



## Provision Circuits/VCs

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## Provision Circuits/VCs in Cisco EPN Manager

The process of creating and provisioning a circuit/VC is similar for all the supported technologies and involves:

- Specifying the endpoints of the circuit/VC.
- Defining the configuration parameters of the circuit/VC.

To create and provision a new circuit/VC:

- 
- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.
  - Step 2** Click on the **Device Groups** button, select the required device group(s) and click **Load**.
  - Step 3** Close the **Device Groups** dialog box.
  - Step 4** In the **Network Topology** window, click the **Circuits/VCs** tab.
  - Step 5** Click the '+' icon to open the Provisioning Wizard in a new pane to the right of the map.

**Note** You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**

- Step 6** From the **Technology** drop-down list, choose the required technology. For example, if you are creating a circuit for Optical/DWDM network, choose **Optical**.
- Step 7** In the **Service Type** area, choose the type of circuit/VC you want to create. For example, if you are creating a circuit/VC for Optical/DWDM network, the various circuit types include OCHNC WSON, OCHCC WSON, OCH-Trail WSON, OCH-Trail UNI, ODU UNI, ODU Tunnel, and OPU over ODU.
- Step 8** If you have defined profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles](#), on page 109.
- Step 9** Click **Next** to go to the Customer Service Details page.
- Step 10** (Optional) Select the customer for whom the circuit/VC is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then go to the Provisioning Wizard to start provisioning the circuit/VC.
- Step 11** Enter the service name and its description.
- Step 12** From the **Deployment Action** drop-down list, choose the action that you want to perform after defining the attributes for the circuit/VC. The options are:
- **Preview**—Displays the generated CLIs for each device. You can review the CLIs and decide if you want to edit any attributes or go ahead with the deployment.
  - **Deploy**—Deploys the configuration to the relevant devices immediately after you click **Submit** in the last page of the Provisioning Wizard.
- Click one of the following deployment options:
- **Deploy Now**—Directly deploys the provisioning order
  - **Deploy Later**—Saves the created provisioning order. You can deploy the same order at later point of time. To redeploy the provisioning order click the circuit/VCS link at the bottom of the left pane.
  - **Schedule Deployment**—Saves the order for future deployment at the designated time provided by you. Schedules the provisioning order and creates the Job order to be deployed at the scheduled time. If required, you can specify the date and time to provision the order in the Job Scheduler dialog box.
- If you click this **Schedule Deployment** radio button, specify the following:
- **Deploy Schedule Time**—Specify a schedule time for deployment of provision order.
  - **Server Time**—Displays the current server time.
- To know more about how to schedule and save a provisioning order, see [Save and Schedule a Provisioning Order](#), on page 81
- Step 13** Click **Next** to choose the endpoints and define the attributes based on the technology you have selected.
- Step 14** Click **Submit**. Depending on the deployment action you have chosen, the relevant action will be performed. That is, if you have chosen to preview the configuration, the preview page will be displayed where you can view the configurations, and then click **Deploy**. If you have chosen to deploy, the configurations are directly deployed to the relevant devices.
- Step 15** (Optional) Click the **Leave this View** button to continue using Cisco EPN Manager and to enable the service deployment to continue in the background.

**Note** If the device is busy, the request from Cisco EPN Manager to deploy the service will wait up to a pre-configured period of time before the request times out. To change this setting, see [Set the Service Deployment Timeout Value, on page 3](#).

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The circuit/VC should be added to the list in the Circuits/VCS pane in the Network Topology window. To check the provisioning state, click the **i** icon next to the circuit/VC name to see the Circuit/VC 360 view.

For information about how to create and provision circuit/VCS for various technologies, see:

- [Provision EVCs in a Carrier Ethernet Network, on page 9](#)
- [Provision Circuits in an Optical/DWDM Network, on page 29](#)
- [Provision L3VPN Services, on page 55](#)
- [Provision Circuit Emulation Services, on page 75](#)
- [Provision MPLS Traffic Engineering Services, on page 84](#)

You can view the saved provisioning order in the Planned Circuits/VCS tab from **Administration > Dashboards > Job Dashboard > Provisioning**.

Click the **(I)** icon at the **Last run stat** field and view the configuration and Device details.

## Set the Service Deployment Timeout Value

When you deploy a service to devices, if the devices are pre-occupied or busy, the service request created waits for a pre-configured period of time to acquire a ‘device lock’ for deploying the service. By default, the timeout value is set to 60 minutes.

To change the default timeout value:

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- Step 1** From the left sidebar, choose **Administration > Settings > System Settings**.
  - Step 2** Expand the **Circuits/VCS** section and click **Deployment Settings**.
  - Step 3** Set the required timeout value in minutes.

Cisco EPN Manager will now wait up to the specified time period to acquire the device lock for deploying the service. If the lock is not acquired within this time, the service deploy operation will fail.

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## Set the Circuit Activation Wait Timeout Value

You can configure the maximum time interval for which the provisioning system waits until circuit activation wait timeout.

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- Step 1** From the left sidebar, choose **Administration > Settings > System Settings**.
  - Step 2** Expand the **Circuits/VCS** section and click **Deployment Settings**.
  - Step 3** Set the required timeout value in minutes in the **Circuit Activation Wait Timeout** field.

By default, the timeout is 5 minutes.

