up to 1.544 Mbit/s. The T3 or E3 circuit has a transmission data rate of up to 44.736 Mbit/s. • VT 1.5: Indicates that the controller is a virtual tributary network line with transmission data rate of up to 1.728 Mbit/s. • VT 2: Indicates that the controller is a virtual tributary network line with transmission data rate of up to 2.304 Mbit/s. • Unframed: indicates that a single CEM channel is used for all T1/E1 timeslots.	HOP and LOP.
Clock Source	Identifies the source of the clock signal sent on SONET ports.	Line	Controller will clock its sent data using the clock recovered from the line's receive data stream.	All
		Internal	The transmit clock is taken from line card and can be derived either from an internal physical line.	All
		Free-Running	The transmit clock is taken from line card and can be derived from an internal free running oscillator.	All
		Recovered	In-band pseudowire-based activeclock recovery on a CEM interface which is used to drive the transmit clock.	SONET, HOP, and LOP.
		Enhanced	-	SONET, HOP, and LOP.

Fields	Descriptions	Values	Descriptions	Applicable Controller Modes
Framing	Framing mode used for the CEM channel.	CRC and NO_CRC.	CRC: represents the faming type with cyclic redundancy check.	SONET
		Unframed, DSX1_ESF, DSX1_SF, Auto Detect, C_BIT, and M23.	• Unframed: indicates that a single CEM channel is used for all timeslots. • DSX1_SF: indicates that the DS1 type of interface has the framing type as super frame. SF uses 12 frames per super frame for in-band signaling extraction. • DSX1_ESF: indicates that DS1 type of interface has the framing type as extended super frame. ESF uses 24 frames per ESF.	PDH, HOP, and LOP.
Loopback	Specifies the loopback value associated with the CEM interface.	Local, Network Line, Remote, Remote Line, Network Payload, and Unknown.	For a detailed explanation about the different loopback values, refer the latest IOS Command References.	All
		Diag, Local Payload, Remote ESF Payload, Remote ESF Line, Remote ESF Line CSU, Remote ESF Line NIU, Remote Iboc, Remote Iboc CSU, Remote Iboc FAC1, Remote Iboc, and FAC2.	—	PDH
Protection Role	Identifies the priority based on which the recovered clock must be obtained.	Primary	The recovered clock is obtained from a clock with the highest priority.	SONET
		Secondary	The recovered clock is obtained from a clock with a lower priority than the primary clock.	SONET
Protection Group Number	Identifies the group number associated with the clock for the CEM interface.			SONET
Protection Loopback Name	Identifies the loopback group number associated with the clock for the CEM interface.			SONET

Fields	Descriptions	Values	Descriptions	Applicable Controller Modes
Protection Loopback IP	Identifies the IP address of the loopback interface associated with the CEM interface.			SONET
Protection Revertive Time	Identifies the backup revertive time settings associated with the clock for the CEM interface.			SONET
Operational Status	Operational status of the CEM interface. This field cannot be edited.	Up, Down, and Not-Applicable.	• Down— the interface is down. • Not-Applicable— the interface has an unknown operational status. • Up— the interface is up.	SONET, HOP, and LOP.
Admin Status	Administrative status of the CEM interface.	Up, Down, and Not-Applicable.	• Up— the CEM interface is administratively up. • Down— the CEM interface is administratively down. • Not-Applicable— the administrative status is unknown.	SONET, HOP, and LOP.
Recovered Clock ID	Unique identifier for the clock settings associated with the CEM interface. To configure the Recovered Clock ID, see Configure Clocking for CEM.			PDH, HOP, and LOP.

Configure Alarm Profiles on Ports, Cards, and Nodes of Devices

The Alarm Profiles feature allows you to change default alarm severities by creating unique alarm profiles for different interfaces of the device. An Alarm Profile applied to one node on the network cannot be applied to other nodes using Cisco EPN Manager . When you create Alarm Profiles, they are first stored on the node before they can be applied to the node, card, or port (using the Alarm Behavior menu). The Alarm Behavior menu displays the alarm profiles saved on the selected device.

In the Node view, the Alarm Behavior tab displays the alarm profiles for the node. Alarms form a hierarchy. A node-level alarm profile applies to all cards in the node, except those that have their own profiles. A card-level alarm profile applies to all ports on the card, except those that have their own profiles. At the node level, apply profile changes on a card-by-card basis or set a profile for the entire node. At the card level, apply profile

changes on a port-by-port (module) basis or set the profiles for all ports on that card simultaneously (using the Port Profiles tab).

Note If an Alarm Profile is applied to a node, it cannot be applied to the cards and ports associate with the same node. And if it is applied to the card, it cannot be applied to the ports associate with the same card.

To create alarm profiles and associate them with interfaces:

Step 1 Choose **Configuration > Network Devices.**

Step 2 Select the device that you want to configure by clicking the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the left side **Logical View** tab.

Step 4 Create new alarm profiles with severity parameters:

a) Choose **Alarm** > **Alarm Profile**.

b) To add a new alarm profile, click the '+' button.

c) Specify a unique name for the alarm profile and click **Save**.
The name cannot contain special characters or the words ‘Default’ and ‘SupressAlarm’.

d) To associate alarm severity parameters to the alarm profile created in the step above:

1. Locate the alarm profile from the Alarm Profiles list, by clicking the Alarm Name hyperlink.
2. Click the **Profile Details** tab.
3. Click the '+' icon to add a new set of severity parameters, and to edit existing severity parameters, click the appropriate Condition hyperlink and then click the Edit icon at the top right corner of the page .

e) Specify the following severity parameters:

Note You can associate only a single alarm profile to a given interface. However, the same alarm profile may be associated with multiple interfaces.

Table 7:

Fields	Applicable Values	Descriptions
Alarm Type	-	The type of alarm for which the specified conditions must be met. Select one of these options: • HW_Optics • HW_Ehternet • HW_GFP • HW_G709 • HW_SONET • HW_SDH_Controller

Fields	Applicable Values	Descriptions
Service Affecting Severity Non Service Affecting Severity	Critical	The alarm is a critical, traffic-affecting alarm.
	Major	The alarm is a major alarm.
	Minor	The alarm is a minor alarm.
	Not Alarmed	A raise or clear of the condition is sent to clients as a nonalarmed TL1 message (REPT EVT). The message has no severity and no service affecting flag.
	Not Reported	A raise or clear of the condition is not sent to clients, but is tracked on the NE.
	Default	Indicates the default device severity value.
Condition	-	The type of condition that must be considered for the Alarm Type selected above.

At this stage the profile is created and pushed to the device. For alarm profiles to be activated, you need to apply this alarm profile to the required nodes/cards/ports as explained in the steps below.

Step 5 Apply the alarm profile to the device:

a) Choose **Alarm** > **Alarm Behavior**.

b) Click the '+' sign to configure the alarm behavior parameters.

Note Before you apply an alarm profile to an interface, ensure that the interface has not inherited the same alarm profile from its parent. This could cause the application of the alarm profile to fail.

c) Depending on the type of interface that you want to apply the alarm profile to, click on the **Node Profiles**, **Card Profiles**, or **Port Profiles** tabs.

d) Depending on the interface that you want to apply the alarm profile to, click on the appropriate Alarm Profile Name hyperlink and then click the Edit icon at the top right corner of the page.

e) Use the **Alarm Profile Name** drop-down menu to choose the alarm profile that must be applied to this interface.

f) Use the **Suppress Alarm** checkbox to specify whether or not the alarms for a particular card/node/port must be suppressed. If checked, all generated alarms are suppressed.

g) Click **Save** to deploy your changes to the device. The profile you created is now applied to the specified ports/cards/nodes.
Once an alarm profile has been applied to an interface, the alarm profile cannot be deleted from Cisco EPN Manager. To delete the alarm profile you need to ensure that its association with the interfaces has been removed.

h) (Optional) Navigate to **Monitor > Monitoring Tools > Alarms and Events** to access the Alarms Table that shows all alarms for all devices, for a specific device group, or for a specific device. You may need to wait until the devices sync before you can view the generated alarms.

Synchronize the Clock Using Sync-E, BITS, and PTP

Synchronous Ethernet (Sync-E):

Using Cisco EPN Manager , you can enable frequency synchronization to provide high-quality bit clocks synchronization over Ethernet interfaces. Synchronous Ethernet (Sync-E) provides this required synchronization at the physical level.

To do this you need to configure Sync-E that helps routers identify the clock in the network with the highest priority. This clock is also called the Master Clock. All the other devices (members) on the network reset their clocks based on the master clock's settings. Messages are constantly exchanged between the master clock and its members to ensure efficient continued synchronization of all clocks in the network. Cisco EPN Manager enables you to specify this master clock and also set the Sync-E parameters at the global and interface levels. Once the Sync-E properties have been configured, you can view the logical hierarchy and topology between the devices on the network topology overlay.

Note Sync-E configuration is supported only on Ethernet interfaces.

Building Integrated Timing Supply (BITS):

BITS is the method by which clocking information is provided by a Building Integrated Timing Supply (BITS) port clock. In Sync-E, Ethernet links are synchronized by timing their bit clocks from high-quality, stratum-1-traceable clock signals in the same manner as SONET/SDH. Operations messages like SSM and ESMC maintain Sync-E links and ensure that a node always derives its timing from the most reliable source.

Precision Time Protocol (PTP):

In networks that employ TDM, periodic synchronization of device clocks is required to ensure that the receiving device knows which channel is the right channel for accurate reassembly of the data stream. The Precision Time Protocol (PTP) standard:

- Specifies a clock synchronization protocol that enables this synchronization.
- Applies to distributed systems that consist of one or more nodes communicating over a network.

PTP uses the concept of master and slave devices to achieve precise clock synchronization. With the help of Cisco EPN Manager , you can use PTP to configure the master device which periodically starts a message exchange with the slave devices. After noting the times at which the messages are sent and received, each slave device calculates the difference between its system time and the system time of the master device. The slave device then adjusts its clock so that it is synchronized with the master device. When the master device initiates the next message exchange, the slave device again calculates the difference and adjusts its clock. This repetitive synchronization ensures that device clocks are coordinated and that data stream reassembly is accurate. The PTP clock port commands are used to modify PTP on individual interfaces. Once the PTP properties have been configured, you can view the logical hierarchy and topology between the devices on the network topology overlay.

Note Due to the limitations on the device, you can configure a maximum of 4 clock sources on interface modules, with a maximum of 2 per interface module. This limitation applies to both Sync-E and TDM interfaces.

To configure Sync-E, BITS, and PTP:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's name hyperlink.

Step 3 Set the global Sync-E properties.

a) Click the **Configuration** tab, then click the **Logical View** left side tab.
b) Click **Clock > Sync-E**. All available Sync-E global settings are listed.
c) To create a new set of global Sync-E properties, click the '+' icon. You can create only one set of Sync-E global parameters.
d) Specify the global parameters for Sync-E. For a detailed description about these parameters, see table below.
e) Click **Save**.
Your changes are saved and the global Sync-E configuration is deployed to the device. You can now specify the interfaces that you want to associate with this configuration.

Step 4 Specify the associated interfaces and interface specific Sync-E parameters.

a) Select the Sync-E global configuration created in the above steps from **Clock > Sync-E**.
b) Click the **Interface Input Source** tab.
c) Click '+' to specify the required interfaces.
You can configure only one interface per synchronization type.
d) Use the **Interface Name** drop-down menu to select the required interface.
e) Specify the interface level Sync-E parameters. For a detailed description about these parameters, see table below.
f) Click **Save**.

Step 5 Specify the frequency settings for BITS:

a) Click the **Configuration** tab, then click the **Logical View** left side tab.
b) Click **Clock > BITS-Frequency**.
c) Specify the following BITS values:
   - Source slot: Your options are RO and R1.
   - Priority: Enter a numeric value within the range 1 to 250.
   - Clock Type: Your options are E1 and T1.
d) Click **Save**.
e) Specify the BITS clock settings for the interface:
   1. Navigate to **Clock > BITS-Frequency** and select the BITS Frequency settings created in the above step.
   2. Click the **Bits Clock Settings** tab and specify the clock settings as described in the table below.
   3. Click **Save**.

Step 6 Specify the interface settings for BITS:

a) Click the **Configuration** tab, then click the **Logical View** left side tab.
b) Click **Clock > BITS-Interface**.
c) Specify the following BITSs values:
   - Source slot: The values are RO and R1.

- Priority: Numeric value within the range 1 to 250.
- Clock Type: The values are 2.048MHz and 10MHz.

d) Click **Save**.

Your changes are saved and the selected interfaces are associated with the Sync-E parameters. To verify your changes view the Sync-E and BITS parameters under **Configuration** tab > **Clock** for the selected device.

Step 7 Specify the PTP clock settings:

a) Click the **Configuration** tab, then click the **Logical View** left side tab.
b) Click **Clock > PTP**.
c) Click '+' to specify a new set of PTP values, or click the Clock Mode hyperlink and then click the Edit icon at the top right corner of the page.
d) Specify the following common PTP parameters and click **Save**.

- **Clock Mode**: Choose the mode of PTP operation. Your options are **Ordinary**, **Boundary**, and **E2E Transparent**. E2E stands for End-to-end transparent clock mode.
- **Domain No**: Enter the number of the domains used for PTP traffic. A single network can contain multiple domains. Range is from 1 to 127.
- **Hybrid Clock**: Enable or disable hybrid cloud.

e) Click the Clock Mode hyperlink and click the **Port** tab to specify the port details that must be associated with the common properties.
f) Specify the following Port details and click **Save**.

- **Port Name**: Enter the name of the PTP port clock.
- **Port Mode**: Choose the PTP role of the clock, Master or Slave.
- **Loopback Interface Number**: Enter the clock identifier derived from the device interface.
- **Announce Timeout**: Enter the number of PTP announcement intervals before the session times out. Range is 1 to 10.
- **Delay Request Interval**: Choose the time when the interface is in PTP master mode and the selected interval is specified to member devices for delay request messages. The intervals use base 2 values.
- **Sync Interval**: Choose the time interval for sending PTP synchronization messages.
- **Announce Interval**: Choose the time interval for sending PTP announcement packets.

g) Click the Port Name hyperlink and click the **Clock Source** tab.
h) Click '+' to add a new interface, or click the source address hyperlink and click Edit at the top right corner of the page.
i) Specify the **Source Address** and the **Priority** for the clock.

- **No Priority**- Assigns the priority value as 0.
- **Priority 1**- Checks the first value for clock selection. The clock with the lowest priority takes precedence and the value 1 is assigned.
- **Priority 2**- If two or more clocks have the same value in the Priority 1 field, the value in this field is used for clock selection. This assigns the priority value of 2.

j) Click **Save** to deploy your changes to the device.

For detailed descriptions about all Sync-E global and interface level parameters, see the table below:

Fields	Descriptions
Clock > Sync-E Properties (Global)	
Synchronous Type	Indicates the type of method used for synchronization of the clocks. The values are: Automatic, Forced, Manual, and Cisco. Note- You can configure only one interface per synchronization type.
Clock Type	Indicates the Ethernet Equipment Clock (EEC) option to be used: Option 1- represents EEC-Option I of the European time zone. Option 2- represents EEC-Option II of the American time zone.
QL Mode Enabled	Indicates whether the clock is to be used with the Quality Level (QL) function: Enabled or Disabled.
ESMC Enabled	Indicates the status of the Ethernet Synchronization Message Channel (ESMC): Enabled or Disabled.
SSM Option	Indicates the Synchronization Status Message (SSM) option being used: Option 1- represents ITU-T Option I Option 2- GEN1- represents ITU-T Option II Generation 1 Option 2- GEN2- represents ITU-T Option II Generation 2
Hold Off Time (global level)	Indicates the length of time (in milliseconds) for a device to wait before issuing a protection response to a failure event. A valid range is between 300 and 1800 milliseconds.
Wait To Restore Time (global level)	Indicates the length of time (in seconds) to wait after a failure is fixed before the span returns to its original state. A valid range is between 0 and 86400 seconds.
Revert Enabled	Specifies whether the network clock is to use Revertive mode: Enabled or Disabled.
Sync-E > Interface Input Source (Interface Level) Properties	

Fields	Descriptions
Interface Name	Name and hyperlink of the Gigabit or 10 Gigabit interface associated with Sync-E.
Priority	Indicates the value used for selecting a Sync-E interface for clocking if more than one interface is configured. Values are from 1 to 250, with 1 being the highest priority. The highest priority clock represents the master clock.
Hold Off Time (interface level)	Indicates the length of time (in milliseconds) to wait after a clock source goes down before removing the source. A valid range is a value between 300 and 1800 milliseconds.
Wait To Restore Time (interface level)	Indicates the length of time (in seconds) to wait after a failure is fixed before the interface returns to its original state. A valid range is a value between 0 and 86400 seconds.
Clock > BITS-Frequency and BITS-Interface Properties	
Source Slot	Indicates whether the clock source is R0 or R1.
Priority	Indicates the value used for selecting a BITS interface for clocking if more than one interface is configured. Values are from 1 to 250, with 1 being the highest priority. The highest priority clock represents the master clock.
Clock Type	Indicates whether the clock type that must be used is from an E1 line or a T1 line. In case of the Bits Interface parameters, the clock type indicates the frequency values that must be associated with the clock. The options are 2.048MHz and 10MHz.
Bits Framing	Framing values (such as CAS) that must be associated with the BITS configuration.
Impedance	The impedance value that is associated with the clock in OHMS format. The default value is 120 ohms.
Line code	Line encoding method for the DS1 link: • For E1, the options are Alternate Mark Inversion (AMI) and high-density bipolar of order 3 (HDB3). • For T1, the options are AMI and bipolar with 8 zero substitution (B8ZS).

What to Do Next

(Optional) You can view the Sync-E and PTP device properties on the network topology overlay. See Show Clock Synchronization Networks on a Network Topology Map:

- **Sync-E overlay**: shows the topology and hierarchy of the Sync-E network. It shows the primary clock and the primary and secondary clock inputs for each device.
- **PTP overlay**: shows the clock synchronization tree topology, the hierarchy of the Precision Time Protocol, and the clock role of each device in the tree (master, boundary, slave, or transparent).

Configure IP SLAs (TWAMP Responder)

The IETF Two-Way Active Measurement Protocol (TWAMP) defines a standard for measuring round-trip IP performance between any two devices that support the TWAMP protocols. The TWAMP-Control protocol is used to set up performance measurement sessions. It is used to send and receive performance-measurement probes. TWAMP enables complete IP performance measurement and provides a flexible choice of solutions as it supports all devices deployed in a network.

When you configure TWAMP using Cisco EPN Manager , the device you select is configured as a TWAMP server and you enter the TWAMP server configuration mode. It then uses the port value that you specify to configure the port to be used by the TWAMP server that listens for connection and control requests. The Inactivity Value that you specify will be configured as the inactivity timer (in seconds) for a TWAMP control session.

Note When you configure IP SLA using Cisco EPN Manager , the IP SLA responder is automatically configured on the device. You do not have to use the command *ip sla responder twamp* to pre-configure the IP SLA responder.

To configure interfaces for TWAMP:

Before You Begin

A TWAMP control-client and the session-sender must be pre-configured in your network before you can configure TWAMP responder using Cisco EPN Manager .

For IP SLAs TWAMP Responder v1.0, ensure that the TWAMP server and the session-reflector are configured on the same Cisco device.

Step 1 Choose **Configuration > Network Devices.**

Step 2 Select the device that you want to configure by clicking the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **IP SLA > TWAMP Responder** to add or edit the TWAMP Responder configuration.

Step 5 Click the '+' icon to add the TWAMP parameters to the selected device. To edit existing parameters, click the Port Name hyperlink and click the Edit icon at the top right corner of the page. You can only add one set of TWAMP parameters per device.

Step 6 Make your modifications to the following parameters. All parameters are mandatory.

- **Port**- Use a numeric value between 1 and 65535 to specify the port that must be configured for the TWAMP server to listen for connection and control requests. The default value is 862.
- **Inactivity Timeout**- Use a numeric value between 1 and 604800 to specify the time that must be configured as the inactivity time (in seconds) for a TWAMP responder test session. The default value is 900 seconds.
- **Server Inactivity Timeout**- Use a numeric value between 1 and 6000 to specify the time that must be configured as the TWAMP server inactivity time (in seconds) for a TWAMP control session. The default value is 900 seconds.

Step 7 Click **Save** to deploy your changes to the device.
If the deploy fails, ensure that the device's Inventory Collection status is 'Completed'. You also need to ensure that the pre-requisites mentioned above are met.

Configure Interfaces

Using Cisco EPN Manager , you can configure your CE and Optical Interfaces using the following configuration options:

Before you configure the interfaces, ensure that the device's Inventory Collection status is 'Completed'.

Configure Ethernet Interfaces and Subinterfaces

The Configuration tab on the Device Details page lists the current interface configurations on the device. Depending on your device configuration and user account privileges, you can create, edit, delete, enable, and disable these interfaces.

Step 1 Choose **Configuration > Network Devices.**

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Interfaces > Ethernet**.

Step 5 To add an Ethernet subinterface:

a) Choose an Ethernet interface and click **Add Subinterface**.

Note This button is enabled depending on the device that you select. For example, on Cisco ASR903 devices, this button is disabled.

a) In the Basic Configuration area, at a minimum, enter the **Interface Number** (if not already populated) and optionally provide a description for the subinterface.

b) In the **VLAN Number** field, enter a numerical value that can be used to represent the VLAN ID for this subinterface. Note that only the 802.1Q type of encapsulation is supported.

c) To use the same VLAN number as the native VLAN ID, enable the **Native VLAN** checkbox.

d) In the **Dataplane Loopback** drop-down menu, select the value that must be set as the loopback value. Your options are: **Blank** (makes no change in the configuration), **None** (removes the Ethernet loopback from the interface), **Internal**, and **External**. The value that is already configured on the device is highlighted in the bold font.

e) If you are creating an IPv4 subinterface, in the IPv4 Interface area, select an **IP Type**. Your options are:

- None
- Static IP, with the IP address and subnet mask.
- DHCP IP, with the pool name.

- DHCP Negotiated, with the hostname and client ID (None, Interface, Port Channel).

You can also enter a secondary IP address with mask.

f) If you are adding an IPv6 subinterface, in the IPv6 Address area, select a type from the **Add** drop-down list. Your options are: Global, Unnumbered, Link Local, Auto Configuration, and DHCP.

- Global, with the IP address and subnet mask, and type (General, EUI-64, Anycast, CGA).
- Unnumbered, and enter text in the Interface Unnumbered To text box.
- Link Local, auto-configured or manually-configured (requires IPv6 address).
- Autoconfiguration.
- DHCP (with option to enable two-message exchange for address allocation).

If you choose to edit an existing interface or subinterface, you are allowed to only change all values except the Interface Number value.

g) Click **Save** to add the sub-interface to the selected interface of the device.

Step 6 To enable, disable, or delete interfaces and subinterfaces, select the interfaces and click the appropriate buttons. The Delete Subinterface button may only be enabled on some supported devices, such as, Cisco ASR903 devices.

Step 7 Click **Save** to deploy your changes to the device.

Configure Loopback Interfaces

You can change the loopback state of an interface to test how your optical network is performing. Before changing the loopback setting, ensure that the device is either in Managed state or ideally in Complete state.

To change the loopback settings on an interface:

Step 1 Choose **Configuration > Network Devices.**

Step 2 Select the device that you want to configure by clicking the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Interfaces > Loopback**.

Step 5 To specify a new loopback interface, click **Add**.

a) In the Basic Configuration tab, specify the **Loopback Interface Number** (if not pre-populated).

b) If you are creating an IPv4 loopback interface, specify an **IP Type**:

- None.
- Static: along with the IP address and subnet mask of the static IP address.
- DHCP IP: along with the DHCP pool name.