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## Configure to Auto Delete WSON/SSON Circuits

You can enable the option to auto delete the NCS2K TL1 based WSON/SSON circuits that EPNM manages. If the circuits are deleted from other devices or CTC, it is also deleted from EPNM. To configure auto delete WSON/SSON circuits:

- 
- Step 1** From the left sidebar, choose **Administration > Settings > System Settings**.
  - Step 2** Expand the **Circuits/VCS** section and click **Deployment Settings**.
  - Step 3** Check the **Auto delete WSON/SSON circuits** check box.
- 

## What Happens When a Deployment Fails

When you deploy a circuit/VC, Cisco EPN Manager performs configuration changes in the participating devices based on the type of circuit/VC. Only when the configuration changes are successfully deployed to the devices, the circuit/VC will be considered as successfully provisioned. If the deployment of configuration changes fails in any one of the participating device, Cisco EPN Manager rolls back the configuration changes made so far in all the devices.

If the deployment of configuration changes fails in any one of the participating device, you can click **Redeploy** on the provisioning wizard. The redeploy action reattempts the deployment with the same configuration.



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**Note** Redeploy button is supported for OCHNC WSON, OCHCC WSON, OCHCC, OCH-Trail WSON, OCH-Trail, Media Channel NC SSON, Media Channel Trail SSON, Media Channel CC SSON optical circuits.

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Deployment action can result in any one of the following scenarios:

- Deployment succeeds in all the participating devices; roll back is not initiated—In this scenario, all devices are successfully configured and the circuit provisioning is successful.
- Deployment fails; roll back is initiated and succeeds—In this scenario, when configuring multiple devices, the configuration fails in one of the device. The failure could be due to various reasons, for example, the device has declined the configuration. Cisco EPN Manager identifies the failure and successfully rolls back all the configuration changes that were made on all the devices. In this scenario, all device configurations are restored to the states, which were there before the deployment was attempted.

Here is an example with three devices, A, B, and C, which are configured in a sequential order to provision a circuit. The configuration changes are deployed successfully in device A, but the deployment fails in device B. Cisco EPN Manager detects the failure and stops further configuration in devices B and C. It rolls back the configuration in the reverse order of provisioning, that is, it first rolls back the device B, followed by device A. Following are the actions that are performed sequentially in the three devices:

- Device C—Rollback is not required for device C because there were no changes deployed to the device. This is because the configuration failure was detected in device B before configurations changes were sent to device C.

- Device B—Cisco EPN Manager checks if there are any configuration changes made on this device before the deployment failed. If there are any changes, the partial configuration on this device is removed and the device is rolled back to the previous configuration.
- Device A—Cisco EPN Manager performs a complete roll back in device A, where all the configuration changes that were successfully deployed earlier are removed and the device is rolled back to the previous configuration.
- Deployment fails; roll back is initiated but fails— In this scenario, when the configuration deployment fails on any of the participating device(s), Cisco EPN Manager performs a rollback, but the rollback on one or more devices fail. Now, the device(s) on which the roll back had failed, has the partial configuration. For example, the configuration changes are successfully deployed in devices A and B, the deployment fails in device C. Cisco EPN Manager identifies the failure and initiates the rollback in the reverse order of provisioning, that is, it first rolls back the device C, device B, and then device A. Following are the actions that are performed sequentially in the three devices:
  - Device C—Cisco EPN Manager performs a successful rollback in device C.
  - Device B—When attempting a rollback on device B, device connectivity is lost and there could be partial configurations left on the device.
  - Device A—Cisco EPN Manager performs a rollback of Device A, even if the roll back fails in device B.



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**Note** The rollback may fail due to various other reasons.

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In the Provisioning Wizard, after previewing the configurations, click **Deploy**. When the deployment fails, the rollback configuration and the status for each participating device is displayed. From the **Device(s)** drop-down list, choose the device for which you want to view the rollback configuration and the status.

The following figure illustrates the rollback configuration and the rollback status for each device.

What Happens When a Deployment Fails

**Deploy: Failure**

Service Name **EVPL\_withQOS**

Service Type **EVPL**

Device(s) **NCS4206-120.81**

**Attempted Configuration**

```

ethernet cfm domain EVC level 4
service number 41 evc EVPL_withQOS
continuity-check
continuity-check interval 1s
ethernet evc EVPL_withQOS
oam protocol cfm domain EVC
class-map match-all test_1
match cos 3
policy-map pol_123
class test_1
police cir 900m
conform-action transmit
exceed-action drop
interface pseudowire177
encapsulation mpis
control-word include
neighbor 192.168.0.145 159
mtu 1508
interface GigabitEthernet0/0/7
no ethernet lmi interface
ethernet uni id Testuni23
service instance 5 ethernet EVPL_withQOS
    
```

**Status**

```

Command returned an error : customizedError
config t
Enter configuration commands, one per line. End with CNTL/Z.
NCS4206-120.81(config)#ethernet cfm domain EVC level 4
NCS4206-120.81(config-ecfm)#service number 41 evc EVPL_withQOS
NCS4206-120.81(config-ecfm-srv)#continuity-check
NCS4206-120.81(config-ecfm-srv)#continuity-check interval 1s
NCS4206-120.81(config-ecfm-srv)#ethernet evc EVPL_withQOS
NCS4206-120.81(config-ecv)#oam protocol cfm domain EVC
    
```

**Rollback Configuration**

```

interface GigabitEthernet0/0/7
no service instance 5 ethernet EVPL_withQOS
no interface pseudowire177
ethernet evc EVPL_withQOS
no oam protocol cfm
ethernet cfm domain EVC level 4
no service number 41 evc EVPL_withQOS
class-map match-all test_1
no match cos 3
policy-map pol_123
class test_1
no police cir 900000000
police cir 90000000
conform-action transmit
exceed-action drop
interface GigabitEthernet0/0/7
no ethernet uni id Testuni23
ethernet lmi interface
ethernet uni id Testuni23
    
```

**Rollback** Success

1	Attempted Configuration— Shows the configurations that were deployed to the device selected in the <b>Device(s)</b> drop-down list.
2	Deployment Status— Shows the deployment status of the selected device. If the deployment succeeds, it shows the status as "Success". If the deployment fails, it provides information about the failure.
3	Roll back Configuration— Shows the configurations for which rollback is automatically attempted.