You can also enter a secondary IP address with its mask so that it can be used as the backup loopback interface.

c) If you are adding an IPv6 loopback interface, in the IPv6 Address area, select a type from the Add drop-down list. Your options are:

- Global- which also requires you to specify the IP address, subnet mask, and type (General, EUI-64, Anycast, CGA).
- Unnumbered- which requires you to enter text in the Interface Unnumbered To text box.
- Link Local- which is either auto-configured or manually-configured and only applies to requires IPv6 address.
- Autoconfiguration
- DHCP- which also allows you to set the option to enable two-message exchange for automatic address allocation.

Step 6 To edit an existing loopback interface, select the interface and click the **Edit** button to change only the speed, duplex, and other settings. The Interface Number cannot be edited.

Step 7 To enable the above loopback settings on the interfaces, select the required loopback process and click **Enable**.

Step 8 Click **Save** to deploy these configuration changes on the device.

Configure Tunnel Interfaces

The Configuration tab in the Device Details page lists the current interface configurations on the device. Depending on your device configuration and user account privileges, you can create, edit, delete, enable, and disable these interfaces.

Step 1 Choose **Configuration > Network Devices.**

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Interfaces > Tunnel**.

Step 5 To create a new tunnel interface, click **Add**.

a) In the Basic Configuration area:

- At a minimum, enter the Interface Number (if not already populated) and select a mode from the Tunnel Mode drop-down list.
- (Optional) Enter a description, MTU (in bytes), bandwidth (in Kbps), Keepalive (in seconds) and number of keepalive retries. To avoid fragmentation, check the check box under MTU.

b) If you are creating an IPv4 tunnel interface, select an IP Type:

- Static, with the IP address and subnet mask
- DHCP IP, with the pool name

You can also enter a secondary IP address with mask.

c) If you are adding an IPv6 tunnel interface, in the IPv6 Address area, select a type from the Add drop-down list: Global, Unnumbered, Link Local, Auto Configuration, or DHCP.

- Global, with the IP address and subnet mask, and type (General, EUI-64, Anycast, CGA)
- Unnumbered, and enter text in the Interface Unnumbered To text box
- Link Local, auto-configured or manually-configured (requires IPv6 address)
- Autoconfiguration
- DHCP (with option to enable two-message exchange for address allocation)

d) Optionally configure the tunnel source in the Advanced Configuration area by choosing Interface or IP address (with tunnel source interface, tunnel destination, and IPSec Profile).

Step 6 To edit an existing tunnel interface, you can change the speed, duplex setting, and other parameters listed in the previous step except the Interface Number parameter.

Step 7 To enable, disable, or delete a tunnel interface, select the interfaces and click the appropriate buttons.

Step 8 Click **Save**.

Configure SwitchPort Interfaces

The Configuration tab in the Device Details page lists the current interface configurations on the device. Depending on your device configuration and user account privileges, you can create, edit, delete, enable, and disable these interfaces.

Step 1 Choose **Configuration > Network Devices.**

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Interfaces > SwitchPort**.

Step 5 To edit an interface, select the interface and click **Edit**.

- Choose and Administrative Mode: Static, Trunk 802.1Q, or Routed.
- Enable or disable the port fast setting, and adjust the speed and duplex, if needed.

Step 6 Click **Save**.

Configure Virtual Template Interfaces

The Configuration tab in the Device Details page lists the current interface configurations on the device. Depending on your device configuration and user account privileges, you can create, edit, delete, enable, and disable these interfaces.

Step 1 Choose **Configuration > Network Devices.**

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Interfaces > Virtual Template**.

Step 5 To create a new virtual template interface, click **Add**.

a) In the Basic Configuration area, at a minimum, enter the Interface Number (if not already populated), Type. Type can be Serial (with PPP, Slip, or FrameRelay encapsulation), Ethernet, or Tunnel (with tunnel mode).

b) If you are creating an IPv4 virtual template interface, select an IP Type:

- Static, with the IP address and subnet mask
- DHCP IP, with the pool name

You can also enter a secondary IP address with mask.

c) If you are adding an IPv6 virtual template interface, in the IPv6 Address area, select a type from the Add drop-down list: Global, Unnumbered, Link Local, Auto Configuration, or DHCP.

- Global, with the IP address and subnet mask, and type (General, EUI-64, Anycast, CGA)
- Unnumbered, and enter text in the Interface Unnumbered To text box
- Link Local, auto-configured or manually-configured (requires IPv6 address)
- Autoconfiguration
- DHCP (with option to enable two-message exchange for address allocation)

d) Optionally perform the advanced configurations:

- For Serial, the advanced configuration depends on the encapsulation type. For example, for Frame Relay, enter the LMI type (cisco, ansi, autosense, or q933a), and DLI. You can optionally choose to IETF encapsulation when connecting to non-Cisco routers.) For PPP, enter the authentication type (CHAP, PAP, both, with credentials).
- Unnumbered, and enter text in the Interface Unnumbered To text box
- Link Local, auto-configured or manually-configured (requires IPv6 address)
- Autoconfiguration

e) Specify the tunnel source in the Advanced Configuration area by choosing Interface or IP address (with tunnel source interface, tunnel destination, and IPSec Profile).

Step 6 To edit an existing tunnel interface, you can change the speed, duplex setting, and other parameters listed in the previous step except the Interface Number parameter.

Step 7 To enable, disable, or delete a tunnel interface, select the interfaces and click the appropriate buttons.

Step 8 Click **Save**.

Configure VLAN Interfaces

The Configuration tab in the Device Details page lists the current interface configurations on the device. Depending on your device configuration and user account privileges, you can create, edit, delete, enable, and disable these interfaces.

Step 1 Choose **Configuration > Network Devices.**

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Interfaces > Vlan**.

Step 5 To add a VLAN interface, click **Add**.

a) In the Basic Configuration area, at a minimum, enter the Interface Number (if not already populated). You can also enter a description, MTU (in bytes), and bandwidth (in Kbps).

b) If you are creating an IPv4 VLAN interface, select an IP Type:

- Static, with the IP address and subnet mask
- DHCP IP, with the pool name

You can also enter a secondary IP address with mask.

c) If you are adding an IPv6 VLAN interface, in the IPv6 Address area, select a type from the Add drop-down list: Global, Unnumbered, Link Local, Auto Configuration, or DHCP.

- Global, with the IP address and subnet mask, and type (General, EUI-64, Anycast, CGA)
- Unnumbered, and enter text in the Interface Unnumbered To text box
- Link Local, auto-configured or manually-configured (requires IPv6 address)
- Autoconfiguration
- DHCP (with option to enable two-message exchange for address allocation)

Step 6 Click **Save**.

Configure Optical Interfaces

Using EPN Manager you can configure your optical interfaces to change their admin settings, enable standard FEC modes on them, modify their payload settings, and change their loopback settings. To do this, use the Configuration tab in the Device Details page which lists the current interface configurations on the device. Depending on your device configuration and user account privileges, you can create, edit, delete, enable, and disable these interfaces.

You can configure optical interfaces in the following ways:

Change the Loopback Settings on an Optical Interface

You can change the loopback state of an interface to test how your optical network is performing. Before changing the loopback setting, ensure that the device is either in Managed state or ideally in Complete state. The interface that you want to modify must be in Maintenance (OOS, MT) admin state. EPN Manager allows you to edit the loopback settings only on SONET, SDH, Ethernet, FC/FICON, and OTN interface types.

To change the loopback settings on an interface:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Choose **Optical Interfaces** > **Maintenance** > **Loopback**.

The interfaces of the selected device are displayed along with their loopback settings. Interfaces that are not supported, for example, Data Storage, OTS, or Video, are not displayed.

Step 5 To edit the loopback settings, select the interface name (hyperlink) and click **Edit** to make your changes. Ensure that the device is in Managed or Complete state and the interface is in Maintenance (OOS, MT) admin state.

a) Internal—this applies the same configuration applied in Terminal loopback.

b) Line—this applies the same configuration applied in Facility loopback.

c) No_Loopback—Select this option to set no loopback values on the interface.

Before you change the loopback state ensure that you first clear the current loopback setting using the No_loopback option from the drop-down menu and then re-apply the setting of your choice.

Step 6 Click **Save** to save your edits.
A pop-up notification notifies you about the status of your changes.

Note If the Edit task fails, check if the device is in Managed or Completed state and ensure that Cisco EPN Manager is in sync with the device configuration. If not, resync the device with Cisco EPN Manager . See, Collect a Device's Inventory Now (Sync), on page 3.

Continuous Verification of the Connection Status

Using the Connection Verification feature, you can view the power levels of optical interfaces and verify the interfaces for connectivity and insertion loss. Verifying the connectivity indicates whether the cable is in a connected state and verifying the insertion loss indicates whether the cable loss is within an expected value. The parameters for insertion losses are collected for every possible optical path inside the network element in order to predict possible failures.

Using Cisco EPN Manager you can view the Connection Verification parameters and opt to enable or disable Connection Verification on interfaces. You can also set the acknowledgment values for associated alarms.

To verify the connection status for your optical interfaces:

Step 1 Choose **Configuration > Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 To enable or disable the Connection Verification feature and set the common threshold vales, click **Optical Interfaces > Provisioning > Connection Verification**.

Step 5 Click the Edit icon at the top right corner of the page to edit common parameters.

Step 6 Enter the following threshold parameters for the selected device and click **Save**:

- Connection Verification Enabled- Set to True or False to enable or disable this feature on the selected device.
- Fail IL Threshold (dB)- Enter a numerical value ranging from 0 to 20. When this threshold value is exceeded, an alarm is generated.
- Degree IL Threshold (dB)- Enter a value lesser than the failed IL threshold value.

Step 7 Click **Optical Interfaces > Maintenance > Connection Verification Entry**.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 8 Click the A Side hyperlink to view the following values of the connection:

- A Side- Displays the originating slot for connection verification.
- Z Side- Displays the destination slot for connection verification.
- Last Refresh- Displays the date and time when the connection verification and insertion loss verification was run previously.
- Connectivity Last Change- Displays the date and time when the connectivity information was previously changed.
- Connectivity Verification- Displays the status of connectivity:
  - Connected- Cable or patch cord is connected.
  - Disconnected- Cable or patch cord is disconnected.
  - Disabled- Cable or patch cord is excluded from connection verification.
  - Not Measurable- Power source not detected; cable or patch cord cannot be tested for connection verification.
  - Not Verified- Cable or patch cord is yet to be tested for connection verification.
- Excess Insertion Loss (dB)- Display the excess insertion loss that is higher than the set threshold.
- Insertion Loss Last Change- Displays the date and time when the insertion loss verification information was previously changed.
- Display names for- A and Z Side, A and Z Side Modules- identification names of the connection for A and Z Side, and A and Z Side Modules.

Step 9 In the **Connection Verification Action** drop-down menu, choose an action that must be taken when the configured threshold values are reached, and click **Save**. Your options are: **Verify loss and connectivity**, **Disable verification**, and **Acknowledge loss alarm**.

Step 10 (Optional) Select one of the following values to specify how alarms must be generated with respect to the Connection Verification parameters:

- **Acknowledge Loss Alarm** - allows the interfaces to operate beyond the Fail IL Threshold thresholds without raising an alarm. If the Fil IL Threshold further increases, alarms are raised again.
- **Clear Acknowledge** - indicates that the Fail IL Threshold thresholds are set to default and alarms are re-evaluated. If thresholds are exceeded, an alarm is raised.

Configure PRBS on ODU Controllers

Pseudo Random Binary Sequence (PRBS) is a testing mechanism used to ensure that the selected overhead bytes can be used to transport the header and trailer data safely. Both the transmitting node and receiving node must be aware that PRBS testing is taking place. To do this you can use Cisco EPN Manager to enable

appropriate PRBS modes on the nodes. Cisco EPN Manager allows you to configure PRBS only on the non-channelized ODU controllers of an optical device.

PRBS also enables trunk ports to generate the PRBS_31 pattern and detect PRBS_11, PRBS_23, and PRBS_31 patterns.

Step 1 Choose **Configuration > Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Choose **Optical Interfaces > Maintenance > PRBS Configuration**. All ODU controllers and their current PRBS parameters are displayed. If the controllers are not listed, ensure that the above stated pre-requisites are met.

Step 5 To configure PRBS, click the controller's name hyperlink and click the Edit icon at the top right corner of the page.

Step 6 Make your modifications to the following parameters.

a) In the **Admin State** drop-down list, select a valid admin state for the ODU controller. Your options are **00S-MT** (maintenance), **OOS-DSBLD** (disabled), and **IS** (inservice).
The PRBS parameters can be edited only if you set the Admin State to 00S-MT (maintenance) state.

To edit only the admin state of the controller, set the PRBS mode to Disabled, and choose the admin state of your choice.

b) Select the PRBS Test value as **Enabled** or **Disabled**.

c) Select the PRBS mode for the controller. When you set one controller with the values in column one (see below), ensure that the second controller (node 2) is set with the corresponding values shown in the second column of this table:

Controller 1 Mode (Node 1)	Controller 2 Mode (Node 2)
Source	Sink
Sink	Source
Source-Sink	Loopback
Loopback	Source-Sink

d) From the **Pattern** drop-down list, select one of the following PRBS patterns. This pattern will be either generated or detected by the line cards:

- NONE
- PN11
- PN23
- PN31
- INVERTEDPN11
- INVERTEDPN31

Step 7 Click **Save** to deploy the updated configuration to the device.

Step 8 (Optional) To verify, view updated PRBS parameters in the **Configuration** tab for the selected controller, under **Optical Interfaces > Provisioning > PRBS**. To run a PRBS test on ODU UNI circuits, see, Run PRBS Test on Circuits (ODU UNI).

Enable and Disable OSC

Using Cisco EPN Manager, you enable or disable the Optical Service Channel (OSC) terminations on the interfaces of optical devices. OSC can be configured on OC3 lines, and on FastEthernet (FSTE) and GigabitEthernet (GigE) interfaces of the following cards:

- Transmission Network Control System (TNCS)
- Transport Node Controller - Enhanced (TNCE)
- Transport Node Controller (TNC)

For ONS15454 NEs, the supported interfaces are OC3 interfaces of the following cards:

- Optical Service Channel Modem (OSCM)
- Optical Service Channel and Combiner/Separator Module (OSC-CSM)

To configure OSC on optical devices:

Step 1 Choose **Configuration > Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Choose **Optical Interfaces > Comm Channels**.
All configurable G709 enabled interfaces of the selected device are displayed.

Step 5 Click the **OSC** tab.

Step 6 Choose the communication channel that that you want to configure by clicking the communication channel's name hyperlink.
The communication channel name and current OSC setting is displayed.

Step 7 Click the Edit icon at the top right of the page.

Step 8 Use the **OSC** checkbox to enable or disable OSC on the selected communication channel.

Step 9 Click **Save**.
Your changes are saved and the updated configuration is deployed to the device. To verify, view the OSC settings for the selected communication channel under **Optical Interfaces > Provisioning > Comm Channels**.

View and Acknowledge Unverified Alarms

Based on the alarm generated on your devices, you can view the details of the alarm in Unverified status and then mark them Acknowledged so that they no longer appear as unread alarm notifications on the device. To do this:

Step 1 Choose **Configuration > Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Choose **Optical Interfaces** > **Maintenance** > **Unverified Alarms** to view the alarms with the Unverified status.

Step 5 Once you have reviewed the alarms and taken the required action, select the alarms and click the **Acknowledge** button to mark these alarms Verified directly on the device.

Provision Optical Interfaces

You can use Cisco EPN Manager to enable the following configuration options on your optical devices.

Note The following configuration options are enabled or disabled depending on the device you select. To check whether your device supports these options, see Supported Devices for Cisco EPN Manager.

- **Ethernet MTU**
  Using Cisco EPN Manager you can configure the MTU values on the Ethernet interfaces of your optical devices. The MTU is the Maximum Transmission Size, in bytes, of a packet passing through the interface. You can use Cisco EPN Manager to modify the MTU values on all Ethernet interfaces except Gigabit Ethernet and Fast Ethernet interfaces on TNC and ECU modules.

  To verify that your new Ethernet MTU values are configured on the device, navigate to your device's Device Details page and click the Ethernet Interface tab.

- **GMPLS**
  Using Generalized Multi-Protocol Label Switching (GMPLS), you can define and view the fiber and alien wavelength parameters that are used during GMPLS circuit creation. It ranges the packet based data on the MPLS protocol to allow the creation and maintenance of channels across the networks. It supports non-packet switching devices. This means that GMPLS extends the packet based MPLS protocol to allow creation and maintenance of tunnels across networks that consist of non-packet switching devices. GMPLS tunnels can traverse Time-Division Multiplex (TDM) interfaces and switching types.

  To configure GMPLS, you can use the Configuration tab in Cisco EPN Manager which allows you to configure GMPLS on all LMP enabled optical controllers. The enabling of LMP which is a pre-requisite for GMPLS configuration can also be done using the same Configuration tab.

Note You cannot disable GMPLs on LMP enabled controllers that are part of active optical circuits.

- **Packet Termination**
  Using Cisco EPN Manager you can set up packet termination on the ODU controllers of your optical devices. To do this, ensure that packet termination is pre-configured on the device for Ethernet packets. You can then edit the configuration that is already created on the device and discovered by Cisco EPN Manager .

  To configure packet termination, you must specify both the Termination Mode and Mapping Mode values.

- **LMP**
  The Link Management Protocol (LMP) helps in managing channels and links that are required between nodes for routing, signaling, and link management. LMP is also used to manage the Traffic Engineering (TE) link. It allows multiple data links into a single Traffic Engineering (TE) link that runs between a pair of nodes.

  To create an LMP neighbor using Cisco EPN Manager , you need to specify the neighbor's name, link ID, router ID, and interface ID, and the common link and interface IDs. You can add only one LMP link per controller on your optical device.

  While the LMP configuration can be successfully deployed to a single device using Cisco EPN Manager , for LMP to function effectively, you need to configure it on both sets of devices that are participating in the link. This ensures that the LMP link is activated.

  Limitations:

  - Although LMP is supported on Cisco NCS 40XX and Cisco NCS 20XX devices individually, LMP links cannot be created between Cisco NCS 20XX and Cisco CRS devices.
  - You cannot edit the Numbering value of an LMP link after it has been created. To edit the Numbering value, delete the LMP link and recreate it with the new Numbering value.
  - You cannot have duplicate Neighbor Router IDs between two LMP neighbors.
  - When you add an LMP link, ensure that the controller is not already associated with another LMP link. This will cause your deploy to fail.

- **OTN Topology**

  You can use the Configuration tab to add or modify the topology instance and Area ID associated with an optical OTN controller. If the controller does not have a pre-configured Topology Instance and Area ID, Cisco EPN Manager automatically sets the topology instance to OTN and the Area ID to 0.

  Cisco EPN Manager does not allow you to use the same topology instance and Area ID that is already pre-configured on other controllers. To know the Topology Instance and Area ID that is pre-configured on the device, go to **Maps > Network Topology**.

- **NNI**

  You can configure your optical interfaces to act as network-node interfaces (NNIs). An NNI indicates that the interface connects to other network nodes. Cisco EPN Manager allows you to configure NNIs on the OTU controllers of your optical device. These interfaces can further be configured to act as source and destination ports.

If a device is not part of a topology, configuring its NNI controller creates an OTN topology instance for that controller with an Area ID 0.

You can create only one NNI configuration per controller for every controller present on the device.

Note: You cannot delete NNI controllers that are pre-configured with a Topology Instance.

- **Breakout**

  Enabling breakout on your optical devices utilizes the multilane architecture of the optics and cables to enable you to split single higher density ports into multiple higher density ports. For example, a 100G port can be configured to operate as ten different 10G ports. Or a single 40G port can act as four different 10G ports. To configure breakout using Cisco EPN Manager , see the table below.

  Pre-requisite:

  Ensure that Breakout is pre-configured on the interface by changing the interface's Port Mode value to Breakout. See Change the Payload and Breakout Settings, on page 50. This changes all other port mode parameters of that interface to 'None' enabling breakout on the port, thus allowing you to configure lanes. You can add up to ten lanes per interface.

  Limitations:

  - All lanes that belong to a particular interface must have the same mapping type.
  - OTU2 and OTU2e controllers are supported only if they are in the packet termination mode.
  - In Cisco NCS 5.2.4x devices, breakout lanes can only be created when the port modes are of type Ethernet.
  - 10G clients that are mapped to OPU2e framing type are not supported.
  - Breakout cannot be configured on SONET and SDH controllers.

  Example configuration:

  If you select a controller optics 0/0/0/0 and enable Breakout with GFPF as its mapping mode and with a framing value of OPU2, then the configuration pushed to the device is:

  ```
  controller optics 0/0/0/0 breakout-mode 1 ethernet framing opu2 mapping gFpF
  ```

- **Performance Monitoring**

  Performance Monitoring (PM) helps you gather performance counters for system maintenance and troubleshooting. You can retrieve both current and historical PM counters at regular intervals. You can enable and disable performance monitoring on OTU and ODU controllers of an optical device.

  To configure performance monitoring at the TCM controller level, you must configure OTN interfaces and their associated TCM performance counters, see:

  - Reference—Performance Counters for OTN-FEC Interfaces
  - Reference—Performance Counters for OTN-ODU Interfaces
  - Reference—Performance Counters for OTN-OTU Interfaces

- **Channelize ODU (LO) Controllers:**

  Associate your ODU controllers with multiple lower order ODU sub-controllers and configure tributary port number (TPN) and tributary slots (TS) for those ODU sub-controllers. A valid range of TPN is from 1 to 80. If a TS string is separated using a colon (:), this indicates individual tributary slot. If a TS string is separated using an en-dash (-), this indicates a range of tributary slots.

When you select the ODU level for the sub-controllers, ensure that the sub-controller's ODU level is lower than that of the main controller you are associating it with. For example, if you are associating sub-controllers with an ODU controller of ODU3 level, then the sub-controllers cab be of levels ODU2, ODU1, or ODU1.

- **Configuring OTDR Settings:**
  Using this feature, you can configure OTDR scans to begin automatically on a fiber span that has been repaired or on the startup of an OSC channel. A fiber is considered to be repaired when the LOS on the fiber is cleared. If you set the Enable Absolute Threshold value to True, the 'OTDR-LOSS-THR-EXCEEDED' alarm is raised when the insertion loss measured for the OTDR scan is greater than the Absolute Event Loss Threshold (dB) value configured. The alarm is also raised when the total back reflection for the OTDR scan is less than the Total Back Reflection (dB) value that you specify.

  If the Absolute Pass Fail Criteria is disabled, the Loss and Back Reflection values from the baseline scan in the previous release are considered as threshold values. The alarm raised for this scenario is the same as in the previous scenario (OTDR-LOSS-THR-EXCEEDED alarm).

  You can configure the Event Loss Threshold value within which the total span loss on the fiber is permitted. If the measured span loss on the fiber is greater than the Event Loss Threshold value, then the OTDR scan is triggered on the fiber.

- **Configure Automatic Laser Shutdown (ALS):**
  Automatic Laser Shutdown (ALS) is a technique used to automatically shut down the output power of the transmitter in case of issues such as a fiber break. This is a safety feature that prevents dangerous levers of laser light from leaking out of a broken fiber, provided ALS is provisioned on both ends of the fiber pair. Once an interface has been shut down, you can configure the action the action that must be taken to restart the interface by setting the ALS mode to:

  - **Disabled mode—**If mode is disabled, ALS is disabled. Loss Of Signal (LOS) will not cause laser shutdown.
  - **Manual restart mode—**The laser is turned off when the ALS agent detects an LOS for 500 ms. After ALS is engaged, a manual command is issued that turns on the laser for the time period of the pulse width. The laser is turned on when the LOS has been cleared for 100 ms.
  - **Automatic restart mode—**The laser is shut down for the time period of pulse spacing when the ALS agent detects a LOS for 500 ms. Then, the laser automatically turns on for the time period of the selected pulse width. If an LOS still exists at that time, the laser is shut down again. This pattern continues until the LOS is cleared for 100 ms; then, the laser will stay on.

  Cisco EPN Manager enables you to set the ALS mode, the ALS recovery interval (in seconds), and the recovery pulse width (in seconds). If the ALS Mode for the interface has been set to Manual Restart, you need to manually restart the interface. To do this, navigate to the device's Device Details page, choose **Optical > Automatic Laser Shutdown**, locate the interface set to the Manual Restart ALS mode, and click the **Restart** button.

- **Using the SNTP Server to Set the Date and Time:**
  Simple Network Time Protocol (SNTP) is an internet protocol used to synchronize the clocks of computers to a time reference. Using the SNTP server ensures that all NEs use the same date and time reference. The server synchronizes the node's time after power outages or software upgrades.

  To use the SNTP server to set the date and time you must first specify the current time along with the time zone value and then set the primary and backup servers that can be used as a point of reference for the date and time. Before you set the timezone values, ensure that the SNTP server values are not

configured. When you delete an SNTP server, ensure that you first delete the Backup server and only then the Primary server. You cannot delete only the Primary server.

- **Configuring the Wavelength:**
  Cisco EPN Manager enables you to provision the wavelength frequency for your optics controllers. You can view the current wavelengths configured on the optics controllers and then depending on the type of card selected, you can change the wavelength frequency.

  You can configure the wavelengths on an optics controller only when it is configured as a DWDM optics port. To confirm this, navigate to the device's Device Details page, choose **Interfaces > Optical Interfaces**, and check if the Optics Type column for the interface is either **DWDM** or **Grey**.

Table- Provisioning Optical Interfaces

To configure your optical devices with the above features:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Navigate to the required configuration menu as described in the table below, and specify the required values.

Table 8: Table- Configuring Optical Interfaces

Task	Supported Interfaces/Controllers	Navigation	Notes
Configuring Ethernet MTU	All Ethernet interfaces except Gigabit/Fast Ethernet interfaces on TNC and ECU modules.	Optical Interfaces > Provisioning > Ethernet MTU	-
Configuring GMPLS	LMP enabled optical controllers.	Optical Interfaces > Provisioning > GMPLS	-
Configuring Packet Termination	ODU controllers pre-configured with Packet Termination.	Optical Interfaces > Provisioning > OTN > Packet Termination	Applicable only to Ethernet packets.
Configuring an LMP Neighbor	All optical controllers.	Optical Interfaces > Provisioning > LMP	Neighbor Router ID cannot be duplicated between neighbors
Configuring OTN Topology	All optical OTN controllers.	Optical Interfaces > Provisioning > OTN > Topology	-
Configuring NNI	All OTU controllers.	Optical Interfaces > Provisioning > OTN > NNI	-

Configuring Breakout	All optical controllers with Port Mode values set to 'Breakout'.	Optical Interfaces > Provisioning > Port Mode > Breakout tab	-
Configure Performance Monitoring	All OTU and ODU controllers.	Optical Interfaces > Provisioning > Performance Monitoring	-
Channelize ODU (LO) Controllers	All ODU controllers.	Optical Interfaces > Provisioning > ODU Channelization > Sub-Controllers tab	-
Configuring OTDR Auto Scan	-	Optical Interfaces > Provisioning > OTDR Auto Scan	-
Configuring ALS	All ALS supported interfaces	Optical Interfaces > Provisioning > Automatic Laser Shutdown	-
Setting the Date and Time using SNTP	-	• To specify the primary and backup servers for SNTP: Choose Optical Interfaces > Provisioning > NTP Settings • To specify the current time and time zone that can be used by SNTP: Choose Optical Interfaces > Provisioning > Time Zone Settings	-
Configure Wavelength	All optics controllers	Optical Interfaces > Provisioning > Wavelength	-
Configure TCM and TTI	-	See Configure TCM and TTI, on page 48	-
Configure Protection Profiles	-	See Configure Protection Profiles, on page 47	-

Configure the Payload and Breakout Settings	-	See Change the Payload and Breakout Settings, on page 50	-
Configure the Admin Status	-	See Change the Admin Status of an Optical Interface, on page 46	-
Configure FEC Mode	-	See Enable the Standard FEC Mode on an OTN Interface, on page 51	-
Enabling and Disabling GCC	-	See, Enable and Disable GCC Connections, on page 52	-
Configure Squelch Mode	-	See, Configure Squelch Mode, on page 53	-

Change the Admin Status of an Optical Interface

Cisco EPN Manager enables you to change the admin state of an interface to enhance the performance testing abilities for your optical network. The Admin Status of an interface defines whether the interface is being managed by Cisco EPN Manager , whether it is down, or whether it is in maintenance mode. When the admin status of an interface is down, it indicates that the interface is in an unreachable state, or that the device is not supported by Cisco EPN Manager . Changing the admin status to Up enables Cisco EPN Manager to manage the interface and thus provide better monitoring capabilities. To change the admin state on an interface:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Choose **Optical Interfaces** > **Provisioning** > **Admin Status**.
The interfaces of the selected device are displayed along with their Admin State settings. Interfaces on which you cannot modify the admin state, for example, PCHAN and PLINE interfaces are not displayed.

Step 5 Click either the **Optical Controllers** or **Ethernet Controllers** tab to edit the required controllers.

Step 6 To edit the admin status, select the interface by clicking the interface's Name hyperlink, and then click the **Edit** icon at the top right corner of the page. Ensure that the device's inventory collection status is in Managed or Completed state. Choose one of the following values:

a) **Down—**implies that the interface will be administratively down.
b) **Up—**implies that the interface will be administratively up.
c) **Testing—** implies that the interface is in Maintenance state and that the administrator is performing tests using it.

Step 7 Click **Save** to save to deploy your changes to the device.
A pop-up notification notifies you about the status of your changes. To see an example of the admin status being changed on a Cisco NCS2K device, see Example: Change the Admin Status for Cisco NCS 2006 Interface, on page 53.

Note If the Edit task fails, check if the device is in Managed or Completed state and ensure that Cisco EPN Manager is in sync with the device configuration. If not, re-sync the device with Cisco EPN Manager as described in Collect a Device's Inventory Now (Sync), on page 3.

Configure Protection Profiles

Using Cisco EPN Manager , you can provision different protection profiles (or groups) for your optical devices. This ensures availability and improved reliability for these devices. Protection profiles define whether Automatic Protection Switching (APS) must be enabled on the cards and they also set the direction for traffic flow in case of failures. The cards on the device can either be set to support unidirectional regeneration of configuration or can be set to ensure that both transmit and receive channels will switch when a failure occurs on one.

Step 1 Choose **Configuration** > **Network Devices**.
Step 2 Click the device hyperlink to launch its Device Details page.
Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.
Step 4 Choose **Optical Interfaces** > **Provisioning** > **Protection Profile**.
Step 5 To add a protection profile, click the + symbol.
Step 6 Provide a unique name for the protection profile. The name is a mandatory field and should not contain space or exceed 32 characters.
Step 7 Select the required type for the protection profile. Your options are:

- **One plus one BDIR APS**- Enables one plus one Automatic Protection Switching (APS) and configures the card to be bidirectional.
- **One plus one UNIDIR APS**- Enables one plus one APS and configures the card to be unidirectional.
- **One plus one UNIDIR NO APS**- Enables one plus one with no APS and configures the card to be unidirectional.
- **One plus one PLUS R BIDIR APS** - Enables one plus one plus R APS and configures the card to be bidirectional.

Note
- BDIR (bidirectional) indicates that both transmit and the receive channels will switch if a failure occurs on one.
- UNIDIR (unidirectional) indicates that the card supports unidirectional regeneration of configuration. Hence the ports can only be used as the link source if they are transmit ports and as the link destination if they are receive ports.

Step 8 Select the protection mode for the profile as **Revertive** or **Non-Revertive**. Revertive mode ensures that the node returns traffic towards the working port post a failure condition after the amount of time specified as the Wait to Restore Time (step 9).

Step 9 Select the sub network connection mode as **SNC_N** (default), **SNC_I**, or **SNC_S**.

Step 10 When you select the sub network connection mode as **SNC_S**, you can then select TCM-ID value from the TCM drop-down list. By default, TCM-4 is selected once you select SNC_S as Sub Network Connection mode. You can change the TCM-ID column value from TCM4 to TCM1-TCM6 for SNC_S.

Note For SNC_I and SNC_N, you are not allowed to change the TCM-ID value. It should be set to **None**.

Step 11 Enter a value for the Wait to Restore Time in seconds using a number between 0 and 720. For any value greater than 0, ensure that the value is greater than 300 and in intervals of 30 seconds. The wait to restore time defines the time the system must wait to restore a circuit. If you have selected the protection mode as Revertive, then the default wait to restore time is 300, else it is 0.

Step 12 Enter a value for the **Hold Off Time** in milliseconds. This value defines the time the system waits before switching to the alternate path. The valid range is from 100 to 10000 seconds. Default value is 0.

Step 13 Click **Save** to deploy the updated changes to your device.

Step 14 (Optional) To verify, view the updated protection profile parameters in the **Configuration** tab for the selected controller, under **Optical Interfaces > Provisioning > Protection Profile**.

Configure TCM and TTI

Using Cisco EPN Manager you can configure Tandem Connection Monitoring (TCM) and Trail Trace Identifiers (TTI) on ODU controllers of ODU Tunnel circuits. This helps you enable and disable performance monitoring capabilities on these controllers.

You can further monitor your device's capabilities by configuring the threshold for signal failure and signal degrading in the TCM connections of these ODU controllers. You can also modify the source and destination access point identifiers. To do this, ensure that the following pre-requisites are met.

Before You Begin

- Ensure that the device's inventory collection status is 'Completed'.
- Ensure that the controllers are configured for Loopback. If not, change the controllers loopback settings under **Optical Interfaces** > **Maintenance** > **Loopback**. See Configure Loopback Interfaces, on page 30.

Note For the endpoints of an ODU UNI circuit, TCM is supported only on OTUx-ODUx controllers.

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.

For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Choose **Optical Interfaces** > **Provisioning** > **TCM Configuration**.

Step 5 To view or edit the TCM parameters of any of the listed controllers, click the TCM ID hyperlink of that controller.

Step 6 To edit these parameters, click the Edit icon at the top right corner of the page.

Step 7 Make your changes to the following TCM parameters:

Editable TCM Parameters	Descriptions
State	Configures the state of TCM properties on the device as enabled or disabled.
Signal Failure Threshold	Configures the threshold value for signal failures on ODUk controllers. The values are E6, E7, E8, and E9.
Sent API	Configures the source access point identifier of the TTI. Enter a value of up to 14 bytes in length.
Sent DAPI	Configures the destination access point identifier of the TTI. Enter a value of up to 14 bytes in length.
Sent Operator Specific String Type	Configures the type of the operator specific string of the TTI as hexadecimal or ASCII type.
Sent Operator Specific String	Configures the operator specific string of the TTI. Enter a value of up to 32 characters in length.
Performance Monitor	Enables or disables performance monitoring on an ODUk controller.
Signal Degrade Threshold	Configures the signal degrade threshold value. The values are: E6, E7, E8, and E9.
Expected SAPI	Configures the current source access point identifier of the TTI. Enter a value of up to 14 bytes in length.
Expected DAPI	Configures the current destination access point identifier of the TTI. Enter a value of up to 14 bytes in length.
Expected Operator Specific String Type	Configures the type of the operator specific string of the TTI as hexadecimal or ASCII type.

Editable TCM Parameters	Descriptions
Expected Operator Specific String	Configures the operator specific string of the TTI. Enter a value of up to 32 characters in length.

Step 8 Click **Save** to deploy the updated configuration to the device.

Step 9 (Optional) To verify, view the selected device's TCM parameters in the Configuration tab, under **Optical Interfaces** > **Provisioning** > **TCM Configuration.**

Step 10 (Optional) You can view these updated TCM and TTI parameters in the Device Details and Port 360 view of the selected device. See View Device Details and View a Specific Device's Interfaces: Device 360 View.

Step 11 (Optional) The TCM parameters are also represented on the network topology overlay. To view these parameters, navigate to **Maps** > **Network Topology** and select an optical circuit with these associated TCM parameters.

Change the Payload and Breakout Settings

Using the Device Configuration tab, you can view and modify the type of the payload for packets on SONET and SDH interfaces and enable breakout on them. Before changing the payload setting, ensure that the device is in sync with Cisco EPN Manager . Enabling breakout on your optical devices utilizes the multilane architecture of the optics and cables to enable you to split single higher density ports into multiple higher density ports. For example, a 100G port can be configured to operate as ten different 10G ports. Or a single 40G port can act as four different 10G ports.

To change the payload and breakout setting on an interface:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Choose **Optical Interfaces** > **Provisioning**.

Step 5 Depending on the type of device that you have selected, choose **Payload Type** or **Port Mode**

Step 6 Click the name (hyperlink) of the interface that you want to modify.
Common properties of the interface such as its name and its payload type are displayed.

Step 7 Click the name (hyperlink) of the OTN interface that you want to modify and click the Edit icon.

Step 8 Make your changes to the Port Mode, Framing, Mapping Type, Rate, and Bit Rate values. Ensure that these values do not exceed the card's bandwidth limitations.

Step 9 To associate breakout lanes for Ethernet and OTN packets on this interface, click the **Breakout** tab. This tab is only displayed if the device has breakout pre-configured.

a) Click the '+' icon to add a new lane. You can add up to 10 lanes per controller. To modify existing lanes, click the Lane hyperlink.

b) Specify the breakout parameters such as the lane number, the port mode and mapping type for the breakout lane, the owning port number, and the framing value.

Step 10 Click **Save** to deploy your changes to the device.
A pop-up notification notifies you about the status of your changes.

Note If the Edit task fails, check if the interface is in Managed state and ensure that Cisco EPN Manager is in sync with the device's configuration. If not, resync the device with Cisco EPN Manager . See Save Your Device Changes, on page 3. You also need to ensure that the payload does not exceed the card's bandwidth limitation.

Enable the Standard FEC Mode on an OTN Interface

The FEC Mode defines an OTN circuit's forward error correction (FEC) mechanism. The forward error correction (FEC) mechanism provides performance gains for improved margins and extended optical reach. To change the FEC Mode setting to Standard, you need to use the Device Configuration tab.

Before changing the FEC mode setting, ensure that the admin state of the interface you are trying to modify is in Down (out of service) state with G709 configuration enabled. To enable G709 configuration, use the TL1 session from CTC or use the TL1 terminal directly.

To change the FEC mode on an interface:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Choose **Optical Interfaces** > **Provisioning**.

Step 5 Change the admin state of OTN interfaces for which FEC needs to be modified to Down. See Change the Admin Status of an Optical Interface, on page 46.

Step 6 Depending on your device type, choose one of the following and select the interface you want to modify:

- **OTNLines** > **OTNFEC**
- **OTN** > **FEC**

All configurable G709 enabled interfaces of the selected device are displayed.

Step 7 Select the interface you want to edit, and click the Edit icon at the top right of the window.

Step 8 Make your changes to the FEC Mode and SDBER value. Your options are:

a) **FEC Mode**:

- **Standard—** Enables the standard FEC mode on the interface.
- **None—**Enabled by default. When selected, no FEC Mode setting is enabled on the interface.

b) (Cisco NCS 2000 devices only) **SDBER**: Signal Degrade Bit Error Rate (SDBER) condition indicates that a signal degrade alarm will occur for line degradation based on the threshold value that you set. The default value is 1E7 and the options range from 1E7 to 1E9.

Step 9 Click **Save** to save your edits.
A pop-up notification notifies you about the status of your changes.

Note If the Edit task fails, check if the interface is in Managed or Completed state and ensure that Cisco EPN Manager is in sync with the device's configuration. You also need to ensure that G709 configuration is enabled on the device. You can enable G709 configuration by using the TL1 session from CTC or by directly through the TL1 terminal. To change the admin state of the interface see, Change the Admin Status of an Optical Interface, on page 46.

Enable and Disable GCC Connections

Cisco EPN Manager supports the provisioning of Generic Communication Channel (GCC) connection on the interfaces of optical devices. GCC can be configured on trunk ports of TXP or MXP cards and on OTN, OTU, and ODU controllers. The GCC configuration can be modified irrespective of the FEC modes and admin statuses configured on the interfaces.

To configure GCC on optical devices:

Step 1 Choose **Configuration > Network Devices**. All Cisco EPN Manager devices are displayed.
Step 2 Select the optical device that you want to configure by clicking the device name hyperlink.
Step 3 Click the **Configuration** tab and choose **Optical Interfaces** > **Provisioning**.
Step 4 Depending on your device type, choose one of the following:

- **Comm Channels > GCC**
- **OTN > GCC**

All configurable G709 enabled interfaces of the selected device are displayed.

Step 5 Click the **OTU Controllers** or **ODU Controllers** tab based on the type of controller that you want to edit.
Step 6 To edit the GCC configuration of any of the listed controllers, click the controller's name hyperlink.
Step 7 Click the Edit icon at the top right of the page.
Step 8 Use the **GCC** check box to enable or disable GCC on the selected controller. The value configured on ODU controllers is GCC1 and that on OTU controllers is GCC0.
Step 9 Click **Save**. Your changes are saved and the updated configuration is deployed to the device.
To verify, view the GCC parameters for the selected controller under **Optical Interfaces > Provisioning.**

Configure Squelch Mode

Using Cisco EPN Manager, you can configure different squelch modes on the interfaces of optical devices. Squelch modes help shut down the far-end laser in response to certain defects. Squelch modes can be configured on OCH, OTN, SONET or SDH, FC or FICON, Ethernet, Video, and Data Storage interfaces of optical devices.

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab.
For Cisco NCS 2000 and Cisco ONS devices, this choice is under the Logical View tab that is at the top of the Device Details page.

Step 4 Choose **Optical Interfaces** > **Provisioning** > **Squelch Mode**.

Step 5 Choose the interface that that you want to configure by clicking the interface's name hyperlink.
The interface's name and current squelch mode setting are displayed.

Step 6 Click the Edit icon at the top right corner of the page.

Step 7 Select the required squelch mode for the interface. Your options are:

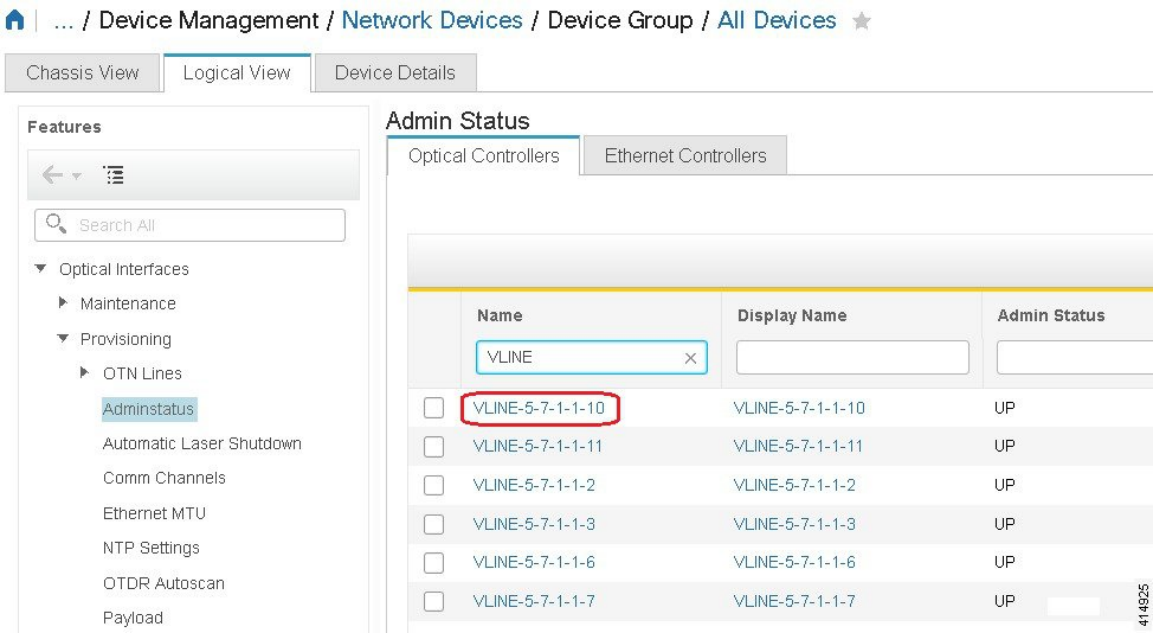
- **DISABLE**- Squelch is disabled.
- **AIS-** Alarm Indication Signal (AIS) is enabled.
- **NONE**- Transparent mode is enabled.
- **SQUELCH**- Squelch is enabled.
- **ODU_AIS**
- **G_AIS**- Generis AIS is enabled.
- **NOS**- Squelch is disabled in FC payloads.
- **LF**

Step 8 Click **Save**.
Your changes are saved and the updated configuration is deployed to the device. To verify, view the squelch mode parameters of the selected interface under **Optical Interfaces > Squelch Mode**.

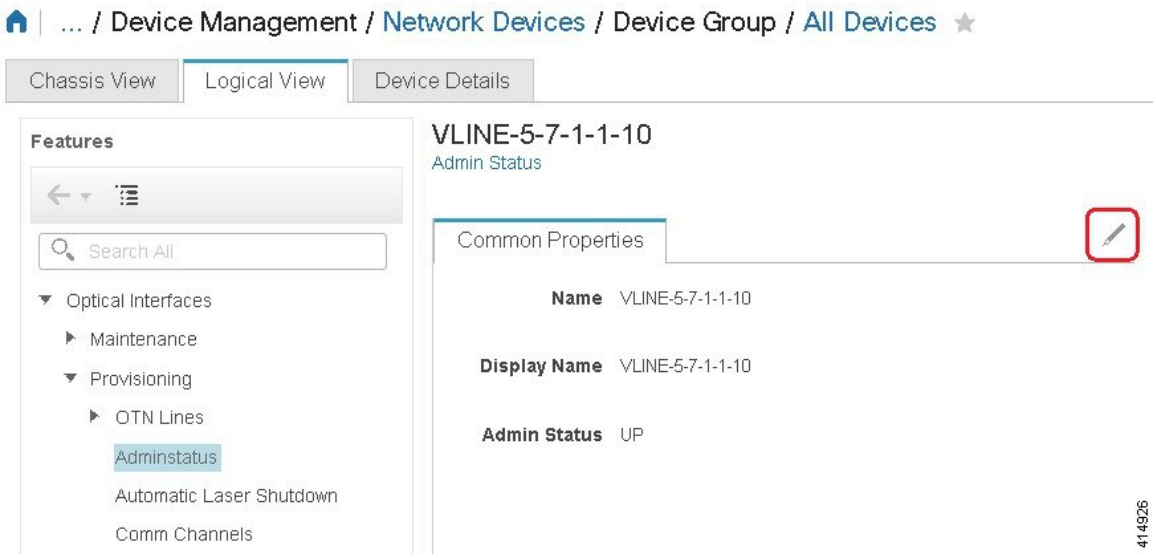
Example: Change the Admin Status for Cisco NCS 2006 Interface

This example illustrates how to change the admin status for a Cisco NCS 2006 VLINE interface. In this example, the configuration change is launched from the Device Details page, but under the **Logical View** tab. (For other devices, configuration changes are performed under the **Configuration** tab.)