4	Roll back Status— Shows the rollback status of the selected device. If the rollback succeeds, it shows the status as "Success". If the rollback fails, it provides information about the failure. You can use this information to manually clean up the partial configurations on the device.
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You can also delete the failed deployments from this window by clicking **Delete**.

You can also click the *i* icon next to the **Provisioning** column in the Circuits/VCS and Deleted Circuits/VCS tabs in the extended tables to view the details of configuration, configuration errors, rollback configuration, and rollback configuration errors for each device participating in the circuit/VC. The *i* icon is available for all provisioning states, except None. For information about how to access the extended tables, see [View Detailed Tables of Alarms, Network Interfaces, Circuits/VCS, and Links from a Network Topology Map](#).

For information about how to troubleshoot deployment and rollback failures, see [Troubleshoot Configuration Deployment Failures and Roll Back Failures, on page 7](#).

## Troubleshoot Configuration Deployment Failures and Roll Back Failures

Following are the tips to troubleshoot the deployment or roll back failures:

- Deployment fails, but roll back succeeds— If the configuration deployment fails, roll back is automatically initiated and the results are displayed in the results page. Analyze the attempted configuration and error message shown in the results page for each device and identify the root cause of the deployment failure.

The deployment failure could be due to, but not limited to the following issues:

- Invalid values entered for the service parameters in the Provisioning Wizard. For example, the Service ID may already exist or there could be semantic errors in the CLI that is generated, and so on.
- Device issues such as, device is not reachable, device password has changed, and so on.

In this case, you must locate the circuit (by the name that you had given when creating it) for which deployment has failed, edit the circuit, and re-attempt the provisioning. If the service parameter for which the value to be changed is not editable, delete the circuit and create a new circuit.




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**Note** Before deleting the circuit, ensure that it is not in use.

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- Both, deployment and roll back fails— In this case, do the following:
  1. Ensure that the device is reachable and perform a device re-synch.
  2. If there were any device issues that were reported in the previous deployment, try to fix the issues.
  3. Edit the circuit and update the attributes, if required, and then re-attempt the circuit deployment.
  4. If the deployment fails, Cisco EPN Manager will initiate the roll back.
  5. If the roll back fails again, identify the cause of the roll back failure.
  6. To identify the cause of the failure, you can use the configuration and roll back transaction details, history of the service deployment attempts, and the roll back attempts that are displayed in the Circuit/VC 360 view. See [Get Quick Information About a Circuit/VC: Circuit/VC 360 View](#).
  7. Manually remove the partial configurations that are stored on the device.

You can also contact the Cisco representative to analyze and identify the root cause of configuration deployment failure and roll back failure.

## WAN Automation Engine Integration

### Cisco WAN Automation Engine Integration with Cisco EPN Manager

The Cisco WAN Automation Engine (WAE) platform is an open, programmable framework that interconnects software modules, communicates with the network, and provides APIs to interface with external applications.

Cisco WAE provides the tools to create and maintain a model of the current network through continuous monitoring and analysis of the network and based on traffic demands that are placed on it. This network model contains all relevant information about a network at a given time, including topology, configuration, and traffic information. You can use this information as a basis for analyzing the impact on the network due to changes in traffic demands, paths, node and link failures, network optimizations, or other changes.




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**Note** For details, refer to the latest *Cisco WAN Automation Engine (WAE) Installation Guide* and *Cisco WAN Automation Engine (WAE) User Guide*.

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In Cisco EPN Manager, when you create an unidirectional or a Bidirectional tunnel with an explicit path, the WAN Automation Engine (WAE) integration provides you the explicit path using a REST call from Cisco EPN Manager automatically. Thus, you can avoid manually entering the explicit paths. WAE provides you a list of possible network paths to review and allows you to select an appropriate path.

### Configure WAE Parameters

To specify the WAE path details:

#### Before you begin

Ensure to set the WAE parameters:

1. Choose **Administration > Settings > System Settings**
2. Expand Circuit VCs and then choose **WAE Server Settings**.
3. Enter the relevant WAE Details (version 7.1.1 and above) and field details such as **WAE Server IP**, **WAE Port Address**, **WAE Server User Name**, and **WAE Server Password**.
4. Click **Save** to save the WAE server settings or click **Reset to Defaults** to clear all the entries.

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- Step 1** Create a Unidirectional or Bidirectional tunnel with necessary parameters. For more information, see [Create and Provision an MPLS TE Tunnel, on page 91](#).
- Step 2** In the **Path Constraints Details** area, choose the path type either as **Working** or **Protected**. See [Field References for Path Constraint Details—MPLS TE Tunnel, on page 99](#) for descriptions of the fields and attributes.
- Step 3** Check the **New Path** check box if you want to enable the **Choose Path from WAE server** check box.
- Step 4** Check the **Choose Path from WAE server** checkbox. EPNM manager sends a REST request to WAE to obtain WAE networks.  
WAE will return a list of possible networks.