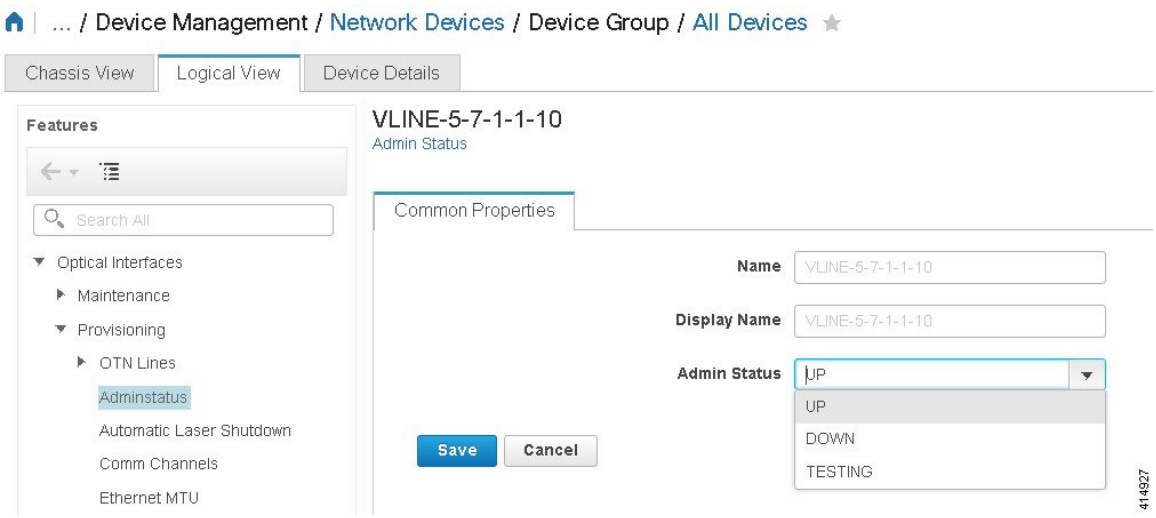
Step 1 On the Device Details page under the Logical View tab, click the hyperlink for the interface you want to edit.



Step 2 In the interface's Common Properties window, click the Edit icon at the top right corner of the window.



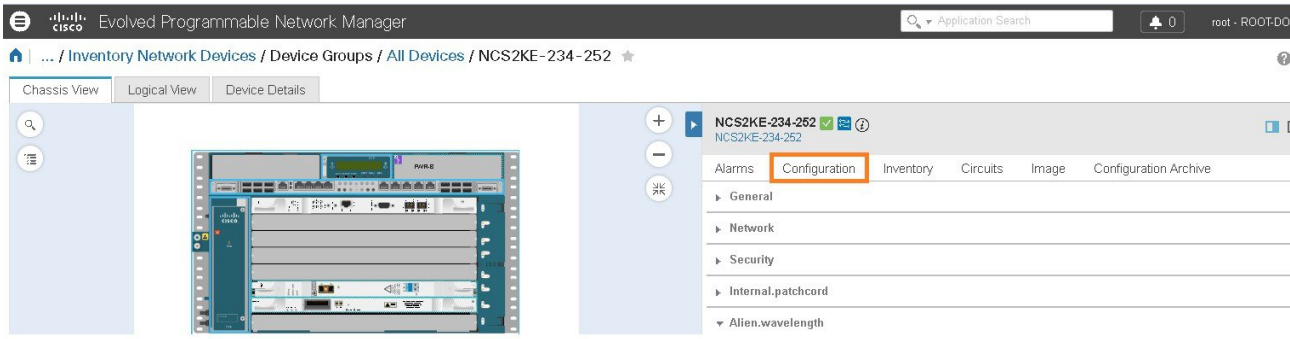
Step 3 Choose a new setting from the **Admin Status** drop-down list, then click **Save**.



Configure Devices Using the Chassis View

You can configure devices and cards from the devices' Chassis View. This can only be done from the **Configuration** sub-tab in the Chassis View. The sub-tabs are displayed depending on the type of device you select in the **Network Devices** page.

Note This feature is available only for Cisco NCS 2000 and Cisco ONS devices.



Step 1 From the left sidebar, choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's name hyperlink. The Chassis View tab for the device appears.

Step 3 In the right pane, click the **Configuration** sub-tab.

Step 4 Expand the **General** area, and then enter the details of the device such as the node name, node alias, and select the location where you want to provision the device.

Step 5 Set up the synchronization time for the device to synchronize with its associated controllers. You can either use the NTP/SNTP server time or set up a manual date and time for synchronization.

Step 6 Check the **Enable Manual Cooling** check box to manually change the cooling profile of the device. The cooling profile allows you to control the speed of the fans in the device's shelf.

Step 7 Click **Apply**. The changes in the settings are updated in the CTC.

Step 8 Expand the **Network** area, select the network setting you want to modify, and then click the edit icon at the top left of the **Network** area. The **Edit Network General Settings** window appears.

Step 9 Modify the required settings, and then click **Apply**.

Note You cannot modify the Node Address, Net/SubnetMask Length, Mask, and MAC Address of the device.

Step 10 Configure security settings for a device. See Create and Manage Users and User Logins for a Device, on page 57.

Step 11 Configure the origination (TX) and termination (RX) patchcords for a device. See Configure Patchcords for a Device, on page 57.

Step 12 Configure the alien wavelength for a device. See Create Alien Wavelength for a Device, on page 59.

Create and Manage Users and User Logins for a Device

Use this procedure to create users and assign roles to manage a device. You can also view the list of users who are accessing the device at a time.

Step 1 From the left sidebar, choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's name hyperlink. The Chassis View tab for the device appears.

Step 3 In the right pane, click the **Configuration** sub-tab, and then expand the **Security** area.

Step 4 In the **Users** tab, click the + icon to add a user.

Step 5 Enter the user name.

Step 6 From the **Security Level** drop-down list, choose one of the following options:

- Retriever—Users with this security level can view and retrieve information from the device, but cannot modify the configuration.
- Maintenance—Users with this security level can retrieve information from the device and perform limited maintenance operations such as card resets, Manual/Force/Lockout on cross-connects or in protection groups, and BLSR maintenance.
- Provisioning—Users with this security level can perform all maintenance operations and provisioning actions except those that are restricted to super users.
- Super User—Users with this security level can perform all provisioning user actions, plus creating and deleting user security profiles, setting basic system parameters such as time, date, node name, and IP address, and doing database backup and restoration.

Step 7 Enter your password, and then click **Save**. The user is added to the Users table.

You can select a user to edit or delete the user. However, you cannot edit the user name. Moreover, you cannot delete a user who has added the device to Cisco EPN Manager .

In the Security area, click the **ActiveLogins** tab to view the list of users who have logged in to the device using CTC, TL1 session, or Cisco EPN Manager . You can choose to logout a user or multiple users when the maximum login sessions for a device is reached.

Configure Patchcords for a Device

The client card trunk ports and the DWDM filter ports can be located in different nodes or in the same single-shelf or multi-shelf node. A virtual link is required between the client card trunk ports and the DWDM filter ports. The internal patchcords provide virtual links between the two sides of a DWDM shelf, either in single-shelf or multishelf node. The patchcords are bidirectional, however, each direction is managed as a separate patchcord.

This feature is only supported on Cisco NCS 2000 and Cisco ONS devices.

This procedure explains how to configure internal patchcords using the Chassis View using ANS (automatic node setup) for WDMs (wavelength division multiplexing). You can use the Chassis View to create and delete these internal patchcords. To configure origination (TX) and termination (RX) patchcords for a device:

Step 1 From the left sidebar, choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's name hyperlink. The Chassis View tab for the device appears.

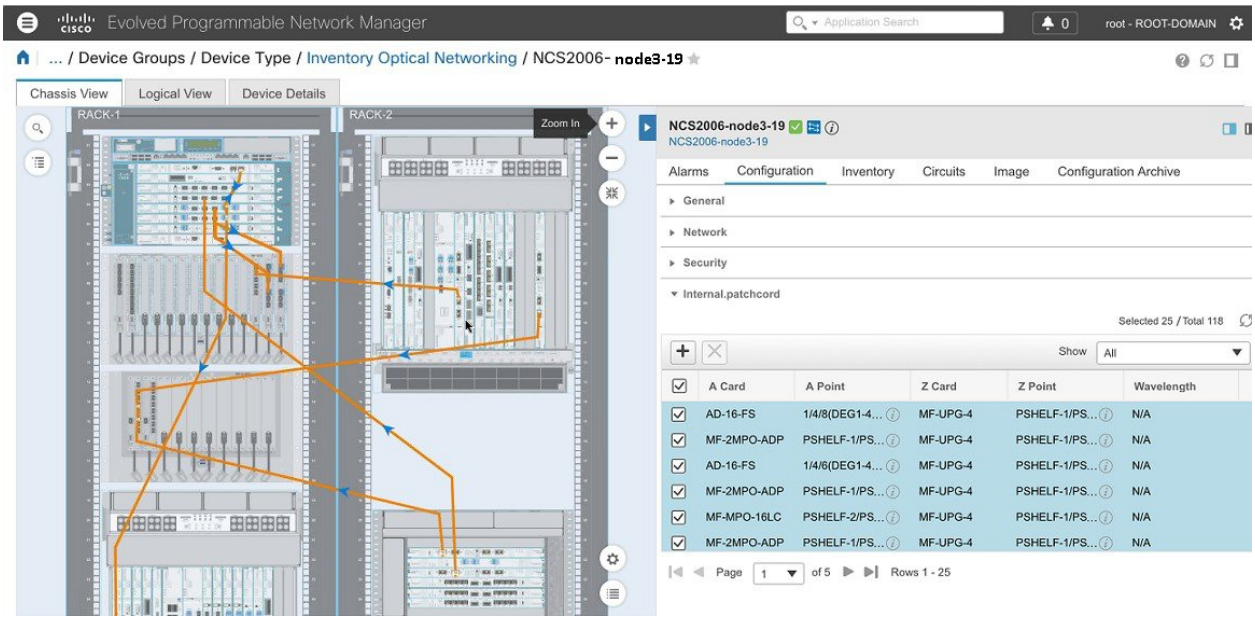
Step 3 In the right pane, click the **Configuration** sub-tab, and then expand the **Internal.patchcord** area.

Step 4 Click the + icon, and then choose the required origination (TX) and termination (RX) patchcords for the device.

Step 5 Click **Finish**. The patchcords are added to the Internal Patchcords table.

Note Once you have created the patchcord, you cannot modify it. However, you can delete it.

You can select a patchcord or multiple patchcords in the Internal Patchcords table to view the direction of the patchcords in the Chassis View of the device, which is displayed in the left pane (as shown in the figure below).



Create Alien Wavelength for a Device

Use the alien wavelength to connect a transponder from Cisco to a third-party DWDM interface. To configure the alien wavelength for a device:

Step 1 From the left sidebar, choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's name hyperlink. The Chassis View tab for the device appears.

Step 3 In the right pane, click the **Configuration** sub-tab, and then expand the **Alien.wavelength** area.

Step 4 Click the + icon to open the Create Alien Wavelength window.

Step 5 Choose the position at which you want to configure the alien wavelength.

Step 6 Choose the required alien wavelength class, trunk mode and the forward error correction (FEC) mode.

Step 7 Click **Save**. The alien wavelength is added to the Alien Wavelength table.

You can select an alien wavelength to edit or delete it. However, you cannot edit the position at which the alien wavelength has been added.

Configure a Protection Group for a Shelf in a Device

Use this procedure to create a protection group for a shelf in a device.

Note You cannot configure a protection group for a rack.

Before You Begin

Following are the prerequisites before creating a protection group for a shelf:

- To create a Y Cable protection group, ensure that two cards of the same type that are configured with client ports are plugged in to the same shelf.
- To create a Splitter protection group, ensure that at least one OTU2XP card that is configured with trunk port 3-1 and trunk 4-1, is plugged in to the shelf.

Step 1 From the left sidebar, choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's name hyperlink. The Chassis View tab for the device appears.

Step 3 Expand the Chassis View Explorer, and then select the shelf for which you want to configure the protection group.

Step 4 In the right pane, click the **Configuration** sub-tab, and then expand the **Protection** area.

Step 5 Click the + icon to open the Create Protection Group window.

Step 6 From the Type drop-down list, choose one of the following protection type:

- Splitter—This protection type is applicable only when a MXPP/TXPP card is used. These cards provides splitter (line-level) protection (trunk protection typically on TXPP or MXPP transponder cards).
- Y Cable—This protection type is applicable only when two transponder or two muxponder cards that are configured with client ports, are plugged in to the same shelf in a device.

Step 7 Choose a protect port and a working port for the shelf.

Note You will be able to select these ports only if you have completed the prerequisites listed at the beginning of this procedure.

Step 8 Click the **Revertive** toggle radio button to revert the shelf from the protected port to the original port after the failure is fixed.

Step 9 Choose the soak time in minutes or seconds. Soak time is the period that the shelf on the protected port must wait before switching to the original port after the failure is fixed. The shelf can revert to the original port after the soak time expires. The minimum value of soak time must be 0.5.

Step 10 Click **Apply**. The protection group is added to the Protection table.

Configure Optical Cards

Configure Cards from the Chassis View

This procedure adds a card to Cisco EPN Manager using the Chassis View. After adding the card, you can configure it by following the procedure in the relevant topic for that card type. Normally this is done before you physically add the card to the slot.

Before You Begin

This feature is only supported on Cisco NCS 2000 and Cisco ONS devices.

Step 1 Launch the Chassis View as described in Open the Chassis View.

Step 2 Select the slot to which you want to add the card by doing one of the follow:

- Select the empty slot from the physical Chassis View, then click the **Add Card** link in the slot pop-up window.
- Use the Chassis View explorer to navigate to the empty slot, hover your mouse cursor over the "i" icon next to the slot, then click the **Add Card** hyperlink in the informational popup window.

Cisco EPN Manager highlights the slot in the physical Chassis View (indicating it is preprovisioned) and lists all of the cards that are supported by that device type.

Note Make sure the card you select is appropriate for the physical slot type.

Step 3 Locate the card you want to add, then click **Add**. Cisco EPN Manager displays a status message after the card is added.

Step 4 If you want to configure the card right away, click **Configure Now** in the status popup message. Otherwise, click **Ignore**.

Delete a Card

When you delete a card, Cisco EPN Manager removes all information about the card including the card operating mode configuration associated with the card. When you add this card again at a later point of time, this information is not restored.

This feature is only supported on Cisco NCS 2000 and Cisco ONS devices.
To delete a card from Cisco EPN Manager :

Before You Begin

Before you delete a card, make sure that:

- The associated payload values and card operating modes are deleted.
- The card does not have any active configuration running on the card (you will not able to restore the configuration when you re-add the card).

Step 1 Launch the Chassis View as described in Open the Chassis View.

Step 2 Select the slot from which you want to delete the card by doing one of the follow:

- Select the card in the slot from the physical Chassis View, then click the **Delete Card** link in the pop-up window.
- Use the Chassis View explorer to navigate to the card, hover your mouse cursor over the "i" icon next to the card, then click the **Delete Card** hyperlink in the popup window.

Cisco EPN Manager highlights the slot in the physical Chassis View (indicating it is preprovisioned) and once you delete all cards of a slot, the slot is left blank in the Chassis View.

After you delete a card, Cisco EPN Manager performs an inventory collection for the node.

Reset a Card

Resetting a card repositions the card in the chassis, which is similar to performing a sync operation. Cisco EPN Manager does not modify any configuration changes, and instead saves the settings and triggers an inventory collection.

This feature is only supported on Cisco NCS 2000 and Cisco ONS devices.
To reset a configured card:

Step 1 Launch the Chassis View as described in Open the Chassis View.

Step 2 Select the slot from which you want to delete the card by doing one of the follow:

- Select the card in the slot from the physical Chassis View, then click the **Reset Card** link in the pop-up window.
- Use the Chassis View explorer to navigate to the card, hover your mouse cursor over the "i" icon next to the card, then click the **Reset Card** hyperlink in the popup window.

Cisco EPN Manager highlights the slot in the physical Chassis View (indicating it is preprovisioned). After you reset the card, a sync is performed and inventory collection is triggered.

What to Do Next

Configure the properties of the card as described in Configure cards: 400G-XP, 100G-CK-C, 100ME-CK-C, 200G-CK-LC, 100GS-CK-C, 100G-LC-C, 100G-ME-C, and 10x10G-LC, on page 64.

Configure cards: OTU2-XP, MR-MXP, WSE, AR-XPE, AR-XP, AR-MXP, 40E-MXP-C, and 40ME-MXP-C

To configure card operating modes and PPMs:

Before You Begin

OTU2-XP and 40E-MXP-C cards can be configured with PPM directly without having to set the card operating mode. However, if you want to configure card operating modes for other cards you can perform this configuration directly via Cisco Transport Controller.

- Ensure that the device sync is complete and that the device's inventory collection status is 'Managed' or 'Completed'.

- Every time you add or delete a PPM, reactive inventory collection is triggered, and the device begins the sync process. Ensure that you wait for reactive inventory collection to complete before you deploy further configuration changes to the device. When the device sync is in progress, the deploy of PPM configuration changes to the device will fail.
- Once the card operating modes are configured, ensure that the device sync is completed. If not, Cisco EPN Manager will not be able to display the right Payload values for the selected cards.
- Ensure that granular inventory is enabled for all cards before performing any configuration changes on the cards.
- For all supported cards except 40E-MXP-C, 40ME-MXP-C, and OTU2-XP cards, you must first configure the card operating modes using Cisco Transport Controller and then return to Cisco EPN Manager to proceed with the following steps.

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's Name hyperlink to launch the device's Chassis view. This feature is supported only on Cisco NCS 2000 devices.

Step 3 Use the **Chassis Explorer** to select the card that you want to configure.

Step 4 Click the **Configuration** sub-tab from the window displayed on the right.

Step 5 Navigate to the CTC tool and configure the operating modes for the cards. Card mode configuration is not supported on: OTU2-XP, MR-MXP, WSE, AR-XPE, AR-XP, and AR-MXP cards. For all other cards on Cisco NCS 2000 devices, configure card operating modes as described in Configure cards: 400G-XP, 100G-CK-C, 100ME-CK-C, 200G-CK-LC, 100GS-CK-C, 100G-LC-C, 100G-ME-C, and 10x10G-LC, on page 64.

Step 6 Expand the **Pluggable Port Modules** section to configure port modules and their respective payload values.

Step 7 Click the '+' (Add) icon in the **Port Modules** section to create port modules (PPMs).

Step 8 Select the **PPM number** and then click **Save**. The PPM port is set to PPM (1 port) by default and cannot be modified.

Note The '+' (Add) button is disabled when the maximum number of PPMs for the selected card are created. You must create all available ports before you can continue to the next step.

Step 9 Click the '+' (Add) icon in the **Pluggable Port Modules** section.

Note For some PPMs, the respective payload values may not be enabled. To enable it, complete the card mode configuration described in Step 5 above, and then try to re-configure the payload values.

Step 10 Choose the **port number**, **port type**, and **number of lanes** that must be associated with the selected PPM. The Port Type (payload) can be set to any supported client signals described in Table 2 below.

Note If the specified Port Type (payload) is not supported for the selected card operating mode or PPM, then the changes are not deployed to the device successfully. Ensure that the Payload values you specify, are supported on the selected card. See Table 2 below for reference.

Step 11 Click **Finish** to deploy your changes to the device.

Step 12 (Optional) If your changes are not visible in the Cisco EPN Manager , it could be because more than one person is working on the same card mode configuration and the changes are not reflected dynamically. Click the Refresh icon within each section to view the most recent changes.
If you encounter a deploy failure, navigate to the error logs folder **/opt/CSCOlumos/logs/config.log** for more details about the cause of the error.

Configure cards: 400G-XP, 100G-CK-C, 100ME-CK-C, 200G-CK-LC, 100GS-CK-C, 100G-LC-C, 100G-ME-C, and 10x10G-LC

To configure card operating modes and PPMs:

Before You Begin

- Ensure that the device sync is complete and that the device's inventory collection status is 'Completed'. If the device sync is on, then the deploy of PPM configuration changes will fail.
- Card mode configuration is not supported on: OTU2-XP, MR-MXP, WSE, AR-XPE, AR-XP, and AR-MXP cards. To configure the card operating modes on these cards, please use the Cisco Transport Controller tool.
- Ensure that the device sync is complete and that the device's inventory collection status is 'Managed' or 'Completed'.
- Ensure that granular inventory is enabled for all cards before performing any configuration changes on the cards.

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's Name hyperlink to launch the device's Chassis view.

Step 3 Use the **Chassis Explorer** to select the card that you want to configure.

Step 4 Click the **Configuration** sub-tab from the window displayed on the right.

Step 5 Expand the **Pluggable Port Modules** section to configure port modules and their respective payload values.

Step 6 Click the '+' (Add) icon in the **Port Modules** section to create port modules (PPMs). Select the PPM number and then click **Save**. The **PPM Port** value is set to PPM (1 port) by default and cannot be modified.

Note
- The '+' (Add) button is disabled when the maximum number of PPMs applicable for the selected card are created. You must create the required number of PPMs for the selected card before proceeding to the next step. For example, for 400G-XP cards, you must create all 12 PPMs before proceeding to the next step. However, for 100G-CK-C cards, you only need to create a single PPM.
- For 400G-XP cards, ensure that the PPMs 11 and 12 are created before configuring the card operating modes described in the next step (although the card mode is being created for either of the trunk ports). Without PPMs 11 and 12, the configuration changes deployed to the device will fail.
- This step is optional for 100G-LC-C, 100G-ME-C, 100G-CK-C, 100ME-CK-C, 200G-CK-LC, and 100GS-CK-C cards.

Step 7 Expand the **Card Operating Modes** section to configure operating modes for the selected card.

Step 8 Click the '+' (Add) icon to display a list of supported card operating modes or click the Edit icon to modify existing card operating modes. For 10x10G-LC cards you can add up to 5 card operating modes (10 ports that can act as sets of client or trunk ports), whereas for all other cards, only a single card operating mode can be set, after which, the + (Add) button is disabled.

Step 9 Select an operating mode from the panel on the left and make your changes to the parameters as described in the Table 1.

Note

- 400G-XP cards have only one operating mode while all other supported cards have multiple operating modes.
- Some card operating modes are disabled based on the card's peer configuration. Click on the '**i**' icon next to the operating modes to understand how they can be enabled. See Table 1 below to understand the peer card configuration required to enable these operating modes.
- For MXP cards, ensure that the trunk, peer, and peer skip card configuration is in the order described below:

Card Operating Modes	Truck Card	Peer Card	Peer Skip Card
MXP_200G	Slot 2	Slot 3	Slot 4
MXP_200G on ONS 15454 M6 devices	100GS-CK-LC or 200G-CK-LC card in slots 2 or 7.	Slots 3, 4 or 5, 6.	Slots 3, 4 or 5, 6.
MXP_200G on Cisco NCS 2015 devices	100GS-CK-LC or 200G-CK-LC card in slots 2, 7, 8, 13, or 14.	MR-MXP cards in adjacent slots.	MR-MXP cards in adjacent slots.
MXP_10x10G_100G	Slot 7	Slot 6	Slot 5
MXP_10x10G_100G on ONS 15454 M6 devices	100GS-CK-LC or 200G-CK-LC card in slots 2 or 7	MR-MXP cards in adjacent slots 3, 4 or 5, 6.	MR-MXP cards in adjacent slots 3, 4 or 5, 6.
MXP_10x10G_100G on Cisco NCS 2015 devices	100GS-CK-LC or 200G-CK-LC card in slots 2, 7, 8, 13, or 14.	MR-MXP cards in adjacent slots.	MR-MXP cards in adjacent slots.
MXP_CK_100G on ONS 15454 M6 devices	100GS-CK-LC or 200G-CK-LC card and the peer MR-MXP card need to be in adjacent slots 2-3, 4-5, 6-7.		
MXP_CK_100G on Cisco NCS 2015 devices	100GS-CK-LC or 200G-CK-LC card and the peer MR-MXP card need to be in adjacent slots 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, 14-15.		