- Step 5** From the **Select WAE Network** drop-down list, choose a network. EPNM manager will send a REST conf request to WAE with all the required parameters such as Source, Destination, and Network. Max path returned default value = 2; Max Path value is configured through WAE. WAE displays a list of possible paths satisfying the request.
- Step 6** From the **Select WAE Path** drop-down list, choose the appropriate paths returned. EPNM shows the selected path overlay on the map.
- Step 7** Enter the name of the path in the **Path Name** field. You can proceed with provisioning the order using the last selected path as explicit path.
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## Provision EVCs in a Carrier Ethernet Network

- [Summary of Cisco EPN Manager Carrier Ethernet Provisioning Support](#) , on page 9
- [Prerequisites for EVC Provisioning](#), on page 10
- [Create and Provision a New Carrier Ethernet EVC](#), on page 10
- [Create and Provision a New Carrier Ethernet EVC using EVPN VPWS Technology](#), on page 13
- [Create and Provision an EVC with Multiple UNIs](#), on page 15

## Summary of Cisco EPN Manager Carrier Ethernet Provisioning Support

This topic provides a summary of the Carrier Ethernet service provisioning support in Cisco EPN Manager. For a more detailed overview of the different types of EVCs and the supported underlying networks, see [Overview of Circuit/VC Discovery and Provisioning](#).

Cisco EPN Manager supports provisioning of port-based and VLAN-based VCs of the following types:

- E-line—Ethernet Private Line (EPL) and Ethernet Virtual Private Line (EVPL). See [E-Line](#).
- E-LAN—EP-LAN and EVP-LAN. See [E-LAN](#).
- E-Access—Access EPL and Access EVPL. See [E-Access](#).
- E-TREE—EP-TREE and EVP-TREE. See [E-Tree](#).
- EVPN Virtual Private Wire Service (VPWS). See [EVPN Virtual Private Wire Service \(VPWS\)](#).

Cisco EPN Manager supports the following supplementary provisioning functions that can be used during EVC creation:

- Provision UNIs—For each EVC, you must define the attributes of the participating UNIs. You can either do this during the EVC creation or you can provision a UNI independently of the EVC creation process. See [Configure a Device and Interface To Be a UNI](#), on page 22.
- Provision ENNI—For E-Access circuits, you must define the attributes of the ENNI. You can either do this during the EVC creation or you can provision an ENNI independently of the EVC creation process. See [Configure a Device and Interface To Be an ENNI](#), on page 23.
- EVC Attribute Profiles—You can create profiles containing all the required attributes for an EVC. These profiles can be selected during EVC creation to define the attributes of the EVC, instead of having to define the attributes individually for each EVC. See [Create Circuit/VC Profiles](#) , on page 109.

## Prerequisites for EVC Provisioning

The following prerequisites must be met before you can provision EVCs:

1. Communication between devices must be set up before you can provision EVCs:
  - In an MPLS end-to-end network, Label Distribution Protocol (LDP) must be set up across the network and each device must be provided with an LDP ID. This enables peer label switch routers (LSRs) in an MPLS network to exchange label binding information for supporting hop-by-hop forwarding. Alternatively MPLS end-to-end connectivity can be achieved using MPLS Traffic Engineering or segment routing, and specifically, EVC (only P2P type) provisioning over unidirectional or bidirectional TE tunnels is supported. CEm provisioning over TE tunnels and provisioning over SR policies is also supported.
  - If there is Ethernet access, that is, not all devices are MPLS-enabled, G.8032 rings or ICCP-SM must be configured to connect the Ethernet access switch to the MPLS switch.
  - CDP or LLDP must be configured on the links within the G.8032 ring to enable Ethernet link discovery.
2. To provision EVCs over ICCP-SM and G.8032 networks, all VLANs (1–4095) should be configured either as primary or as secondary VLANs.
3. Inventory collection status for the devices on which the EVCs will be provisioned must be *Completed*. To check this, go to **Inventory > Device Management > Network Devices**, and look at the status in the Last Inventory Collection Status column.
4. Customers can be created in the system so that you can associate a circuit/VC to a customer during the circuit/VC creation and provisioning process. Choose **Inventory > Other > Customers** in the left sidebar to create and manage customers.
5. For interfaces to be used in EVCs, it is recommended to reset the default configuration on the interfaces. In global configuration mode, configure the following command on each interface:

```
default interface 'interface-name'
```

6. To provision EPL and EVPN services when using EVPN, define the following command under BGP section in device configuration. If you do not configure this command, the device will not be displayed when you provision an EVPN service.

```
address-family l2vpn evpn
```

## Create and Provision a New Carrier Ethernet EVC

EVCs are created in the context of the topology map. You can access the topology map and the Provisioning Wizard by choosing **Configuration > Network > Service Provisioning** in the left sidebar or you can open the Provisioning Wizard from the topology map, as described in the procedure below.

The process of creating and provisioning an EVC is similar for all supported EVC types and involves:

- Specifying the endpoints (UNIs and ENNIs) of the EVC.
- Defining the configuration parameters of the circuit/VC.

After a service is provisioned, you can edit the service and update or change the A-end or Z-end points.

Endpoint modification is supported with E-line services such as EPL and EVPL. you can modify only managed endpoints and full and partial services.

During modification of service, if existing UNI has different device or same device with different port, you can change to other existing UNI.

Some limitations are:

- You cannot modify the endpoints on both end in a single modification of services.
- Create an UNI using the standalone UNI wizard and use it in modification of EPL or EVPL services.
- During modification of service you cannot create a new UNI.

### Before you begin

For information about the prerequisites that must be met before you can provision EVCs, see [Prerequisites for EVC Provisioning, on page 10](#).

To create a new EVC:

- 
- Step 1** In the left sidebar, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click the Device Groups button in the toolbar and select the group of devices you want to show on the map.
- Step 3** In the Circuits/VCS tab, click the '+' icon to open the Provisioning Wizard in a new pane to the right of the map.
- Step 4** Select **Carrier Ethernet** in the Technology drop-down list. Cisco EPN Manager displays a list of relevant circuit/VC types in the Service Type area. For example, Carrier Ethernet service types include EPL, EVPL, EP-LAN, and so on.
- Step 5** In the Service Type list, select the type of circuit/VC you want to create.
- Step 6** If you have defined profiles to set the attributes of the different services, select the required profile from the Select Profile drop-down list. See [Create Circuit/VC Profiles , on page 109](#).
- Step 7** Click **Next** to go to the Service Details page.
- Step 8** (Optional) Select the customer for whom the EVC is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 9** Enter the Service Details. See [Service Details Reference, on page 17](#) for descriptions of the fields and attributes.
- Step 10** For E-Line, E-Tree, and E-LAN EVCs: If required, configure the service OAM which enables fault and performance monitoring across the EVC. For E-Line EVCs, select the Enable CFM check box to enable the Service OAM options. You can then choose to either create a new CFM domain or select an existing domain for the E-Line EVC. See [Service OAM, on page 21](#). Click the Plus icon to add a row to the Service OAM table and provide values in the relevant columns. For E-Tree EVCs, you must specify the direction, i.e., Leaf-to-Root, Root-to-Leaf, or Root-to-Root.
- If you want to promote and reconcile point-to-point services or multipoint services, for example EVPL/EPL services, enable the CFM parameters such as CFM Domain name, CFM Domain level, Maint. Assoc. Name Type, ITU Carrier Code, ITU MEG ID Code and Continuity check interval fields. CFM parameters will be read from the discovered version during service promotion. You can perform reconciliation with discovered or provisioned version.
- Note** By default IEEE is selected as the Maint Assoc Name. If ITU is selected in the Maint. Assoc. Name Type drop down list, ITU Carrier Code and ITU MEG ID code appears.
- Step 11** In the Deployment Action field, specify what you want to do when the EVC creation process is completed. You can either request a preview of the configurations that will be deployed to the relevant devices before the actual deployment or you can deploy the configurations immediately upon completion.

**Step 12** Click **Next** to go to the page(s) in which you define the UNI(s). In the case of E-Access, there is an additional page for defining the ENNI.

**Step 13** Identify the device and interface that will serve as the UNI:

**Note** If one of the endpoints is an interface on a device that is not managed by Cisco EPN Manager, select the Unmanaged check box and provide information for the unmanaged device. See [Provision a Circuit/VC with an Unmanaged Endpoint, on page 111](#).

- If you have already configured the required interface on the device as a UNI, uncheck the **Create New UNI** check box and select the relevant UNI Name from the list.

**Note** The UNI names in the list vary according to the services and the options selected at the time of creating the UNI.

- For EPL, Access EPL, EP LAN, and EP Tree services, only those UNIs for which the **All To One Bundling** option was selected at the time of creation will be listed.
  - For EVPL, Access EVPL, and EVP Tree services, only those UNIs for which the **Multiplexing** or **Bundling** options or both are selected at the time of creation will be listed.
- To create a new UNI:
    - Make sure that the **Create New UNI** check box is checked.
    - In the UNI Name field, enter a name for the UNI that will enable easy identification of the UNI.
    - Select a device from the list in the Device field or click on a device in the map to select it and populate the Device field. A list of the selected device's ports is displayed.
    - Select the required port from the Port table. If the port cannot be used for the UNI, there is an alert icon next to the UNI name in the Port table that displays the reason why the port cannot be selected.

**Note** The device you select during UNI creation is circled in orange in the map. The UNI name is displayed above the orange circle. If it is a point-to-point EVC, the orange circle is labeled to indicate whether it is an A-side or Z-side endpoint.

**Step 14** If you are creating a new UNI, enter the New UNI Details. See [New UNI Details Reference, on page 18](#) for descriptions of the fields and attributes.

**Step 15** Enter the UNI Service Details. See [UNI Service Details Reference, on page 19](#) for descriptions of the fields and attributes.

**Step 16** For E-LAN and E-TREE EVCs with H-VPLS as the core technology, select the devices that will serve as the primary and secondary hubs.

**Step 17** For E-Line EVCs: In the Pseudowire Settings page, you can select a TE tunnel over which the EVC will traverse, as follows:

- a. Check the **Static Preferred Path** check box to assign a static route for the service.
- b. Choose the Preferred Path Type as Bidirectional or Unidirectional or SR Policy.
- c. Select the required bidirectional TE tunnel from the Preferred Path drop-down list. This list contains all existing bidirectional TE tunnels between the endpoints of the EVC.