Step 10 Click **Save** to deploy your changes to the device.

Step 11 Expand the **Pluggable Port Modules** section to configure the payload values for each PPM.

Step 12 Click the '+' (Add) icon in the Pluggable Port Modules section.

Note For some PPMs, the respective payload values may not be enabled. To enable it, complete the card mode configuration described in Step 9 above, and then try to re-configure the payload values.

Step 13 Choose the **port number**, **port type**, and the **number of lanes** that must be associated with the selected PPM. The Port Type (payload) can be set to any supported client signals described in the Table 1 below.

Note
- If the specified Port Type (payload) is not supported for the selected card mode or PPM, then the changes are not deployed to the device successfully. Ensure that the Payload values you specify, are supported on the selected card. See Table 1 for reference.
- You can configure the number of lanes only on cards that allow payload values to be split. For all other cards, the Number of Lanes field is disabled.

Step 14 Click **Finish** to deploy your changes to the device.

Step 15 (Optional) If your changes are not visible in the Cisco EPN Manager , it could be because more than one person is working on the same card mode configuration and the changes are not reflected dynamically. Click the Refresh icon within each section to view the most recent changes.
If you encounter a deploy failure, navigate to the error logs folder **/opt/CSCOlumos/logs/config.log** for more details about the cause of the error.

Configure SONET and Flex Line Cards

This procedure describes how you can use Cisco EPN Manager to modify the line card configuration on 10X10G-LC SONET cards and 400G-XP, 200G-CK-LC, and 100GS-CK-LC Flex cards.

This feature is only supported on Cisco NCS 2000 and Cisco ONS devices.
To configure a SONET or Flex line card:

Before You Begin

- To configure SONET line cards, ensure that you select a card with the operating mode MXP10X10G and OC192 payload value.
- To delete the SONET or Flex line card configuration, you only need to delete the payload values associated with the selected card. This deletes the SONET or Flex configuration from the device automatically. To delete the payload values, use the Pluggable Port Modes area under the configuration sub-tab.
- While configuring the SONET or Flex line card configuration, if you want to change the Line card type from SONET to SDH, or make other similar changes, you must first ensure that the admin state of the device is set to OOS-Disabled. If the device state is not OOS-Disabled, the line configuration changes deployed to the device will fail.
- To configuring Flex line card configuration, ensure that the card operating modes for the card have been previously set. See Configure cards: 400G-XP, 100G-CK-C, 100ME-CK-C, 200G-CK-LC, 100GS-CK-C, 100G-LC-C, 100G-ME-C, and 10x10G-LC, on page 64.

Step 1 Launch the Chassis View as described in Open the Chassis View.

Step 2 Select the slot from which you want to configure the card by doing one of the follow:

- Select the card in the slot from the physical Chassis View using the zoom in and out options.

- Use the Chassis Explorer view to navigate to the card and select it.

Step 3 Click the **Configuration** sub-tab from the window displayed on the right.

Step 4 Expand the **Line** section and choose the **SONET** or **Flex** sub-tabs.
The supported cards for SONET configuration are only 10x10G-LC cards, and for Flex cards, it is 400G-XP, 200G-CK-LC, and 100GS-CK-LC cards.

Step 5 Choose one of the following ways to edit the configuration:

- Select the SONET or Flex tab for configuration that you want to edit and click the Edit icon.
- Click the inline parameters that you want to edit one by one within the rows of the table.

Step 6 Make the required changes to the parameters described in the table below and click **Save** to deploy your changes to the device.
While configuring SONET parameters:

- When you set the Type to SDH, the Sync Messages checkbox is automatically disabled and cannot be configured.
- When you enabled the Sync Message checkbox, the Admin SSM option is disabled and set to null.

While configuring Flex parameters:

- For 400G-XP-LC cards, Flex line cards can be configured only for trunk ports 11/12.
- For 100GS-CK-LC cards, Flex line cards can be configured only for trunk port 2.

Table 9: SONET and Flex Line Configuration Parameters and Descriptions

Line Card Type	Line Card Configuration Parameters	Descriptions
SONET	Port Number	The port number of the SONET interface you are configuring.
	Port Name	Allows you to add a name for the SONET optical port.
	SD BER	Sets the signal degrade bit error rate.
	SF BER	Sets the signal fail bit error rate.
	Type	Defines the port as SONET or SDH.
	Provides Sync	When checked, the card is provisioned as an NE timing reference.
	Sync Messaging	Enables synchronization status messages (S1 byte), which allow the node to choose the best timing source.
	Admin SSM In	If the node does not receive an SSM signal, it defaults to synchronization traceability unknown (STU). Admin SSM allows you to override the STU value with one of the following: • PRS—Primary reference source (Stratum 1) • STS2—Stratum 2 • TNC—Transit node clock • STS3E—Stratum 3E • STS3—Stratum 3 • SMC—SONET minimum clock • ST4—Stratum 4

Line Card Type	Line Card Configuration Parameters	Descriptions
Flex	Port	The port number of the Flex interface you are configuring.
	Gridless	Enables or disables the gridless tunability feature on the selected card. When the feature is enabled, you can configure the frequency values on the card. Your options are: • ITU12_5- When selected, enables you to edit the frequency parameter for Flex. • ITU50- When selected, disables the frequency parameter for Flex.
	Frequency	Specifies the frequency on the port of the 400G-XP, 200G-CK-LC, and 100GS-CK-LC cards in the range 191350 to 196100.

Edit and Delete Pluggable Port Modules and Card Mode Configuration

Before You Begin

Pre-requisites for deleting PPMs:

- Ensure that the PPMs are not part of any Active or Provisioned circuits.
- PPMs and their respective payload values must be deleted only in the order described in the procedure below. Ensure that you first manually delete client ports 1 to 10 before deleting associated PPMs.
- Ensure that device sync is completed and the device's inventory collection status is either 'Completed' or 'Managed'.

Pre-requisite for deleting card operating modes:

- Ensure that the cards are not part of any Active or Provisioned circuits.
- For 400G-XP cards, PPMs 11 and 12 cannot be deleted. These PPMs are deleted automatically when the associated card operating mode is deleted.

- The peer card or skip card must not be in Active state. You can delete the peer or skip card associations using CTC and then retry deleting the card operating mode via Cisco EPN Manager. You can also try directly deleting the card from Cisco EPN Manager. For more information, see Delete a Card, on page 61.

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Select the device that you want to configure by clicking the device's Name hyperlink to launch the device's Chassis view.

Step 3 Use the **Chassis Explorer** to select the card with the configuration you want to delete.

Step 4 Click the **Configuration** sub-tab from the window displayed on the right.

Step 5 Expand the **Pluggable Port Modules** section to delete Pluggable Port Modules (PPMs).

a) In the **Pluggable Port Modules** sub-section, select the associated payload values that you want to delete and click the '**X**' (delete) icon.

b) Click **OK** to confirm. The changes are deployed to the device.

c) In the **Port Modules** sub-section, select the PPMs that you want to delete and click the '**X**' (delete) icon.

d) Click **OK** to confirm. The changes are deployed to the device.

Note You must delete all payload values associated with a given PPM, before you can delete the PPM.

Step 6 Expand the **Card Operating Modes** section to delete the card configuration.

a) To edit the card mode configuration, ensure that you select only 400G-XP cards, and click the Edit icon to make your changes. For all other cards, the configuration can be edited only by deleting the card mode configuration and re-creating it with new values.

b) To delete the card mode configuration, select the required card mode configuration and click the '**X**' (delete) icon.

c) Click **OK** to confirm. The changes are deployed to the device.

Cards and Supported Configuration for Cisco NCS 2000 Devices

Table 10: 100GS-CK-LC and 200G-CK-LC Cards: Supported Configuration

Card Operating Modes	Trunk Card	Peer card	Peer Skip Card	Supported Payload Types
MXP_200G	100GS-CK-LC or 200G-CK-LC card in slots 2, 7, 8, 13, or 14.	MR-MXP cards in slots 3, 6, 9, 12 or 15.	MR-MXP cards in slots 4, 5, 10, 11 or 16.	100GE and OTU4 OTU4 is supported only for the 200G-CK-LC card. Regeneration of any 100 G configuration 10GE 10GE 100GE

MXP_10x10G_100G	100GS-CK-LC or 200G-CK-LC card in slots 2, 7, 8, 13, or 14.	10x10G-LC cards in slots 3, 6, 9, 12 or 15.	MR-MXP cards in slots 4, 5, 10, 11 or 16.	100GE and OTU4 OTU4 is supported only for the 200G-CK-LC card. Regeneration of any 100 G configuration 10GE 10GE 100GE
MXP_CK_100G	100GS-CK-LC or 200G-CK-LC card and the peer MR-MXP card need to be in adjacent slots 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, 14-15.	N/A	N/A	100GE and OTU4 OTU4 is supported only for the 200G-CK-LC card. Regeneration of any 100 G configuration 10GE 10GE 100GE
RGN-100G	100GS-CK-LC or 200G-CK-LC card and the peer card 100GS-CK-LC or 200G-CK-LC need to be in adjacent slots 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, 14-15.	N/A	N/A	100GE and OTU4 OTU4 is supported only for the 200G-CK-LC card. Regeneration of any 100 G configuration 10GE 10GE 100GE
TXP-100G	100GS-CK-LC or 200G-CK-LC	N/A	N/A	N/A

Table 11: 100G-CK-C and 100ME-CKC Cards: Supported Configuration

Card Operating Modes	Trunk Card	Peer card	Skip Card	Supported Payload Types
TXP-100G	100G-CK-C/100ME-CKC	N/A	N/A	100GE, OTU4 — Regeneration of any 100 G configuration 40GE

RGN-100G	100G-CK-C/100ME-CKC card and the peer card 100G-LC-C/100G-ME-C/100G-CK-C/100ME-CKC need to be in adjacent slots 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, 14-15.		N/A	100GE, OTU4 — Regeneration of any 100 G configuration 40GE
MXP-2x40G	100G-CK-C/100ME-CKC	N/A	N/A	100GE, OTU4 — Regeneration of any 100 G configuration 40GE

Table 12: 100G-LC-C and 100G-ME-C Cards: Supported Configuration

Card Operating Modes	Trunk Card	Peer card	Skip Card	Supported Payload Types
TXP-100G	100G-LC-C/100G-ME-C	N/A	N/A	100GE, OTU4 — Regeneration of any 100 G configuration 40GE
RGN-100G	100G-LC-C/100G-ME-C card and the peer card 100G-LC-C/100G-ME-C/100G-CK-C/100ME-CKC need to be in adjacent slots 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, 14-15.		N/A	100GE, OTU4 — Regeneration of any 100 G configuration 40GE

Table 13: 10X10G-LC Cards: Supported Configuration

Card Operating Modes	Trunk Card	Peer card	Skip Card	Supported Payload Types

TXPP-10G	10x10G-LC	N/A	N/A	OC192/STM-64, 10GE-LAN Phy, 10GE-WAN Phy (using OC192), OTU2, OTU2e, 8G FC, 10G FC, FICON Only OC192/STM64 and 10GE are supported when the 10x10G-LC card is connected with the 100GS-CK-LC card. Only OC192/STM64, 10GE, and OTU2 are supported when the 10x10G-LC card is connected with the 200G-CK-LC card. 10GE-LAN Phy, OTU2 10GE-LAN Phy, OTU2e, OTU2, OC192/STM-64, 8G FC, 10G FC, IB_5G 10GE, 10G FC 10GE 10GE, OTU2e
TXP-10G	10x10G-LC	N/A	N/A	OC192/STM-64, 10GE-LAN Phy, 10GE-WAN Phy (using OC192), OTU2, OTU2e, 8G FC, 10G FC, FICON Only OC192/STM64 and 10GE are supported when the 10x10G-LC card is connected with the 100GS-CK-LC card. Only OC192/STM64, 10GE, and OTU2 are supported when the 10x10G-LC card is connected with the 200G-CK-LC card. 10GE-LAN Phy, OTU2 10GE-LAN Phy, OTU2e, OTU2, OC192/STM-64, 8G FC, 10G FC, IB_5G 10GE, 10G FC 10GE 10GE, OTU2e

MXP-10x10G	10x10G-LC card and the peer [illegible] card need to be in adjacent slots 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, 14-15.	N/A	N/A	OC192/STM-64, 10GE-LAN Phy, 10GE-WAN Phy (using OC192), OTU2, OTU2e, 8G FC, 10G FC, FICON Only OC192/STM64 and 10GE are supported when the 10x10G-LC card is connected with the 100GS-CK-LC card. Only OC192/STM64, 10GE, and OTU2 are supported when the 10x10G-LC card is connected with the 200G-CK-LC card. 10GE-LAN Phy, OTU2 10GE-LAN Phy, OTU2e, OTU2, OC192/STM-64, 8G FC, 10G FC, IB_5G 10GE, 10G FC 10GE 10GE, OTU2e
RGN-10G	10x10G-LC	N/A	N/A	OC192/STM-64, 10GE-LAN Phy, 10GE-WAN Phy (using OC192), OTU2, OTU2e, 8G FC, 10G FC, FICON Only OC192/STM64 and 10GE are supported when the 10x10G-LC card is connected with the 100GS-CK-LC card. Only OC192/STM64, 10GE, and OTU2 are supported when the 10x10G-LC card is connected with the 200G-CK-LC card. 10GE-LAN Phy, OTU2 10GE-LAN Phy, OTU2e, OTU2, OC192/STM-64, 8G FC, 10G FC, IB_5G 10GE, 10G FC 10GE 10GE, OTU2e
LOW-LATENCY	10x10G-LC	N/A	N/A	N/A

FANOUT-10X10G	10x10G-LC	N/A	N/A	OC192/STM-64, 10GE-LAN Phy, 10GE-WAN Phy (using OC192), OTU2, OTU2e, 8G FC, 10G FC, FICON Only OC192/STM64 and 10GE are supported when the 10x10G-LC card is connected with the 100GS-CK-LC card. Only OC192/STM64, 10GE, and OTU2 are supported when the 10x10G-LC card is connected with the 200G-CK-LC card. 10GE-LAN Phy, OTU2 10GE-LAN Phy, OTU2e, OTU2, OC192/STM-64, 8G FC, 10G FC, IB_5G 10GE, 10G FC 10GE 10GE, OTU2e

400G-XP-LC and MR-MXP cards of Cisco NCS 2000 devices can be configured with the following card operating mode and payload values:

- Payload types OTU2/OC192 are supported on MR-MXP cards,
- Payload types 16G-FC/OTU2 are supported on 400G-XP-LC cards,
- Slice operational mode OPM_6x16G_LC is supported on 400G-XP-LC cards.

Discover and Configure MPLS LDP and MPLS-TE Links

Using Cisco EPN Manager you can configure Label Distribution Protocol (LDP) and MPLS-TE links in an MPLS network.

MPLS LDP

LDP provides a standard methodology for hop-by-hop (or dynamic label) distribution in an MPLS network by assigning labels to routes that have been chosen by the underlying IGP routing protocols. The resulting labeled paths, called label switch paths (LSPs), forward labeled traffic across an MPLS backbone. Cisco EPN Manager enables you to configure the potential peers and establish LDP sessions with those peers to exchange information.

To configure LDP using Cisco EPN Manager you need to know the network address and interface of the device on which the LDP links must be configured and also subnet mask for the configured IP addresses.

Note Before configuring MPLS LDP, ensure that the LDP ID is pre-configured on the device.

MPLS-TE

Cisco EPN Manager supports the provisioning of MPLS Traffic Engineering (MPLS-TE) services. MPLS-TE enables an MPLS backbone to replicate and expand the TE capabilities of Layer 2 over Layer 3. MPLS TE

uses Resource Reservation Protocol (RSVP) to establish and maintain label-switched path (LSP) across the backbone. For more information, see, Supported MPLS Traffic Engineering Services.

To configure LDP and MPLS-TE parameters:

Step 1 Choose **Configuration > Network Devices**.

Step 2 Select the device that you want to configure by clicking the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 To configure LDP links:

a) Choose **MPLS > LDP** and click '+' to specify new LDP parameters. To edit existing parameters, click the LDP Address hyperlink and click the Edit icon at the top right corner of the page.

Note You can only add a single set of LDP settings per device.

b) Specify the LDP parameters described in the table below and click **Save** to deploy your changes to the device.

Step 5 To configure MPLS-TE links:

a) Choose **MPLS > MPLS-TE** and click the Edit icon at the top right corner of the page.

b) Specify the MPLS-TE parameters described in the table below and click **Save** to deploy your changes to the device.

Table- Configuring MPLS LDP Links - Field Descriptions

MPLS LDP Fields	Field Descriptions
LDP Interface	Choose the LDP interface that is to be chosen as the source interface for the LDP session on the device. Once the LDP interface is set, it cannot be edited. To change the LDP interface, delete the LDP session and create a new session with the required LDP interface.
LDP Address	Specify the IP address of the LDP interface.
Mask	Enter the network mask for the specified IP address in A.B.C.D format.
Discovery Hold time and Discovery Target Hold time	(Optional) Enter the time, in seconds, an LDP source and a discovered LDP neighbor is remembered without receipt of an LDP hello message from the neighbor. Range is 1 to 65535.
DownStream Min Label and DownStream Max Label	(Optional) Enter the minimum and maximum number of hops permitted in an LSP established by the Downstream on Demand method of label distribution. Range is 16 to 32767.
DownStream Max Hop Count	(Optional) Enter the number of hops permitted in an LSP established by the Downstream on Demand method of label distribution. Range is 1 to 255.
IGP Hold Down Time	(Optional) Enter the time, in seconds, to specify the time for which the declaration of LDP sync state is delayed after session establishment upon link coming up. Range is 1 to 2147483647.
Explicit Null Enabled	(Optional) Enable this value to advertise explicit-null labels for the directly connected route. Values are Yes (enabled) or No (disabled).

MPLS LDP Fields	Field Descriptions
Initial Back Off and Max Back Off	(Optional) Enter the initial and maximum back off delay value in seconds. Range is 5 to 2147483.

Table Configuring MPLS-TE Links - Field Descriptions

Fields	Field Descriptions
MPLS TE Tunnel Enabled	Activates the display of the list of automatic bandwidth enabled tunnels, and indicates if the current signaled bandwidth of the tunnel is identical to the bandwidth that is applied by the automatic bandwidth
Auto Bandwidth Timer Frequency (Sec)	To set the interval (in seconds) at which the automatic bandwidth on a tunnel interface is triggered.
Reoptimize Timer Frequency (Sec)	Set the value (in seconds) to trigger the reoptimization interval of all TE tunnels.
Auto Backup Tunnel Enabled	To display information about automatically built MPLS-TE backup tunnels.
Backup Tunnel Min. Range and Backup Tunnel Max. Range	Configures the range of backup autotunnel numbers to be between the specified minimum and maximum value. Ensure that minimum range for the backup tunnel is lower than the maximum range.
SRLG Exclude	Specifies an IP address to get SRLG values from, for exclusion.
Un-numbered Interface	Enables IP processing on the specified interface without an explicit address.

What to Do Next

Monitor LDP links on the Network Topology:

1. Choose **Maps > Network Topology**.
2. Click the **Device Groups** button and choose the device on which LDP was configured in the steps above.
3. Click the **Utilization** button, and enable the **LDP** check box to display the LDP links on the topology.
4. To view the LDP link details, double click the links displayed between the devices.

For information on how to provision MPLS-TE services, see Provision MPLS Traffic Engineering Services.

Analyze Ports Using SPAN and RSPAN

Using Cisco EPN Manager , you can analyze network traffic passing through ports or VLANs by using SPAN or RSPAN to send a copy of the traffic to another port on the switch or to a monitoring device. SPAN copies

(or mirrors) traffic received or sent (or both) on source ports or source VLANs to a destination port for analysis. Traffic that enters or leaves source ports or traffic that enters or leaves source VLANs are monitored.

If you configure SPAN to monitor incoming traffic, then traffic that gets routed from another VLAN to the source VLAN cannot be monitored. However, traffic that is received on the source VLAN and routed to another VLAN can be monitored.

Cisco EPN Manager allows you to configure only one Local SPAN session per device. Local SPAN sessions copy traffic from one or more source ports in any VLAN to a destination port for analysis.

Using Remote SPAN you can configure source ports, source VLANs, and destination ports on different switches, enabling remote monitoring of multiple switches across your network. The traffic for each RSPAN session is carried over a user-specified RSPAN VLAN that is dedicated for that RSPAN session in all participating switches. The RSPAN traffic from the source ports or VLANs is copied into the RSPAN VLAN and forwarded over trunk ports carrying the RSPAN VLAN to a destination session monitoring the RSPAN VLAN.

Note To monitor ports, you must ensure that the ports are associated with one or more VLANs (source or destination).

To enable port monitoring (or mirroring):

Step 1 Choose **Configuration > Network Devices**.

Step 2 Select the device that you want to configure by clicking the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Configure an RSPAN session:

a) Choose **Port Analyzer > RSPAN > Destination Node** to configure the destination node for RSPAN.

b) Click '+' to specify the RSPAN session ID. To edit existing settings, click the session ID hyperlink and click the Edit icon at the top right corner of the page.
You can add up to 14 RSPAN and SPAN sessions.

c) Choose a session ID and click **Save**.
The session type Remote Destination (Remote RSPAN) is set by default and cannot be edited.

d) Click the session ID hyperlink to specify the source and destination settings for the destination node.

e) Click the **Source Settings** tab, choose a valid VLAN ID (auto populated based on the VLANs configured on the selected device), and click **Save**.
You can add only a single VLAN as the source for the destination node. If no VLANs are configured, you need to configure them and return to this step. See Configure VLAN Interfaces, on page 34.

f) Click the **Destination Settings** tab, select the interface that must act as the destination node for the RSPAN, and click **Save**.

a) From the features panel, choose **Port Analyzer > RSPAN > Source Node** to configure the source node for RSPAN.

b) Click '+' to specify common RSPAN source node settings. To edit existing settings, click the session ID hyperlink and click the Edit icon at the top right corner of the page.

c) Choose a session ID and click **Save**.
The session type Remote Source (Remote SPAN) is set by default and cannot be edited.

d) Click the session ID hyperlink to specify the source and destination settings for the source node.

e) Click the **Source Settings** tab, specify the following values, and click **Save**.

i) In the **Interface** drop-down menu, choose the interface that will act as the source interface for the RSPAN source node.

An interface specified as a source node for RSPAN can also be used as the source/destination node for SPAN.

ii) In the **Direction** drop-down menu, choose direction in which the interface must be applied to the RSPAN source node. Your options are:

- **Transmit**: monitors all packets sent by the source interface after all modification and processing is performed by the switch. A copy of each packet sent by the source is sent to the destination port for that session. The copy is provided after the packet is modified.
- **Receive**: monitors all packets received by the source interface or VLAN before any modification or processing is performed by the switch. A copy of each packet received by the source is sent to the destination port for that session.
- **Both**: (default value) monitors a port or VLAN for both received and sent packets.

You can add multiple interfaces to the source node for RSPAN and then associate a single VLAN ID to these interfaces.

f) Click the **Destination Settings** tab, choose a valid VLAN ID (auto populated based on the VLANs configured on the selected device), and click **Save**.

Step 5 Configure a SPAN session:

a) Click **Port Analyzer > SPAN**.

b) Click the '+' to specify common SPAN source node settings. To edit existing settings, click the session ID hyperlink and click the Edit icon at the top right corner of the page.
Interfaces configured as the source and destination node for RSPAN, cannot be used for SPAN.

c) Choose a session ID and click **Save**.
The session type Local (Local SPAN) is set by default and cannot be edited.

d) Click the session ID hyperlink to specify the source and destination settings for SPAN.

e) Click the **Source Settings** tab, and choose the interface and direction in which the interface must be applied for SPAN, and click **Save**. For more details, see Step 4.
An interface specified as a source node for RSPAN can also be used as the source/destination node for SPAN.

f) Click the **Destination Settings** tab, choose a valid VLAN ID (auto populated based on the VLANs configured on the selected device), and click **Save**.