**Note** This field is available only if you selected **Bidirectional** as the Preferred Path Type.

- d. Select the required unidirectional TE tunnels from the Preferred Path (A-Z) and Preferred Path (Z-A) drop-down lists.  
**Note** These fields are available only if you selected **Unidirectional** as the Preferred Path Type.
- e. Select the **Allow Fallback to LDP** check box if you want the default path to be used if the preferred path is unavailable.  
**Note** If no tunnel exists between the endpoints, the Preferred Path and the Fallback to LDP options will be disabled.
- f. Select the **Send Control Word** check box if you want a control word to be used to identify the pseudowire payload on both sides of the connection.
- g. Select the **Interworking Option** if you need to interconnect sites using either Ethernet, VLAN, or IP. This option must be enabled if one of the endpoints in the EVC is an unmanaged device.
- h. Enter the required bandwidth for the pseudowire.
- i. In the **PW ID** field, enter an identifier that is displayed in the Pseudowire settings for point-to-point services.  
**Note** Pseudowire (PW) ID is automatically allocated from the resource pool of PW ID. You can modify the PW ID value only when you create a service. You cannot edit this value during modification of an EVC service. If the entered PW ID is already allocated to the service then an error message is displayed.

- Step 18** (Optional) If you want to append a template with additional CLI commands that will be configured on the devices participating in the service, do so in the Service Template page. See [Extend a Circuit/VC Using Templates, on page 111](#) for more information.
- Step 19** When you have provided all the required information for the circuit/VC, click **Submit**. If you chose to see a preview of the CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the attributes. Otherwise, the configurations will be deployed to the devices immediately.
- Step 20** The circuit/VC should be added to the list in the Circuits/VCS tab in the Network Topology window.

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If the configuration deployment fails, see the [What Happens When a Deployment Fails, on page 4](#) section.

## Create and Provision a New Carrier Ethernet EVC using EVPN VPWS Technology

To create and provision a carrier ethernet EVC with EVPN:

### Before you begin

For information about the prerequisites that must be met before you can provision EVCs, see [Prerequisites for EVC Provisioning, on page 10](#).

- 
- Step 1** In the left sidebar, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click the Device Groups button in the toolbar and select the group of devices you want to show on the map.
- Step 3** In the Circuits/VCS tab, click the '+' icon to open the Provisioning Wizard in a new pane to the right of the map.

- Step 4** Select **Carrier Ethernet** in the Technology drop-down list. Cisco EPN Manager displays a list of relevant circuit/VC types in the Service Type area. EVPN is supported by Carrier Ethernet service types EPL and EVPL.
- Step 5** In the Service Type list, select the type of circuit/VC you want to create.
- Step 6** If you have defined profiles to set the attributes of the different services, select the required profile from the Select Profile drop-down list. See [Create Circuit/VC Profiles](#), on page 109.
- Step 7** Click **Next** to go to the Service Details page.
- Step 8** (Optional) Select the customer for whom the EVC is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 9** Enter the Service Details. See [Service Details Reference](#), on page 17 for descriptions of the fields and attributes.
- Step 10** Select the **Use EVPN** checkbox.
- Step 11** For E-Line EVCs: If required, configure the service OAM which enables fault and performance monitoring across the EVC. Select the Enable CFM check box to enable the Service OAM options. You can then choose to either create a new CFM domain or select an existing domain for the E-Line EVC. See [Service OAM](#), on page 21. Click the Plus icon to add a row to the Service OAM table and provide values in the relevant columns.
- Note** ICC based CFM is not supported for EVPN.
- Step 12** In the Deployment Action field, specify what you want to do when the EVC creation process is completed. You can either request a preview of the configurations that will be deployed to the relevant devices before the actual deployment or you can deploy the configurations immediately upon completion.
- Step 13** Identify the device and interface that will serve as the UNI:
- Note** EVPN does not support unmanaged devices.
- If you select the **Use EVPN** check-box on the Service Detail page, only the devices supporting EVPN is displayed on the UNI A and Z pages.
- If you have already configured the required interface on the device as a UNI, uncheck the **Create New UNI** check box and select the relevant UNI Name from the list.
- Note** The UNI names in the list vary according to the services and the options selected at the time of creating the UNI.
- For EPL, Access EPL, EPE LAN, and EP Tree services, only those UNIs for which the **All To One Bundling** option was selected at the time of creation will be listed.
  - For EVPL, Access EVPL, and EVP Tree services, only those UNIs for which the **Multiplexing** or **Bundling** options or both are selected at the time of creation will be listed.
- To create a new UNI:
    - Make sure that the **Create New UNI** check box is checked.
    - In the UNI Name field, enter a name for the UNI that will enable easy identification of the UNI.
    - Select a device from the list in the Device field or click on a device in the map to select it and populate the Device field. A list of the selected device's ports is displayed.
    - Select the required port from the Port table. If the port cannot be used for the UNI, there is an alert icon next to the UNI name in the Port table that displays the reason why the port cannot be selected.

**Note** The device you select during UNI creation is circled in orange in the map. The UNI name is displayed above the orange circle. If it is a point-to-point EVC, the orange circle is labeled to indicate whether it is an A-side or Z-side endpoint.

**Step 14** If you are creating a new UNI, enter the New UNI Details. See [New UNI Details Reference, on page 18](#) for descriptions of the fields and attributes.

**Step 15** Enter the UNI Service Details. See [UNI Service Details Reference, on page 19](#) for descriptions of the fields and attributes.

**Step 16** For E-Line EVCs: On the EVPN Settings page:

- a. The **EVPN Instance (EVI) ID** is pre populated. If required, you can modify this value.
- b. You can specify the RD Value by deselecting the Auto RD check-box.
- c. You can specify the Import RT and Export RT value by deselecting the Auto RT check-box.