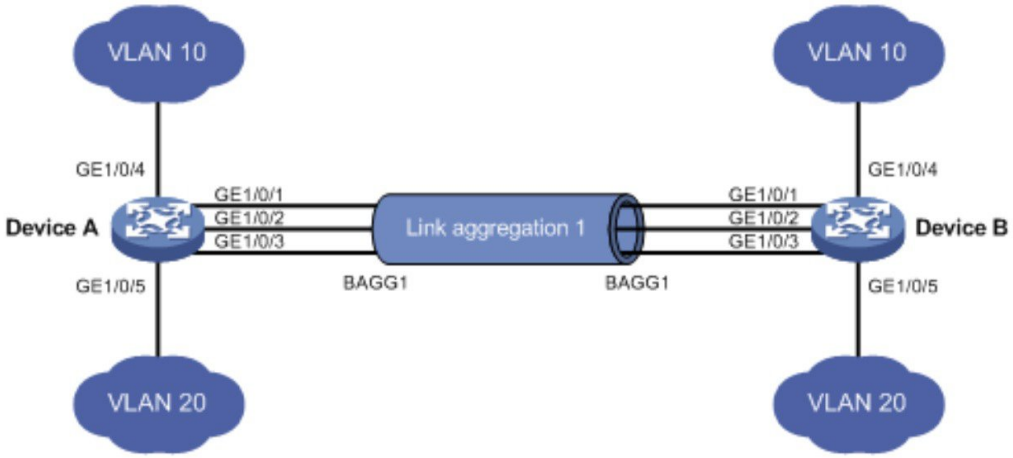
g) (Optional) To verify that your changes were configured correctly, use the following command in your device CLI:

```
show monitor session all
```

Configure and View Ethernet Link Aggregation Groups

An Ethernet Link Aggregation Group (LAG) is a group of one or more ports that are aggregated together and treated as a single link. Each bundle has a single MAC, a single IP address, and a single configuration set (such as ACLs). LAGs provide the ability to treat multiple switch ports as one switch port. The port groups act as a single logical port for high-bandwidth connections between two network elements. A single link aggregation group balances the traffic load across the links in the channel. LAGs help provision services with two links. If one of the links fails, traffic is moved to the other link.

The following figure illustrated a LAG created between two devices: Device A and Device B.



Cisco EPN Manager allows you to view and manage LAGs in the following ways:

- Create Link Aggregation Groups (LAG) Using Multiple Interfaces, on page 80
- Provision Services Over LAG Interfaces, on page 81
- View Ethernet LAG Properties, on page 82

Create Link Aggregation Groups (LAG) Using Multiple Interfaces

Using Cisco EPN Manager , you can create LAGs that provide the ability to treat multiple physical switch ports as a single logical one.

Before You Begin

- Only interfaces that are not already part of an existing LAG can be selected. An interface cannot be part of more than one LAG.
- The selected group of interfaces must all consist of the same bandwidth type.
- Inventory collection status for the devices that participate in the LAG must be *Completed*.

To create a LAG:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Interfaces > Link Aggregation**.

Step 5 Depending on the type of control method that you want to use, click the **PAgP** or the **LACP** tab.

Step 6 Enter a unique name for the LAG. Ensure that the channel group ID that you specify is part of the LAG name. For example, for a channel group ID of 10, your LAG name should be:

- 'Bundle-Ether10' for Cisco IOS-XR devices.
- 'Port-channel10' for Cisco IOS, Cisco ME3600, and Cisco ME3800 devices.

Step 7 To create a new LAG, click the Add (+) sign.

Step 8 Enter a number between 1 to 16 to specify the Channel Group ID. The channel group ID ranges for different types of devices is: 1-8 for Cisco ASR 90X devices, 1-64 for Cisco ASR 920X devices, 1-26 for Cisco ME3x00 devices, 1-48 for Cisco NCS42xx devices, and 1-65535 for Cisco ASR9000 devices.

Step 9 Click the **Member Port Settings** tab to specify the member port values:

- LACP Modes: LACP can be configured with the following modes:
  - Active- In this mode, the ports send LACP packets at regular intervals to the partner ports.
  - Passive- In this mode, the ports do not send LACP packets until the partner port sends LACP packets. After receiving LACP packets from the partner port, the ports then send LACP packets to the partner port.
- PAgP Modes: PAgP modes can be configured with AUTO, DESIRABLE, or ON. For ASR9K devices, only On PAgP mode is enabled. ON implies that the mode is set to PAgP - manual.

Step 10 Click **Save**.
Your changes are saved and you can now add interfaces to the created LAG.

Step 11 To add interfaces to the created LAG, select the required channel group from the Link Aggregation table and click the Edit icon.

Step 12 Select the interfaces you want to use to create the LAG.

Step 13 Click **Save**.
The LAG is created using the interfaces you selected. You can now provision a service using these interfaces. See Provision Services Over LAG Interfaces, on page 81.

Provision Services Over LAG Interfaces

After you create LAGs using CE interfaces, you can use these interfaces to provision a CE service. Interfaces that are part of the LAG are displayed in the device details view on the topology view.

To provision a service over a LAG interface:

Step 1 Create LAG using more than one interface. See Create Link Aggregation Groups (LAG) Using Multiple Interfaces, on page 80.

Step 2 Provision a CE service using the interfaces that you have grouped to create LAG. See Provision EVCs in a Carrier Ethernet Network.

Step 3 View the device's details on the topology view. See Get Quick Information About a Circuit/VC: Circuit/VC 360 View. The following figure shows the LAG interfaces that were used to provision a service on the interfaces of a Cisco ME3600 device.

Figure 1: Service Provisioning Using LAG Interfaces (Cisco ME3600 Device)

View Ethernet LAG Properties

You can view properties for Ethernet LAGs in the following ways:

- Using the Device Configuration tab:
  1. Go to **Network Devices** > **Device Properties** > **Configuration** tab.
  2. Select the device on which you want to configure the LAG by clicking the device name hyperlink.
  3. Click the **Configuration** tab, then click the **Logical View** left side tab.
  4. Click **Interfaces > Link Aggregation** in the Features panel.
- Using the Device Details tab:
  1. Go to **Network Devices** > **Device Properties**.

2 Select the device on which you want to configure the LAG by clicking the device name hyperlink.

3 Click the **Device Details** tab.

4 Click **Interfaces > Ether Channel** in the Features panel.

Configure Routing Protocols and Security

Using Cisco EPN Manager, you can configure the following routing protocols for your CE and Optical devices. You can also configure security for your devices using ACLs.

Before you configure routing protocols and ACLs, ensure that the device's Inventory Collection status is 'Completed'.

To view a device's routing table, open the Device 360 view and choose **Actions** > **Routing Table Info** > **All**.

- Configure a BGP Routing Process, on page 83
- Configure EIGRP, on page 86
- Configure an IS-IS Routing Protocol, on page 87
- Configure OSPF Routing Processes, on page 89
- Configure RIP, on page 91
- Configure a Static Routing Protocol, on page 92
- Configure ACLs, on page 92

Configure a BGP Routing Process

Border Gateway Protocol (BGP) is a standardized exterior gateway protocol designed to exchange routing and reachability information between autonomous systems (AS) in your network. By configuring BGP, your device is enabled to make routing decisions based on paths, network policies, or rule-sets configured by a network administrator.

Using the Cisco EPN Manager , you can configure BGP routing and establish a BGP routing process by specifying the AS number and Router ID. You can then create a BGP neighbor which places the router in neighbor configuration mode for BGP routing and configures the neighbor IP address as a BGP peer. To configure the BGP neighbor, you need to provide the neighbor's IPv4 address and its peer AS number. BGP neighbors should be configured as part of BGP routing. To enable BGP routing, at least one neighbor and at least one address family must be pre-configured.

To view a device's BGP and BGP Neighbors routing table, open the Device 360 view, then choose **Actions > Routing Table Info**.

To configures BGP routing protocol on a device:

Step 1 Choose **Configuration > Network Devices**.

Step 2 Select the required device by clicking the device name hyperlink.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Routing > BGP**.

Step 5 To configure the BGP routing process, click the + icon or if BGP is already configured, click the AS number hyperlink and then click the Edit icon to enter these BGP Process details described in the table below.

Step 6 Click **Save** to deploy your changes to the device and to enable the BGP Address Family and BGP Neighbor tabs.

Step 7 To configure the BGP address family details, click the **BGP Address Family** tab and choose the address family details described in the table below, and click **Save**.

Step 8 To configure the BGP neighbor, click the **BGP Neighbor** tab and choose the neighbor device by selecting the device's IP address from the list.

Step 9 To create a new BGP neighbor, click the Add (+) icon, specify the following details described in the table below.

Step 10 Click **Save**. The updated BGP routing process values are saved and deployed to the selected device.
To verify that your changes were saved, go to **Configuration > Network Devices**, launch the Device Details page, and click the **Logical View** tab. Choose **Routing > BGP**. You can view your BGP configuration details such as the Neighbor Address, Remote AS, Address Family Type and Modifier, and Advertise Interval Time configured on the device.

Table - Configuring a BGP Routing Process - Field Descriptions

Fields	Sub-field	Descriptions
Common BGP Process fields	AS Number	Enter the AS number using a numeric value from 1 to 65535.
	Router ID	• Enter the Router ID. The value can be an IPv4 or an IPv6 address of the format: ◦ A.B.C.D- for IPv4 addresses, where A, B, C, and D are integers ranging from 0 to 255. ◦ xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx - for IPv6 addresses, where x would be a hexadecimal value and where the address uses eight sets of four hexadecimal addresses (16 bits in each set), separated by a colon (:).
	Log Neighbor Changes	Select to track neighbor router changes.
BGP Address Family fields	BGP Global AF	• Address Family: Enter the BGP address family prefixes for the routing process. Your options are IPv4 and IPv6 (for unicast, multicast, and MVPN), VPNv4 and VPNv6 (for unicast), and IPv4 (for MDT). • Allocate Label: Choose the labeled unicast address prefixes.

Fields	Sub-field	Descriptions
		• Allocate Label Custom Policy Name: Choose a custom policy to be associated with the routing process.
	BGP Additional Paths	Specify the details for the paths that enable the advertisement of multiple paths through the same peering session for the same prefix without the new paths implicitly replacing any previous paths. • Additional Paths: Choose whether the device must send, receive, or send and receive additional paths. This is done at the address family level or the neighbor level. During session establishment, the specified BGP neighbors negotiate the Additional Path capabilities (whether they can send and/or receive) between them. • Best Value: This field is enabled only when the Additional Paths value that you choose supports the configuration of the Best Value field.
	BGP Neighbor AF	Specify the address family details that the specified BGP neighbor belongs to: • Neighbor Address: Choose the Router ID of the neighboring router. These values are populated based on the BGP neighbors created in the Neighbor tab. The value can be an IPv4 or an IPv6 address of the format: ◦ A.B.C.D- for IPv4 addresses, where A, B, C, and D are integers ranging from 0 to 255. ◦ xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx - for IPv6 addresses, where x would be a hexadecimal value and where the address uses eight sets of four hexadecimal addresses (16 bits in each set), separated by a colon (:). • Send Label: Choose the type of label that must be associated with the neighbor. • Route Reflector Client: Enable this field to configure the router as the route reflector and the specified neighbor as its client. • AIGP: Select to enable the accumulated interior gateway protocol (AIGP) path attribute. • Send Community: Choose how the community attributes must be sent to an external Border Gateway Protocol (eBGP) neighbor. • Next Hop Self: Select to set the BGP next-hop attribute of routes being advertised over a peering session to the local source address of the session. • Incoming and Outgoing Route Map Name: Choose to indicates whether a route policy is configured to be applied to inbound or outbound updates from the neighbor.
	BGP Network Mask	• Network Address and Mask: Specify the network IP address and network mask for the specified IP address.

Fields	Sub-field	Descriptions
		• Back Door Route: Enable to set the administrative distance on an external Border Gateway Protocol (eBGP) route to that of a locally sourced BGP route, causing it to be less preferred than an Interior Gateway Protocol (IGP) route. • Network Route Policy Name: Choose the route policy that will be used to select prefixes for label allocation. This enables BGP to allocate labels for all or a filtered set of global routes (as dictated by the route policy).
BGP Neighbor tab fields	-	Specify the following values: • Peer AS Number- Enter the value for the autonomous system number using integers in the range 1 to 4294967295. • Neighbor Address- Enter the IP address of the BGP neighbor that you want to configure. Only IPv4 address of the format A.B.C.D are supported. • Local AS Number and Action: Specifies an autonomous-system number to prepend to the AS_PATH attribute. The range of values is any valid autonomous system number from 1 to 65535. • Update Source: Use this option to establish a peer relationship (TCP connection) using the loopback interface as an alternative instead of using the interface closest to the peer router. • Fall-over: Select a value to enable the BGP fast peering session deactivation for improving the convergence and response time to adjacency changes with the specified BGP neighbor. • Password Encryption and Password: Specify whether password encryption is enabled or not, and if enabled, what the password value is.

Configure EIGRP

In EIGRP (Enhanced Interior Gateway Routing Protocol), when an entry in the routing table changes in any of the routers, it notifies its neighbors of only the change (rather than sending the entire routing table). Every router in the network periodically sends a “hello” packet so that all routers on the network understand the states of their neighbors. If a “hello” packet is not received from a router within a certain period of time, the router is considered inoperative.

EIGRP uses the Diffusing Update Algorithm (DUAL) to determine the most efficient route to a destination and provides a mechanism for fast convergence. If EIGRP and IGRP (Interior Gateway Routing Protocol) are being used on the same device, the protocols can interoperate because the routing metric used by one protocol is easily translated into the other protocol's metric.

To view a device's EIGRP and EIGRP Neighbors routing table, open the Device 360 view, then choose **Actions** > **Routing Table Info**.

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Routing** > **EIGRP**.

Step 5 Expand the **IPv4 EIGRP Routes** drop-down, click the Add (+) button, and enter the Autonomous System (AS) number, passive interface, and auto summary value that must be associated with the EIGRP routes.

Step 6 Expand the **IPv6 EIGRP Routes** drop-down, click the Add (+) button to enter the following IPv6 values associated with the EIGRP routes. Depending on the type of device you select, this drop-down may be hidden. For example, for Cisco IOS-XR devices, you cannot specify IPv6 addresses.

a) AS number- Enter the Autonomous System number that must be associated with the EIGRP route using a numeric value from 1 to 65535.
b) Administrative distance- Specify the distance that will be set for path selection. The available values are between 1 and 255.
c) Maximum paths- Specify the highest number of paths that can be used by the router for load balancing per route. You can set a numeric value between 1 and 32.
d) Router ID- Enter the identified for the router on which the EIGRP route must be configured. The router ID must be in the range 0.0.0.1 to 255.255.255.254.
e) Stub AS- Use true or false values to specify whether Stub Autonomous System must be associated with the EIGRP route.

Step 7 Use the **Add/Remove Passive Interfaces** button for both IPv4 and IPv6 EIGRP routes to specify whether the loopback0 value must be associated with the specified interfaces. Depending on the type of device you select, this button may be hidden. For example, for Cisco IOS-XR devices, you cannot specify passive interfaces.

Step 8 Click **Save** to deploy your changes to the device.

Configure an IS-IS Routing Protocol

Intermediate System-to-Intermediate System (IS-IS) Protocol is an intra-domain OSI dynamic routing protocol which uses a two-level hierarchy to support large routing domains (administratively divided into areas). Routing within an area is referred to as Level 1 routing. Routing between areas is referred to as Level 2 routing. In order to enable IS-IS for IP on a Cisco router and have it exchange routing information with other IS-IS enabled routers, you must perform the following tasks:

- Enable the IS-IS routing process on the device and assign areas.
- Enable IS-IS IP routing on the required interfaces.

An interface with a valid IP address can be designated to act as a Level 1 (intra-area) router, a Level 1_2 (both a Level 1 router and a Level 2) router, or a Level 2 (an inter-area only) routing interface for a given IS-IS instance. After the IS-IS routing starts working across the routers between the designated interfaces, the IS-IS neighborhood is automatically generated.

Note To enable ISIS routing, at least one address family must be configured by default. In this release, configuring address families cannot be done using Cisco EPN Manager .

To configure the IS-IS process on a device:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Select the device on which you want to configure the IS-IS routing protocol by clicking the device name hyperlink.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Routing** > **IS-IS**.

Step 5 To configure a new IS-IS process, click the **'+'** icon and enter the following parameters:

- Specify the process ID using alphanumeric characters only. No spaces or special characters are allowed.
- (Optional) Specify the Net ID in NSAP format. For example, your NET ID can be 49.0001.0000.0001.0010.00, where:
  - 49 - represents the first portion of the area ID which represents the AFI (Authority and Format Indicator).
  - 0001 - represents the second portion of the area ID.
  - 0000.0001.0010 - represents the system ID.
  - 00 - represents the N-selector which is always 0.
- Specify the type of IS-IS routing protocol. Your options are: Level 1, Level 2, and Level 1_2.

Step 6 Click **Save**.

Step 7 To configure this routing process on the selected device's interfaces:

a) Select the IS-IS protocol process created in the above steps from the **Routing** > **IS-IS** list.
b) Click the IS-IS process ID hyperlink.
c) Use the **IS-IS Interfaces** tab to specify the interfaces of the device on which the selected IS-IS configuration is to be applied:
   - Click the **'+'** icon to enter the interface details.
   - From the **Circuit Type** drop-down menu, select the type of circuit to which this configuration is to be applied. Your options are: Level 1, Level 2, and Level 1_2.
   - From the **Interface** drop-down menu, select the required interfaces.
   - (Optional) Specify the Level 1 and Level 2 metric and priority values. For the **Priority** field enter a value between 1 to 127 and for the **Metric**, a value between 1 to 16777214.
   - Enable the **Point-to-Point** checkbox to enable point to point connection.
   - Click **Save** to deploy the configuration onto the selected interfaces.

Step 8 Click **Save**. The selected IS-IS process is configured on the specified interfaces of the device.
To verify that your changes were saved, go to **Configuration > Network Devices**, launch the Device Details page, and choose **Configuration > Routing > IS-IS**.

Step 9 (Optional) To delete IS-IS routing processes configured using Cisco EPN Manager :

a) Go to **Configuration > Network Devices**, launch the Device Details page, and choose **Routing > IS-IS**.
b) Select the required IS-IS process from the list.
c) Click the '**x**' icon to delete and click **OK** to confirm the delete operation.

Configure OSPF Routing Processes

Open Shortest Path First (OSPF) is a standards-based routing protocol that uses the Shortest Path First (SPF) algorithm to determine the best route to its destination. OSPF sends Link State Advertisements (LSAs) to all routers within the same configured area. OSPF sends routing updates only for the changes in the routing table; it does not send the entire routing table at regular intervals.

Using Cisco EPN Manager you can configure OSPF for IPv4 and IPv6 addresses. To do this, ensure that you know the router ID, the administrative distance that you want to configure on the router, and the maximum path values to be set.

To configure the OSPF routing process:

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Select the device on which you want to enable OSPF by clicking the device name hyperlink. Select only IOS-XR devices.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Routing > OSPF** .

Step 5 To add a new OSPF process, click the + sign. To modify existing OSPF processes, select the required process by clicking the process ID hyperlink and click the Edit icon at the top right corner of the page.

Step 6 Specify the common OSPF parameters as described in the table below.

Step 7 Click **Save**. Your configuration changes are saved. To verify, click the **Configuration** tab, choose **Routing** > **OSPF**, and view the displayed details.

Step 8 Specify the **OSPF Interfaces** settings:
Once you have configured the OSPF process with basic properties, you can further deploy that configuration directly on an entire network or on an OSPF area. To do this, you need to specify the OSPF area ID, the device's interface details, the network type, etc. To change OSPF interface settings:

a) Choose **Configuration** > **Network Devices**.
b) Select the device on which you want to configure these changes by clicking the device name hyperlink.
c) Click the **Configuration** tab and choose **Routing > OSPF** .
d) Select the required process by clicking the process ID hyperlink.
e) Click the **OSPF Interfaces** tab.
f) Click the Add ('+') icon to add new settings to the interfaces associated with the selected device's OSPF process. To edit existing values, click the Interface Name hyperlink and click the Edit icon at the top right of the page.
g) Specify the parameters as explained in the table below.
h) Click **Save** to deploy your changes to the device.

Options	Description
OSPF Common Properties	**Description**
Process ID	Unique numerical value between 1 and 65535 that identifies the selected OSPF process.
Router ID	Router ID of the Area 0 router.
Cost	Sets a cost for sending packets across the network, which is used by OSPF routers to calculate the shortest path. This is not enabled for Cisco IOS-XE devices. Enter a numeric value between 1 and 65535.
Topology Priority	Displays the designated router for a subnet. Enter a numeric value between 1 and 255.
Maximum number of paths per route	Defines the highest number of paths that can be used by the router for load balancing per route. The default value is 4. You can set a numeric value between 1 and 64.
Administrative Distance	Specifies the distance that will be set for path selection. The default value is 110 and the available values are between 1 and 255.
External Area Distance	Specify the distance for external type 5 and type 7 routes. Your options are any numeric value between 1 and 255.
Inter Area Distance	Specify the inter area distance for inter-area routes using a value between 1 and 255.
Intra Area Distance	Specify the intra area distance for intra-area routes using a value between 1 and 255.
Routing > OSPF > OSPF Interface/PEP Properties	**Description**
Area ID	Specify the OSPF area ID for the NEs using an integer between the 0 and 4294967295. The ID cannot be 0.0.0.0.
Interface Name	Device's interface with which the specified OSPF interface/pep settings must be associated.
Interface cost	Cost of sending packets across the network. This cost is used by OSPF routers to calculate the shortest path.
Interface Priority	Designated router for a subnet.
Network Type	Type of network associated with the OSPF process. Your options are: Broadcast, NBMA, Point to Point, and Point to Multipoint.
Dead Interval	Number of seconds that will pass while an OSPF router's packets are not visible before its neighbors declare the router down. The Cisco default is 40 seconds.
Hello Interval	Number of seconds between OSPF hello packet advertisements sent by OSPF routers. The Cisco default is 10 seconds.

Options	Description
Retransmit Interval	Time that will elapse before a packet is resent. The Cisco default is 5 seconds.
Transmit Delay	Service speed. The Cisco default is 1 second.

Configure RIP

Routing Information Protocol (RIP) is a distance-vector routing protocol that uses hop count as a routing metric. RIP implements a limit of 15 hops in a path from source to a destination, to prevent routing loops. The hop-count limit also limits the size of the networks that RIP supports. RIP sends its routing table every 30 seconds.

The variants of RIP are RIP version 1 (described in RFC1058) and RIP version 2 (described in RFC2453). RIP uses the split horizon, route poisoning, and holddown mechanisms to prevent incorrect routing information from being propagated.

Step 1 Choose **Configuration** > **Network Devices**.

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Routing** > **RIP**. The RIP Routing page appears with options to configure IPv4 and IPv6 (depending on the device you select) RIP routes.

Step 5 Expand the **IPv4 RIP Routes** and **IPv6 RIP Routes** drop-down menus to specify the following RIP parameters.

Note You can specify the IPv6 addresses depending on your device selection. For example, for Cisco IOS-XR devices, you can only specify IPv4 RIP routes.

a) Select the RIP version.

b) Expand the **IPv4 RIP Routes** drop-down, click the Add (+) button, and enter the IPv4 addresses that must be included for the selected RIP version. A valid IP address consists of 4 octets separated by '.'. Each octet must be in the range 0-255. The only valid IPv4 address starting with 0 is 0.0.0.0.

c) Use the **Passive Interface** tab to select the loopback0 or tunnel values that must be associated as passive interfaces with the RIP route. Depending on the type of device you select, this tab may be hidden. For example, for Cisco IOS-XR devices, you cannot specify passive interfaces.

d) Expand the **IPv6 RIP Routes** drop-down, click the Add (+) button to enter the IPv6 addresses. Depending on the type of device you select, this drop-down may be hidden. For example, for Cisco IOS-XR devices, you cannot specify IPv6 addresses.

e) Click **Save** to deploy your changes to the device.

Configure a Static Routing Protocol

Static routing is the simplest form of routing, where the network administrator manually enters routes into a routing table. The route does not change until the network administrator changes it. Static routing is normally used when there are very few devices to be configured and the administrator is very sure that the routes do not change. The main drawback of static routing is that a change in the network topology or a failure in the external network cannot be handled, because routes that are configured manually must be updated to fix any lost connectivity.

Step 1 Choose **Configuration > Network Devices.**

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Routing > Static**.

Step 5 To configure static routing, click **Add**.

a) In the Basic Configuration area, at a minimum, enter the Interface Number (if not already populated). You can also enter a description, MTU (in bytes), and bandwidth (in Kbps).

b) If you are creating an IPv4 VLAN interface, select an IP Type:

- Static, with the IP address and subnet mask
- DHCP IP, with the pool name

You can also enter a secondary IP address with mask.

c) If you are adding an IPv6 VLAN interface, in the IPv6 Address area, select a type from the Add drop-down list: Global, Unnumbered, Link Local, Auto Configuration, or DHCP.

- Global, with the IP address and subnet mask, and type (General, EUI-64, Anycast, CGA)
- Unnumbered, and enter text in the Interface Unnumbered To text box
- Link Local, auto-configured or manually-configured (requires IPv6 address)
- Autoconfiguration
- DHCP (with option to enable two-message exchange for address allocation)

Step 6 Click **Save**.

Configure ACLs

The Configuration tab in the Device Details page lists the current CFM configuration on the device. Depending on your device configuration and user account privileges, you can use the commands listed in the following table to configure ACLs on the device.

To perform these actions:

Step 1 Choose **Configuration > Network Devices.**

Step 2 Click the device hyperlink to launch its Device Details page.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **Security > ACL**.

Step 5 Specify the following parameters for the ACL:

a) Name/Number- Specify a unique identifier for the ACL. You can use alphanumeric characters, hyphens, and underscores.

b) Type- Specify whether the ACL is of type standard or extended. This drop-down menu is hidden depending on the type of device you select. For example, for Cisco IOS-XR devices this drop-down menu is hidden.

c) (Optional) Description- Enter a description about the ACL for reference.

Step 6 Click **Save** to save your values in the Cisco EPN Manager . This does not deploy your changes to the device.

Step 7 Click the drop-down icon next to the ACL created in the above steps and specify the following ACE values:

a) Click **Add Row** to add a new ACE or select an existing ACE and click **Edit**, to specify the Action (Permit or Deny), Source IP, and optionally the wild card source and description that must be associated with the ACE.

b) Click **Save** to save the values associated with the ACE.

c) Use the up and down arrows (buttons) to specify the order in which the ACEs must be applied on the device for the selected ACL.

Step 8 Select the ACL created in the above steps and click **Apply to Interface** to specify the interface(s) on which this ACL must be applied.

Step 9 Click **OK** to deploy the specified ACL values to the selected interfaces of the device.

Configure EOAM Fault and Performance Monitoring

Cisco EPN Manager enables you to prepare the devices in your network for using EOAM (Ethernet Operations, Administration and Management) protocol for monitoring and troubleshooting Carrier Ethernet services. You can configure Connectivity Fault Management (CFM) on the devices participating in the Ethernet services. You can also perform connectivity and performance tests on the Ethernet services using sets of CLI commands available as predefined templates in Cisco EPN Manager.

Configure CFM

Cisco EPN Manager allows you to configure CFM domains, services, and maintenance endpoints on devices in your network. This CFM configuration sets the stage for using the EOAM protocol to monitor and troubleshoot Carrier Ethernet services. CFM must be configured on the endpoints of the service. This can be done per device using the procedure described in Configure CFM Maintenance Domains and Maintenance Associations (Services), on page 95. Alternatively, CFM can be configured on the EVC level when creating and provisioning an EVC, as described in Create and Provision a New Carrier Ethernet EVC.

Once CFM is configured, you can quickly and easily view the CFM settings on individual devices and make changes if necessary. For example, if there is a problem with traffic flow across a specific EVC, you might

want to make the continuity check interval shorter temporarily in order to analyze the problem, keeping in mind that this will increase the management traffic and thus might impact network performance. You can change the setting on the specific device rather than re-provisioning the entire service.

See these topics for more information:

- CFM Overview, on page 94
- Configure CFM Maintenance Domains and Maintenance Associations (Services), on page 95

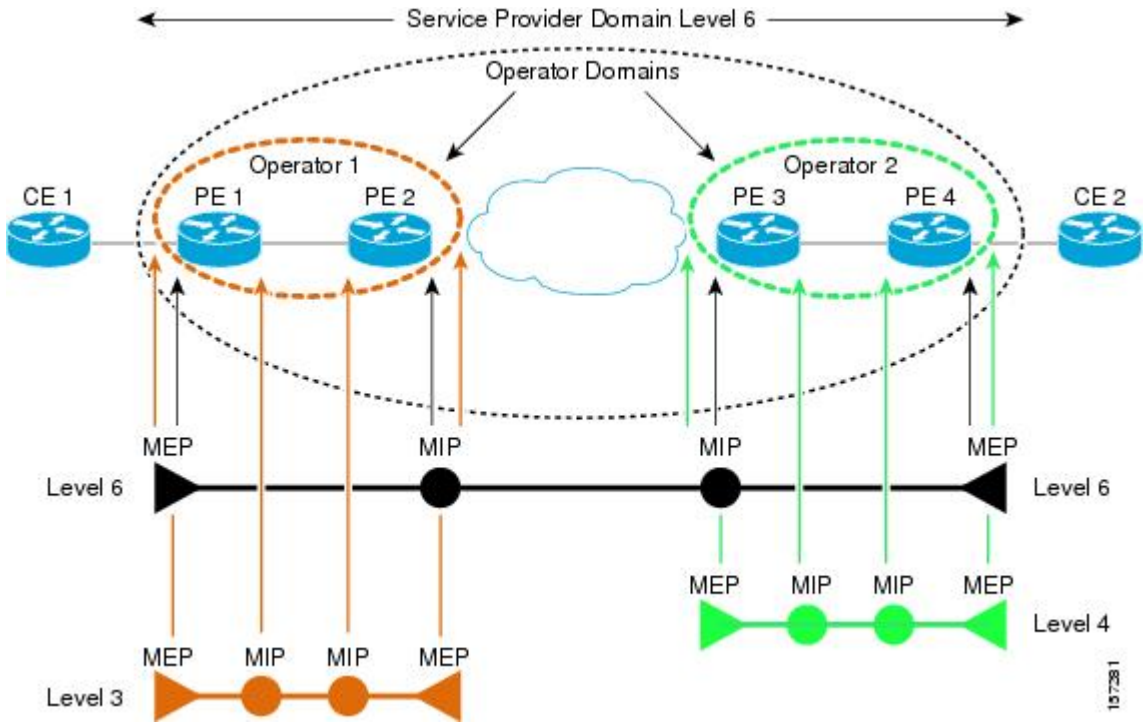
CFM Overview

IEEE Connectivity Fault Management (CFM) is an end-to-end per-service Ethernet layer Operations, Administration, and Maintenance (OAM) protocol. CFM includes proactive connectivity monitoring, fault verification, and fault isolation for large Ethernet metropolitan-area networks (MANs) and WANs.

CFM operates on a per-Service-VLAN (or per-EVC) basis. It lets you know if an EVC has failed, and if so, provides the tools to rapidly isolate the failure.

A CFM-enabled network is made up of maintenance domains, CFM services and maintenance points, as described below.

Figure 2: CFM Maintenance Domains



Maintenance Domains

Ethernet CFM, within any given service provider network, relies on a functional model consisting of hierarchical maintenance domains. A maintenance domain is a management space on a network that is owned and operated by a single entity and defined by a set of internal boundary ports. A domain is assigned a unique maintenance level which defines the hierarchical relationship of domains. Maintenance domains may nest or touch, but

cannot intersect. If two domains nest, the outer domain must have a higher maintenance level than the one it engulfs. A single device might participate in multiple maintenance domains.

CFM Services

A CFM service (maintenance association) enables the partitioning of a CFM maintenance domain according to the connectivity within the network. For example, if the network is divided into a number of virtual LANs (VLANs), a CFM service is created for each of these. CFM can then operate independently in each service. A CFM service is always associated with the maintenance domain within which it operates, and therefore with that domain's maintenance level. All CFM frames relating to the service carry the maintenance level of the associated maintenance domain. There can be many CFM services within a domain. The CFM service must be configured on a domain before MEPs can be configured.

Maintenance Points

A maintenance point demarcates an interface that participates in a CFM maintenance domain. A maintenance point is an instance of a particular CFM service on a specific interface. CFM only operates on an interface if there is a CFM maintenance point on the interface. A maintenance point is always associated with a particular CFM service, and therefore with a particular maintenance domain at a particular level. Maintenance points generally only process CFM frames at the same level as their associated maintenance domain. Frames at a higher maintenance level are always forwarded transparently, while frames at a lower maintenance level are normally dropped. This helps enforce the maintenance domain hierarchy and ensures that CFM frames for a particular domain cannot leak out beyond the boundary of the domain. There are two types of maintenance points:

- Maintenance endpoints (MEPs)—Created at the edge of the domain. Responsible for confining CFM messages within the domain. Maintenance end points (MEPs) are members of a particular service within a domain and are responsible for sourcing and sinking CFM frames. They periodically transmit continuity check messages and receive similar messages from other MEPs within their domain. They also transmit traceroute and loopback messages at the request of the administrator.
- Maintenance intermediate points (MIPs)—Internal to the domain. A MIP will forward CFM packets while MEPs do not forward CFM packets because they must keep them within the domain. MIPs are not explicitly configured on each interface. MIPs are created automatically according to the algorithm specified in the CFM 802.1ag standard.

Configure CFM Maintenance Domains and Maintenance Associations (Services)

To enable CFM in your network, you need to create the relevant maintenance domains and define the maintenance points participating in the maintenance domain. For each device, you specify to which maintenance domain it belongs by assigning a maintenance domain level. You then define the CFM services, where you associate MEPs with the maintenance domain, that is, the interfaces on the device that belong to the maintenance domain.

To configure CFM on a device:

Before You Begin

If you want to associate MEP parameters while configuring CFM, ensure that the following commands have been configured on the devices:

For Cisco IOS and Cisco IOS-XE devices:

```
interface <type of interface, gigabit/tengigabit> <interface number>
```

```
service instance <service instance number, for example 1> ethernet
                encapsulation dot1q 1 <vlan id>
```

Step 1 Choose **Inventory > Network Devices** from the left sidebar.

Step 2 Locate the required device in the list of devices and click the device name hyperlink to open the device details window.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **EOAM > CFM**.

Step 5 In the CFM window, click the '+' icon to add a new CFM domain.

Step 6 Enter the following information:

- Maintenance Domain Name—Enter the name of the maintenance domain to which the device belongs.
- MEP Archive Hold Time—Enter the number of minutes that data from a missing maintenance end point (MEP) is kept before it is purged. The range is 1 to 65535.
- Level— Select a maintenance level (0 to 7) from the **Level** drop-down menu. The level defines the maintenance domain to which the device belongs. A device might belong to more than one maintenance domain, in which case it would be assigned to more than one maintenance level.

Step 7 Click **Save**. The row is added to the table and the configurations are deployed to the device. Now you can define the CFM services and associate end points to the configured maintenance domain. Once the configuration is deployed to the device, you can edit only the MEP Archive Hold Time value in the row. The other values cannot be modified.

Step 8 Locate the maintenance domain name you just created in the table and click on the Maintenance Domain name hyperlink.

Step 9 Click the **Services** tab to add service details.

Step 10 Enter a name for the CFM service.

Step 11 For IOS devices: Enter a bridge domain name.
For IOS-XR devices: Enter the X-connect group name and the name of the point to point connection within the cross connect group.

Step 12 Change the interval (10 to 600000 ms) between messages using the **Continuity Check Interval** drop-down menu.

Step 13 Locate the CFM service you just created in the table and click on the MEP hyperlink. This link was enabled when you saved the details.

Step 14 In the **MEP** tab, specify the interfaces that will serve as the MEPs in the Maintenance Entity Group. These are the interfaces on the device that belong to the specified maintenance domain, have the same level, and are on the same service provider VLAN (S-VLAN).
If the **Interface** drop-down menu is empty, ensure that the device is configured with the pre-requisites mentioned above.

Step 15 For each MEP, enter the MEP ID (a value between 1 and 8191).

Step 16 Click **Save** to save your MEP definitions and close the dialog. To verify that your changes were saved, navigate to **Inventory > Network Devices**, and in the Configuration tab, click **EOAM > CFM** and view the maintenance domain details.

Delete a CFM Domain

You can delete CFM domains that have been created using Cisco EPN Manager. To delete a CFM domain:

Step 1 Choose **Inventory > Network Devices** from the left sidebar.

Step 2 Locate the required device in the list of devices and click the device name hyperlink to open the device details window.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Choose **EOAM > CFM**.

Step 5 Select the domain that you want to delete and in the CFM window, click the 'X' icon to delete it. This deletes the configured maintenance domain both from the table and from the device. If the domain has defined CFM services and associated end points, then you will need to disassociate the services and the end points before deleting the domain.

Perform EOAM Connectivity and Performance Checks

Cisco EPN Manager provides predefined EOAM-related configuration templates that can be used to monitor the connectivity and performance of virtual connections (VCs) in a Carrier Ethernet network.

To use these templates, from the left sidebar, choose **Configuration** > **Templates** > **Features & Technologies**, then choose **CLI Templates** > **System Templates – CLI**.

The following table lists the available EOAM configuration templates, their purpose, and the mandatory input parameters you are required to provide.

Note To see the results and/or output of template deployment, check the job details that are displayed when you deploy a change.

Table 14: EOAM Templates

Template Name	Use it to...	Essential Input Values	Additional Information
EOAM-CCDB-Content-IOS	Display the contents of a maintenance intermediate point (MIP) continuity check database (CCDB) in order to verify CFM operation or to check how EOAM has been set up in the network.	None of the fields are mandatory. **Domain ID:** Choose the way in which you want to identify the maintenance domain and enter a value in the corresponding field. **Service:** Specify a maintenance association within the domain, based on ICC MEG identifier, VLAN ID or VPN ID.	

Template Name	Use it to...	Essential Input Values	Additional Information
EOAM-CCDB-Content-IOS-XR	Display the contents of a maintenance intermediate point (MIP) continuity check database (CCDB) in order to verify CFM operation or to check how EOAM has been set up in the network.	None of the fields are mandatory. **Node ID:** The CFM CCM learning database for the designated node, entered in the rack/slot/module notation.	
EOAM-CFM-Ping-IOS and EOAM-CFM-Ping-IOS-XR	Check connectivity to a destination MIP or MEP using CFM loopback messages.	**Ping Destination Type:** Identify the destination MEP, either by MAC address or MEP ID. Choose Multicast if there are multiple destination MEPs. Maintenance domain name for destination MEP: The name of the domain where the destination MEP resides.	
EOAM-CFM-Traceroute-IOS	IOS devices: Trace the route to a destination MEP to check the number of hops and the connectivity between hops.	**Destination Type:** Identify the destination MEP, either by MAC address or MEP ID. **Maintenance domain name for destination MEP:** The name of the domain where the destination MEP resides. **Service Type:** Identify the maintenance association (MA) within the domain, either by name, ITU carrier code (ICC), MA number, VLAN ID, or VPN ID.	
EOAM-CFM-Traceroute-IOS-XR	IOS-XR devices: Trace the route to a destination MEP to check the number of hops and the connectivity between hops.	**Maintenance domain name for destination MEP:** The name of the domain where the destination MEP resides. **Service Name:** The name of the service instance being monitored by the Maintenance Association (MA) within the specified maintenance domain. **Destination Type:** Identify the destination MEP, either by MAC address or MEP ID. **Source MEP ID:** Identify the maintenance association (MA) within the domain, either by name, ITU carrier code (ICC), MA number, VLAN ID, or VPN ID. **Source Interface Type:** The source interface type of the locally defined CFM MEP. **Interface Path ID:** The physical or virtual interface name.	

Template Name	Use it to...	Essential Input Values	Additional Information
EOAM-Configure-Y-1731-PM-On-Demand-Operation-CFM-Loopback-IOS-XR	Configure an on-demand Ethernet SLA operation for CFM loopback. By default, measures two-way delay and jitter.	**Probe Domain:** Check the checkbox to enable the probe. **Domain Name:** The name of the maintenance domain for the locally defined CFM MEP. **Domain Interface Type:** The source interface type of the locally defined CFM MEP. **Domain Interface Path ID:** The physical or virtual interface name. **Domain MAC Address or MEP-ID:** Choose whether you want to identify the domain by MAC address or by MEP ID and provide the necessary information in the relevant field below. For MEP ID, enter an ID from 1 to 8191.	Optionally, you can specify the type of statistics to measure, whether or not to use bins for aggregate type, probe frequency and duration values, and more. The values you specify will override the default actions.
EOAM-Configure-Y-1731-PM-On-Demand-Operation-CFM-Synthetic-Loss-Measurement-IOS-XR	Configure an on-demand Ethernet SLA operation for CFM synthetic loss measurement. By default, measures one-way Frame Loss Ratio (FLR) in both directions.	**Probe Domain:** Check the checkbox to enable the probe. **Domain Name:** The name of the maintenance domain for the locally defined CFM MEP. **Domain Interface Type:** The source interface type of the locally defined CFM MEP. **Domain Interface Path ID:** The physical or virtual interface name. **Domain MAC Address or MEP-ID:** Choose whether you want to identify the domain by MAC address or by MEP ID and provide the necessary information in the relevant field below. For MEP ID, enter an ID from 1 to 8191.	Optionally, you can specify the type of statistics to measure, whether or not to use bins for aggregate type, probe frequency and duration values, and more. The values you specify will override the default actions.

Template Name	Use it to...	Essential Input Values	Additional Information
EOAM-Configure-Y-1731-PM-On-Demand-Operation-FM-Delay-Measurement-IOS-XR	Configure an on-demand Ethernet SLA operation for CFM delay measurement. By default, measures one-way delay and jitter in both directions, and two-way delay and jitter.	**Probe Domain:** Check the checkbox to enable the probe. **Domain Name:** The name of the maintenance domain for the locally defined CFM MEP. **Domain Interface Type:** The source interface type of the locally defined CFM MEP. **Domain Interface Path ID:** The physical or virtual interface name. **Domain MAC Address or MEP-ID:** Choose whether you want to identify the domain by MAC address or by MEP ID and provide the necessary information in the relevant field below. For MEP ID, enter an ID from 1 to 8191.	Optionally, you can specify the type of statistics to measure, whether or not to use bins for aggregate type, probe frequency and duration values, and more. The values you specify will override the default actions.
EOAM-Configure-Y-1731-PM-Direct-On-Demand-IOS	Perform real-time troubleshooting of Ethernet services in direct mode where an operation is created and run immediately.	Frame Type: The type of frame, either DMMv1 (frame delay) or SLM (frame loss). Domain Name: The name of the maintenance domain for the locally defined CFM MEP. EVC or VLAN: Identify the EVC or VLAN on which the test will be performed. The VLAN ID can be between 1 and 4096. Target MPID or MAC Address: Identify the MEP at the destination, either by MPID (1 to 8191) or by MAC Address. CoS Value: The class of service level (0-7) that will be applied to the CFM message for the specified MEP. Local MPID or MAC Address: Identify the MEP at the source, either by MPID (1 to 8191) or by MAC Address. Burst or Continuous: Specify whether a continuous stream of frames or bursts of frames will be sent during the on-demand operation. Aggregation Period: Specify the length of time in seconds during which the performance measurements are conducted, after which the statistics are generated (1-900).	

Template Name	Use it to...	Essential Input Values	Additional Information
EOAM-Configure-Y-1731-PM-Referenced-On-Demand-IOS	Perform real-time troubleshooting of Ethernet services in referenced mode where a previously configured operation is started and run.	Frame Type: The type of probe, either DMMv1 or SLM. Operation Number: The number of the operation being referenced.	
Remove-CFM-MEP- IOS	Remove the MEP configuration from the device.	Interface Name, Service Instance Number,EVC Name.	
Remove-CFM-MEP-IOSXR	Remove the MEP configuration from the device.	Interface Name, Domain Name.	
Remove-CFM-Service-IOS	Remove the CFM service.	Interface Name, Service Instance Number, EVC Name, Domain Name, Level, Service Name.	

Configure Quality of Service (QoS)

Quality of Service (QoS) is a set of capabilities that allow the delivery of differentiated services for network traffic. QoS features provide better and more predictable network service by:

- Giving preferential treatment to different classes of network traffic.
- Supporting dedicated bandwidth for critical users and applications.
- Controlling jitter and latency (required by real-time traffic).
- Avoiding and managing network congestion.
- Shaping network traffic to smooth the traffic flow.
- Setting traffic priorities across the network.

Using Cisco EPN Manager you can configure QoS on Carrier Ethernet interfaces. Before the appropriate QoS actions can be applied, the relevant traffic must be differentiated by creating classification profiles, or class maps. Packets arriving at the device are checked against the match criteria of the classification profile to determine if the packet belongs to that class. Matching traffic is subjected to the actions defined in an action profile, or policy map.

To configure classification profiles and action profiles, choose **Configuration > QoS > Profiles** from the left sidebar.

This section includes the following topics:

- Create a QoS Classification Profile, on page 102
- Create a QoS Action Profile, on page 104
- Check Which QoS Profiles are Configured on a Device, on page 109
- Apply a QoS Action Profile to Interface(s), on page 109

• Import QoS Profiles Discovered from Devices, on page 110
• Dissociate a QoS Action Profile from Multiple Interfaces, on page 111
• Delete QoS Classification and Action Profiles from Devices, on page 111

Create a QoS Classification Profile

Create classification profiles (class maps) to differentiate traffic into different classes so that certain actions can be applied to traffic that matches the classification criteria.

To create a classification profile:

Step 1 Choose **Configuration > QoS > Profiles** in the left sidebar.

Step 2 Click the Add ("+") icon at the top of the Global QoS Classification Profiles pane.

Step 3 Enter a unique name for the classification profile. The name should reflect the classification criteria defined in the profile for easy identification. For further clarification, you can add a description.

Step 4 Define the matching criteria for the profile:

- Match All—All the classification criteria must be met in order for the traffic to belong to this class.
- Match Any—Any of the classification criteria can be met in order for the traffic to belong to this class.

Step 5 Under QoS Classifications, click the plus icon to define classification criteria for the classification profile.

Step 6 Select an action based on which the traffic will be classified, then click in the Value column and provide the relevant value, as follows:

Action	Description	Value
ACL	The packet must be permitted by the specified access control list (ACL).	The name of the ACL. A string of up to 32 alphanumeric characters.
MPLS - Imposition	The experimental (EXP) bit value on the imposed label entry of the packet must match the MPLS EXP value that you specify. Use either the MPLS Imposition or the MPLS Topmost for matching criteria. Once you have used one of the MPLS criteria, the other one will no longer be available.	A number from 0 to 7. Up to 8 comma-separated values can be entered.
MPLS - Topmost	The experimental (EXP) bit value in the topmost label must match the MPLS EXP value that you specify.	A number from 0 to 7. Up to 8 comma-separated values can be entered.