**Note** The Import RT, Export RT, RD and Control Word are editable when the used EVI ID is not associated to any other service.

- d. Select the **Control Word** check-box if you want a control word to be used to identify the payload on both sides of the connection.
- e. The Z-End AC Identifier and A-End AC Identifier are pre populated. If required, you can modify these values.
- f. You can select the **Static Preferred Path** check-box to specify the A to Z or Z to A Preferred Path and specify the SR Policy.
- g. Select the Allow Fallback to LDP check box if you want the default path to be used if the preferred path is unavailable.

**Note** If no tunnel exists between the endpoints, the Preferred Path and the Fallback to LDP options will be disabled.

**Step 17** (Optional) If you want to append a template with additional CLI commands that will be configured on the devices participating in the service, do so in the Service Template page. See [Extend a Circuit/VC Using Templates, on page 111](#) for more information.

**Step 18** When you have provided all the required information for the circuit/VC, click **Submit**. If you chose to see a preview of the CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the attributes. Otherwise, the configurations will be deployed to the devices immediately.

**Step 19** The circuit/VC should be added to the list in the Circuits/VCS tab in the Network Topology window.

## Create and Provision an EVC with Multiple UNIs

Cisco EPN Manager supports creating/selecting multiple UNIs during the creation and provisioning of multipoint EVCs (E-LAN and E-Tree).



**Note** You can have multiple UNIs on the same device for EVCs using VPLS as the core technology, but not for H-VPLS-based EVCs.

### Before you begin

For information about the prerequisites that must be met before you can provision EVCs, see [Prerequisites for EVC Provisioning, on page 10](#).

To create a new EVC:

- 
- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.  
The network topology window opens.
- Step 2** From the toolbar, click **Device Groups** and then select the group of devices you want to show on the map.
- Step 3** Click the **Circuits/VCS** tab.
- Step 4** From the **Circuits/VCS** pane toolbar, click the + (**Create**) icon.  
The Provisioning Wizard opens in a new pane to the right of the map.
- Step 5** Select **Carrier Ethernet** in the Technology drop-down list
- Step 6** In the Service Type list, select a multipoint EVC type.
- Step 7** If you have defined profiles to set the attributes of the different services, select the required profile from the Select Profile drop-down list. See [Create Circuit/VC Profiles , on page 109](#).
- Step 8** Click **Next** to go to the Service Details page.
- Step 9** Select the customer for whom the EVC is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 10** Enter the Service Details. See [Service Details Reference, on page 17](#) for descriptions of the fields and attributes.
- Step 11** In the Deployment Action field, specify what you want to do when the EVC creation process is completed. You can either request a preview of the configurations that will be deployed to the relevant devices before the actual deployment or you can deploy the configurations immediately upon completion.
- Step 12** Click Next to go to the page(s) in which you define the UNI(s).
- Step 13** In the Multi UNI area, click the Plus icon to add the first UNI to the table. The UNI is given a default name and is automatically selected in the table. Each time you click the Plus icon, a new UNI is added to the table.  
  
Alternatively, you can click on devices in the map to add new UNIs to the table. In this case, the device name will be populated in the Device field under New UNI details.
- Step 14** Select a UNI in the table to define or edit its attributes.
- Step 15** Identify the device and interface that will serve as the UNI:
- To use an existing UNI, uncheck the Create New UNI check box and select the relevant UNI Name from the list.
 

**Note** The UNI names in the list vary according to the services and the options selected at the time of creating the UNI.

    - For EPL, Access EPL, EP LAN, and EP Tree services, only those UNIs for which the **All To One Bundling** option was selected at the time of creation will be listed.
    - For EVPL, Access EVPL, and EVP Tree services, only those UNIs for which the **Multiplexing** or **Bundling** options or both are selected at the time of creation will be listed.
  - To define a new UNI:
    - Make sure that the Create New UNI check box is checked.



- In the UNI Name field, enter a name for the UNI that will enable easy identification of the UNI.
- Select a device from the list in the Device field. A list of the selected device's ports is displayed.
- Select the required port from the Port table. If the port cannot be used for the UNI, there is an alert icon next to the UNI name in the Port table that displays the reason why the port cannot be selected.

- Step 16** If you are creating a new UNI, enter the New UNI Details. The New UNI details are relevant for the UNI that is currently selected in the Multi UNI table. See [New UNI Details Reference, on page 18](#) for descriptions of the fields and attributes.
- Step 17** Enter the UNI Service Details. See [UNI Service Details Reference, on page 19](#) for descriptions of the fields and attributes. Click Next.
- Step 18** If one of the endpoints is an interface on a device that is not managed by Cisco EPN Manager, provide information for the unmanaged device in the Unmanaged page. See [Provision a Circuit/VC with an Unmanaged Endpoint, on page 111](#)
- Step 19** Optional. If you want to append a template with additional CLI commands that will be configured on the devices participating in the service, do so in the Service Template page. See [Extend a Circuit/VC Using Templates, on page 111](#) for more information.
- Step 20** When you have provided all the required information for the circuit/VC, click Submit. If you chose to see a preview of the CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the attributes. Otherwise, the configurations will be deployed to the devices immediately.
- Step 21** The circuit/VC should be added to the list in the Circuits/VCS pane in the Network Topology window.

## Service Details Reference

The following table lists and describes the attributes that define the EVC on the service level. Note that not all attributes are relevant for all the EVC types.