Action	Description	Value
Cascade	This action is used to cascade one class map into another. It can be used when creating a new class map which has classification policies similar to an existing class map.	Reference the child class map.
QoSClassification - COS	The packet's layer 2 class of service (CoS) bit value must match the specified CoS value.	A number from 0 to 7. Up to 8 comma-separated values can be entered.
QoSClassification - COS - Inner	The specified value must match packet's inner CoS value of QinQ packets for Layer 2 class of service (CoS) marking.	A number from 0 to 7. Up to 8 comma-separated values can be entered.
QoSClassification - DSCP	The packet IP differentiated service code point (DSCP) value must match one or more of the specified values.	Valid values are from 0 to 63. Up to 8 comma-separated values can be entered.
QoSClassification - DSCP - IPv4 only	Match DSCP values for IPv4 packets.	Valid values are from 0 to 63. Up to 8 comma-separated values can be entered.
QoSClassification - Precedence	The packet IP precedence value must match one or more precedence values.	A number from 0 to 7. Up to 8 comma-separated values can be entered.
QoSClassification - Precedence - IPv4 only	Match precedence values for IPv4 packets.	A number from 0 to 7. Up to 8 comma-separated values can be entered.
QoSClassification - DEI	Drop eligible indicator (DEI) is used to indicate frames eligible to be dropped when there is congestion. The packet must match the DEI value specified.	0 or 1.
QoS-Group	The packets must be permitted based on the selected QoS group.	Up to 8 comma separated unique values ranging from or 0-55 or 0-99 based on the selected device. Ensure that the value you enter is supported on the device.

Action	Description	Value
QoSClassification - Service Instance	Service Provider configurations have various service instances on the Provider Edge (PE) routers. QoS policy-maps are applied on these service instances or group of service instances. **Note** This criteria is applicable only on Cisco ASR 903.	Accepts any number of comma separated values ranging from 1-4000 and/or hyphenated value with each ranging from 1-4000.
QoSClassification - Discard Class	Indicates that packets must be permitted/discarded based on the selected discard class.	Accepted value is any number between 0-7.
QoSClassification - Traffic Class	Traffic class of the QoS configuration.	Accepted value is any number between 0-7.

Step 7 Define additional QoS classifications, as required.

Step 8 Click the **Save** button at the bottom of the window to save the profile. A notification in the bottom right corner will confirm that the profile has been saved and the profile will appear in the list of profiles on the left.

Step 9 Select the profile from the list and click the **Deploy** button to initiate deployment of the profile to devices.

Step 10 If you want to create a new profile with the details of an existing Classification Profile , click the **Clone** button. This profile will have the name of the classification profile that you cloned from, and the suffix **-clone**. You can edit the name, matching criteria and any other details of this cloned profile.

Step 11 If you want the selected profile to override any other class map that already exists on the device, check the **Override existing configuration** check box. If this check box is not checked, the profile will be merged with the configurations on the device.

Step 12 Select the device(s) to which you want to deploy the QoS Classification profile.

Step 13 Schedule the deployment, if required.

Step 14 Click **Submit**. A notification in the bottom right corner will confirm that the profile has been deployed. To check the status of the deployment job, choose **Administration > Job Dashboard** from the left sidebar. Select the relevant job to view the job details and history in the lower section of the window. Click the Information icon for further details.

Create a QoS Action Profile

Create action profiles (policy maps) to specify the actions to be applied to traffic belonging to a specific traffic class.

To create an action profile:

Step 1 Choose **Configuration > QoS > Profiles** from the left sidebar.

Step 2 From the QoS Profiles pane on the left, choose, **User Defined Global QoS Profiles > Action Profiles**.

Step 3 Click the Add (“+”) icon at the top of the Create Action Profile pane

Step 4 Enter a unique name for the action profile, and enter a description, if required.

Step 5 Select the classification profiles for which you want to assign actions. Under Classification Profiles, click the plus icon, select the required profile(s) from the list, and click **OK**.

Step 6 Select the Classification Profile (class map) and define the actions to be applied if traffic matches the profile. You can define Policing, Marking, Queuing, Shaping, RED actions, and Service Policy (H-QoS). There is a tab for each of these action types and its definitions, as follows:

- **Policer Action:** Traffic policing manages the maximum rate of traffic allowed on an interface through a token bucket algorithm. Traffic policing also provides a certain amount of bandwidth management by allowing you to set the burst size (Bc) for the CIR. When the peak information rate (PIR) is supported, a second token bucket is enforced and this two-rate policer can meter traffic at two independent rates: the committed information rate (CIR) and the peak information rate (PIR). The committed token bucket can hold bytes up to the size of the committed burst (bc) before overflowing and determines whether a packet conforms to or exceeds the CIR. The peak token bucket can hold bytes up to the size of the peak burst (Be) before overflowing, and determines whether a packet violates the PIR. Different actions can be taken if a packet conforms, exceeds, or violates the CIR/PIR. For instance, packets that conform can be configured to be sent, packets that exceed can be configured to be sent with a decreased priority, and packets that violate can be configured to be dropped.

  In the Policer Action tab, specify the following:

  - Committed Information Rate (CIR)—The long-term average transmission rate, specified in bits per second (bps) or as a percentage of the available or unused bandwidth. Traffic that falls under this rate will always conform. Ensure that the CIR value you enter is supported on the device and choose the right CIR unit value (bps, kbps, mbps, gbps, and percent).
  - Burst (Bc)—How large traffic bursts can be (in bytes) before some traffic exceeds the CIR.
  - Excess Burst (Be)—How large traffic bursts can be (in bytes) before traffic exceeds the PIR.
  - Under Traffic Coloring, select the action to be performed if the traffic conforms, exceeds, or violates the rate limit. Provide values as required.

- **Marker Action:** Packet marking allows you to partition your network into multiple priority levels or classes of service. Marking of a traffic flow is performed by:

  - Setting IP Precedence or DSCP bits in the IP Type of Service (ToS) byte

    .
  - Setting CoS bits in the Layer 2 headers.
  - Setting EXP bits within the imposed or the topmost Multiprotocol Label Switching (MPLS) label.
  - Setting qos-group, traffic-class, and discard-class bits.

  In the Marker Action tab, specify the following:

- Marking Feature and Marking Value—The method by which the traffic will be marked, and the required value.

- **Queueing Action:** Queueing is used for traffic congestion management. It entails the creation of queues, assignment of packets to those queues based on the classification of the packet, and scheduling of the packets in a queue for transmission.

  In the Queueing Action tab, select the method by which traffic will be queued, either Bandwidth or Priority, then specify the following:

  - Bandwidth—The amount of bandwidth to be assigned to the traffic class, either in kilobits per second, or as a percentage of absolute guaranteed bandwidth. If you selected to queue by bandwidth, you can also assign bandwidth as a percentage of remaining bandwidth.
  - Queue Limit— The maximum number of packets/bytes/milliseconds for all the individual queues associated with this class. When the queue size exceeds this value, packets will be dropped.

  If you selected Bandwidth, specify the following:

  - Enable Fair Queue—Check the check box to enable weighted fair queueing

    .
  - Individual Queue Size—Relevant if fair queueing is enabled. Specify the maximum number of packets allowed in each per-class queue during periods of congestion.

  If you selected Priority, specify the following:

  - Queue Burst Size (bytes)—The burst size configures the network to accommodate temporary bursts of traffic. Range is 18 to 2000000 bytes. Default is 200 milliseconds of traffic at the configured bandwidth rate.
  - Priority Level—Classes under a policy map can have different priority, from priority queue level 1 to 3. Packets on these queues are subjected to less latency with respect to other queues. You cannot specify the same priority level for two different classes in the same policy map.

- **Shaping Action:** Traffic shaping regulates traffic by shaping it to a specified rate.

  In the Shaping Action tab, specify the following:

  - Select Average or Peak rate traffic shaping—Average rate shaping limits the transmission rate to the CIR. Peak rate shaping configures the router to send more traffic than the CIR. To determine the peak rate, the router uses the following formula: peak rate = CIR(1 + Be / Bc) where Be is the Excess Burst size and Bc is the Committed Burst size.
  - If you selected Peak rate traffic shaping, specify the burst size and the excess burst size in bytes.
  - If required, enable FECN Adaptive Shaping. Adaptive shaping estimates the available bandwidth when backward explicit congestion notification (BECN) signals are received. With FECN adaptive shaping, the router reflects forward explicit congestion notification (FECN) signals as BECN signals.
  - If FECN Adaptive Shaping is enabled, specify the Adaptive Rate, which is the minimum bit rate to which the traffic is shaped.

- **RED Action:** Weighted Random Early Detection (WRED) is a congestion avoidance technique that implements a proactive queuing strategy that controls congestion before a queue reaches its queue limit. WRED combines the capabilities of the random early detection (RED) mechanism with IP precedence, differential services code point

(DSCP), and discard-class to provide preferential handling of higher priority packets. When an interface starts to become congested, WRED discards lower priority traffic with a higher probability. WRED controls the average depth of Layer 3 queues.

In the RED Action tab, specify the following:

- Classification Mechanism—Select the basis upon which the WRED drop policies are defined. For WRED, you define drop policies based on specific packet classification, as follows:

  CLP—Configures a drop policy for WRED based on a cell loss priority (CLP) value. Valid values are 0 or 1.

  CoS—Configures a drop policy for WRED based on the specified class of service (CoS) bit associated with the packet. Valid values are from 0 to 7.

  Discard Class—Configures a drop policy for WRED based on a discard-class value. Valid values are from 0 to 7. The discard-class value sets the per-hop behavior (PHB) for dropping traffic. WRED based on discard-class is an egress function.

  DSCP—Configures a drop policy for WRED based on a DSCP value. When configured, the router randomly drops packets with the specified DSCP value, according to the WRED thresholds you configure.

  Precedence—Configures a drop policy for WRED based on an IP precedence level. Valid values are from 0 to 7, where 0 typically represents low priority traffic that can be aggressively managed (dropped) and 7 represents high priority traffic. Traffic at a low precedence level typically has a higher drop probability. When WRED drops packets, source hosts using TCP detect the drops and slow the transmission of packets.

  DEI—The discard eligibility (DE) bit in the address field of a frame relay frame is used to prioritize the discarding of frames in congested frame relay networks. The frame relay DE bit has only one bit and therefore only has two settings, 0 or 1. If congestion occurs in a frame relay network, frames with the DE bit set at 1 are discarded before frames with the DE bit set at 0.

  RED Default—The default set of minimum thresholds, maximum thresholds, and Mark Probability Denominator (MPD) settings for a class in the WRED profile.

- If required, enable ECN. ECN (Explicit Congestion Notification) marks packets instead of dropping them when the average queue length exceeds a specific threshold value. Routers and end hosts use this marking as a signal that the network is congested and slow down packet transmission.

- Define the thresholds and mark probability per valid value of the selected classification mechanism. For example, if you are using Precedence, you can define thresholds for each of the 7 valid values. The minimum threshold is the minimum number of packets allowed in the queue. When the average queue length reaches the minimum threshold, WRED randomly drops *some* packets with the specified DSCP, IP precedence, discard-class, or atm-clp value. Valid minimum threshold values are from 1 to 16,384. The maximum threshold is the maximum number of packets allowed in the queue. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified DSCP, IP precedence, discard-class, or atm-clp value. Valid maximum threshold values are from the value of the minimum threshold to 16,384.

- **Service Policy:**

Using the Service Policy tab, you can configure Hierarchical QoS (H-QoS) which enables you to specify QoS behavior at multiple levels of hierarchy. You can use H-QoS to specify multiple policy maps to shape multiple queues together. All hierarchical policy types consist of a top-level parent policy and one or more child policies. The service-policy command is used to apply a policy to another policy, and a policy to an interface.

To configure H-QoS, navigate to the **Service Policy** tab, select the **Enable** check box, and use the **Service Policy** drop-down menu to select the child service policy. The selected child service policy will be associated to the parent

policy map that this action profile belongs to. Note that a child service policy cannot act as a parent policy of the same policy map. For example, if a child service policy called X belongs to a parent policy map Y, then the child policy X cannot contain the service policy map Y.

H-QoS Limitations: On Cisco IOS-XE devices such as Cisco ASR903, Cisco ASR907, Cisco ASR920, and Cisco NCS42XX, the following H-QoS limitations are applicable:

- Parent policy map limitations:
  - A parent policy map can be created only using the 'class-default' class.
  - The parent policy map must contain a class with matching criterion such as an EFP (service instance).
  - The parent policy map must contain a class with matching criterion such as VLANs.
- Child policy map limitations:
  - Child policy maps cannot be created with EFP (service instance) and VLAN as the match-type.

Step 7 Click the **Save** button at the bottom of the window to save the profile. A notification in the bottom right corner will confirm that the profile has been saved and the profile will appear in the list of profiles on the left.

Step 8 From the Global QoS Action Profiles pane, select the profile, and click the **Deploy** button to initiate deployment of the profile to devices.

Step 9 If you want to create a new profile with the details of an existing Action Profile , click the **Clone** button. This profile will have the name of the action profile that you cloned from, and the suffix **-clone**. You can edit the name, actions and any other details of this cloned profile.

Step 10 If you want the selected profile to override any other policy map that already exists on the device, check the **Override existing configuration** check box. If this check box is not checked, the profile will be merged with the configurations on the device.

Step 11 Select the device(s) to which you want to deploy the QoS Action profile.

Step 12 Schedule the deployment, if required.

Step 13 Click **Submit**. A notification in the bottom right corner will confirm that the profile has been deployed. To check the status of the deployment job, choose **Administration > Job Dashboard** from the left sidebar. Select the relevant job to view the job details and history in the lower section of the window. Click the Information icon for further details.

Check Which QoS Profiles are Configured on a Device

To see the QoS profiles that have been deployed to a specific device:

Step 1 Choose **Inventory > Network Devices** from the left sidebar.

Step 2 Locate the required device and click on the device name hyperlink to display the device details.

Step 3 Click the **Configuration** tab, then click the **Logical View** left side tab.

Step 4 Click on the arrow next to QoS in the left pane, and select either **Action Profiles** or **Classification Profiles**. A table listing the profiles that have been deployed to the selected device is displayed. Click on the profile name (blue hyperlink) to display the details of the profile.

Apply a QoS Action Profile to Interface(s)

You can select an action profile deployed to a device and apply it to multiple interfaces on that device. An action profile enables you to specify the actions to be applied to traffic belonging to a specific traffic class. Before applying an existing profile to interfaces, you can modify the profile or use it to create a new profile. When you choose an interface that has an action profile already applied to it, Cisco EPN Manager notifies you about it and enables you to override the existing profile. To be able to apply an action profile to interfaces, you first need to ensure that the required profile has been deployed to the device. To do this, see Create a QoS Action Profile, on page 104.

To apply an action profile to interfaces:

Step 1 Choose **Configuration > QoS > Interfaces** from the left sidebar.
Cisco EPN Manager interfaces are displayed under the categories **Ethernet CSMA/CD, IEEE8023 ADLAG**, **Gigabit Ethernet**, and **L2 VLAN**. All other ports are displayed under the **User Defined** category.

Step 2 Select the interfaces that you want to associate to an Action profile.

Step 3 Click **Associate Action Profile** to select the action profile and to set the direction in which it must be applied.
The available action profiles list and the interfaces it can be applied to are listed. The interfaces are listed by their name, application direction, and the action profiles that already exist on the interface.

Step 4 Select the required action profile from the **Action Profiles** drop-down menu. If the menu is empty, you need to create action profile and then try to associate them with devices. See, Create a QoS Action Profile, on page 104.

Step 5 In the **Interfaces** section, specify the direction in which the profile is to be applied. While applying a profile to a sub-interface, ensure that it is applied in a direction opposite to that of the main interface. To change the applied direction, use the **Edit** icon at the top left corner of the dialog.

Note Policy Maps that contain queuing actions cannot be applied to interfaces in Ingress direction.

Step 6 (Optional) You can also schedule the application of the selected action profile to a later date and time. To do this, expand the **Schedule** section and specify the date and time and frequency for when you the profile to be applied. This task can further be edited on the Jobs page if required.

Step 7 Click **OK** to apply the action profile to the selected devices. A notification at the bottom right corner of the dialog will confirm whether the profile has been successfully applied or if the job failed. Click the **Show Details** link for more information.
To dissociate action profiles from the interfaces they are applied to, see Dissociate a QoS Action Profile from Multiple Interfaces, on page 111

Import QoS Profiles Discovered from Devices

You can import QoS profiles discovered from the device directly into Cisco EPN Manager . Once the QoS profiles are imported, they can be edited and further configured on the device using Cisco EPN Manager . Profiles which are discovered from the device with profile names that match other profiles already present in Cisco EPN Manager are represented as Global profiles. This is indicated in the Global column in the Global Profiles page. Note that Global profiles could have the same names but different QoS configuration. While importing global profiles, you can choose to either overwrite the existing profile (with the same name) using the discovered profile or you can rename the profile before you import it.

To import QoS profiles discovered from devices:

Before You Begin

Ensure that the device's Inventory Collection status is Completed. This ensures that the QoS profiles from the devices are discovered by Cisco EPN Manager .

Step 1 Choose **Configuration > QoS > Profiles** from the left sidebar to display all Cisco EPN Manager QoS profiles.

Step 2 To import Action profiles, from the QoS Profiles pane on the left, choose, **Discovered Profiles** > **Action Profiles**.

Step 3 To import Classification profiles, from the QoS Profiles pane on the left, choose, **Discovered Profiles** > **Classification Profiles**.

Step 4 To first select a device and choose the profiles discovered on that device:

a) Choose **Configuration > Network Devices**, and select the device by clicking the device's Name hyperlink.
b) Click the **Configuration** tab, then click the **Logical View** left side tab.
c) Expand **QoS**.
d) Choose **Action Profiles** or **Classification Profiles** based on the type of profile you want to import from the device.
e) (Optional) After viewing the profiles, to import these profiles directly from the page that lists all QoS profiles discovered by Cisco EPN Manager , click the **Global Profile Page** hyperlink, and skip to Step 5.
f) Select the profiles and click **Make Global**.

g) Go to Step 6.

Step 5 Select the profiles that you want to import and click **Import**. To ensure that you are importing profiles that are not already present on the device, choose profiles that are not Global (marked as No in the Global column).

Step 6 If there are duplicate profiles present in Cisco EPN Manager , you are asked to either rename the profile to create a profile with a new name and the same QoS configuration or overwrite the existing profile. Make the required changes.

Step 7 If you want to create a new profile with the details of an existing QoS Profile , click the **Clone** button. This profile will have the name of the QoS profile that you cloned from, and the suffix **-clone**. You can edit any details of this cloned profile.

Step 8 Click **Save** to import the selected QoS profiles.
To apply the imported profiles to a given device's interfaces, see, Apply a QoS Action Profile to Interface(s), on page 109.

Dissociate a QoS Action Profile from Multiple Interfaces

An action profile enables you to specify the actions to be applied to traffic belonging to a specific traffic class. You can select an action profile deployed to a device and apply it to multiple interfaces on that device. After you have applied the profile to the interfaces, you can choose to dissociate them from those interfaces if required. To dissociate an action profile from interfaces, you first need to ensure that the required profile has been applied to the device. See Apply a QoS Action Profile to Interface(s), on page 109.

To apply an action profile to interfaces:

Step 1 Choose **Configuration** > **QoS** > **Interfaces** from the left sidebar.
Alternatively, you can navigate to **Configuration > QoS > Profiles** to first select the profile before dissociating it from the interfaces it is applied to.

Cisco EPN Manager interfaces are displayed under the categories **Ethernet CSMA/CD, IEEE8023 ADLAG**, and **L2 VLAN**. All other ports are displayed under the **User Defined** category.

Step 2 Select the interfaces from which you want to dissociate the action profile.

Step 3 Click **Dis-associate Action Profile**.

Step 4 (Optional) You can also schedule the de-association of action profiles to a later date and time. To do this, expand the **Schedule** section and specify the date, time, and frequency based on which the profiles must be dissociated.

Step 5 Click **OK** to confirm. The selected interfaces are dissociated from the action profiles that were applied to them. A notification at the bottom right corner of the window will confirm whether the profile has been successfully dissociated or if the job failed. Click the **Show Details** link for more information.

Delete QoS Classification and Action Profiles from Devices

To delete QoS classification and action profiles that are deployed to devices, navigate to the paths listed in the table below.

Note You cannot delete QoS action and classification profiles discovered directly from the device. Only profiles created using (and imported into) Cisco EPN Manager can be deleted.

In order to avoid deletion of referenced profiles, the delete operation is not supported in the following scenarios:

- You cannot delete QoS classification profiles associated with other classification profiles. For example if a classification profile uses the Cascade option to reference the selected classification profile, then the delete operation for the selected profile will fail.
- You cannot delete a QoS classification profiles referenced by an action profile.
- Action profiles successfully applied to device interfaces cannot be deleted.
- An action profile cannot be deleted if it is referenced by another action profile. For example, if action profiles are associated to other action profiles by use of a reference policy, then the delete operation of such action profiles fails.

Table 15: Navigation paths to delete QoS action and classification profiles

Task	Steps in the GUI
Delete user defined classification profiles	**1** Choose **Configuration > QoS > Classification Profiles**. **2** Select the classification profile you want to remove from the devices as well as from Cisco EPN Manager . **3** Click the **X** (delete) icon in the task bar. **4** Alternatively, you can click the device hyperlink to choose the devices from which the selected classification profile must be deleted. **5** Click **Submit**. You can view the status of the delete operation by clicking the Job Details pop up window.
Delete user defined action profiles	**1** Choose **Configuration > QoS > Action Profiles**. **2** Select the action profile you want to remove from the devices as well as from Cisco EPN Manager . **3** Click the **X** (delete) icon in the task bar. **4** Alternatively, you can click the device hyperlink to choose the devices from which the selected action profile must be deleted. **5** Click **Submit**. You can view the status of the delete operation by clicking the Job Details pop up window.

Launch Cisco Transport Controller to Manage Cisco NCS and Cisco ONS Devices

The Cisco Transport Controller (CTC) is the software interface for a subset of Cisco ONS and Cisco NCS devices. CTC is a Java application that resides on the control cards. It is used to provision and administer these devices.

You can launch CTC from Cisco EPN Manager. Only the latest CTC release is launched, regardless of the NE release you selected. If you need to use other CTC releases, launch CTC from a web browser and connect directly to the NE that has the required CTC release.

To launch CTC:

Before You Begin

Make sure the devices are properly configured to launch CTC. See Configure Devices So They Can Be Modeled and Monitored.

Step 1 From the left sidebar, choose **Inventory > Device Management > Network Devices**.

Step 2 Click the "**i**" icon next to the Cisco ONS or Cisco NCS 4000 device's IP address to launch the Device 360 view.

Step 3 In the Device 360 view, choose **Actions > Launch CTC**. The CTC launcher application is downloaded to your computer.

Step 4 In the CTC Launcher window, choose one of the following connection mode:

- Use IP—Connection to the device is established using the device's IP address (default option).
- Use TL1 Tunnel—Connection to the device is established using a TL1 session. You can start a TL1 session from CTC or use a TL1 terminal. Note- Use this option to connect to the device that resides behind the third-party OSI-based GNE. The CTC launcher creates a TL1 tunnel to transport the TCP traffic through the OSI-based GNE and the provisioning occurs in CTC

Step 5 Select the CTC Version, and then click **Launch CTC**.

Step 6 Enter your CTC credentials.