**Table 1: Service Details**

Attribute	Description
Service Name	Unique name to identify the circuit/VC.
Service Description	Description of the VC that will help to identify the VC.
Service Type	Prepopulated based on the type of service you are creating—EPL, EVPL, EP-LAN, and so on.
Use EVPN	Enables you to create EVPN based connections.
Service MTU	The maximum size, in bytes, of any frame passing through the VC. Values can be between 64 to 65535. The service MTU must be lower than or equal to the MTU defined on all of the service's UNIs.
Core Technology	VPLS or H-VPLS. See <a href="#">Core Technology for Multipoint EVCs</a> .  <b>Note</b> For VPLS or H-VPLS, you can provision a maximum number of 20 devices using the Provisioning Wizard.

Attribute	Description
VPN ID	<p>Relevant for multipoint EVCs (both VPLS and H-VPLS). This field is automatically populated with the next available pseudowire ID. This ID can be changed during the EVC creation process (valid value range: 1-4294967295). The ID is not editable when modifying the EVC.</p> <p><b>Note</b> The VPN ID is used uniquely across the network, meaning that two services will not use the same VPN ID. In addition, the VPN ID cannot use a pseudowire ID which is already configured in the network to avoid pseudowire ID collision. The VPN ID value is displayed in the PW ID field. You cannot modify the PW ID value for multipoint services during creation and modification of services.</p>
PW ID	<p>Relevant for multipoint EVCs and point-to-point EVCs. This field is automatically populated with the next available pseudowire ID. You can edit this ID to assign a value only in case of point-to-point EVCs (valid value range: 1-4294967295) during the EVC creation process. The ID is not editable when modifying the EVC.</p> <p><b>Note</b> The PW ID is used uniquely across the network, meaning that two services will not use the same PW ID.</p>
Bundling	Enables multiple VLANs on this VC. Multiple CE-VLAN IDs are bundled to one EVC.
CE-VLAN ID Preservation	Ensures that the CE-VLAN ID of an egress service frame is identical in value to the CE-VLAN ID of the corresponding ingress service frame. This must be enabled if bundling is enabled.
CE-VLAN ID CoS Preservation	Ensures that the CE-VLAN CoS of an egress service frame is identical in value to the CE-VLAN CoS of the corresponding ingress service frame. The CoS markings are unaltered.

## New UNI Details Reference

The following table lists and describes the attributes relating to the port that is specified as the UNI. Note that not all attributes are relevant for all the EVC types.

Table 2: New UNI Details

Attribute	Description
MTU	The Maximum Transmission Size, in bytes, of a packet passing through the interface. The MTU of the UNI must be greater than or equal to the MTU defined on the service level.
Auto Negotiation	Check this check box to automatically negotiate the speed and duplex mode.
Speed	<p>Port speed. You can reduce the speed if this is supported on the port.</p> <p><b>Note</b> This field is not available if you select the Auto Negotiation check box.</p>
Duplex Mode	<ul style="list-style-type: none"> <li>• Full Duplex—Uses simultaneous communication in both directions between the UNI and the customer's access switch, assuming that both sides support full duplex. If one side does not support full duplex, the port will be brought down.</li> <li>• Auto-Negotiation—Uses the mode that is agreed upon between the two devices, depending on what is supported. Full Duplex will be attempted but if one device does not support it, half duplex will be used.</li> </ul> <p><b>Note</b> This field is not available if you select the Auto Negotiation check box.</p>

Attribute	Description
Service Multiplexing	Allows the UNI to participate in more than one EVC instance.
UNI Allows Bundling	Allows the UNI to participate in VCs with Bundling enabled. See Bundling in <a href="#">Service Details Reference, on page 17</a>
Untagged CE-VLAN ID	The ID of the CE-VLAN assigned to untagged traffic.
Ingress/Egress QoS Profile	Select the required QoS profile for ingress or egress traffic on the UNI. The list of profiles includes policy maps that were configured on the device and discovered by the system, as well as user-defined QoS profiles.
UNI QoS Profile	Applies a QoS profile on the UNI itself to define the bandwidth profile and other quality of service attributes of the UNI. If you apply a QoS profile on the UNI level, you should not apply a QoS profile on the service level.
Enable Link OAM	Enables IEEE 803.1ah link operation and maintenance. If Link OAM is enabled, you will see events relating to the state of the link between this UNI and the customer's access switch.
Enable Link Management	Enables the customer access switch to get information about this UNI, VLAN IDs, services on the UNI, and so on.

## UNI Service Details Reference

The following table lists and describes the attributes of the EVC in relation to the UNI, that is, how the EVC operates on this UNI. Not all attributes are relevant for all the EVC types.



**Note** For QinQ attributes, only the attributes that are supported on the selected device appears in the wizard.

**Table 3: UNI Service Details**

Attribute	Description	Additional Information
Ingress/Egress Service QoS Profile	Select the required QoS profile for ingress or egress traffic on the UNI. The list of profiles includes policy maps that were configured on the device and discovered by the system and user-defined QoS profiles.	
Layer 2 Control Protocol Profile	Profile that determines how the various communication protocols are handled. Frames using the various protocols are either tunneled, dropped, or peered. Refer to MEF 6.1 for details.	
Designation	For E-Tree: Select the role of the UNI in the VC, either Leaf or Root.	
Use point to point connection with Root	For E-Tree: If the UNI is designated as a leaf, you can select this check box to create an active pseudowire between root and leaf. The check box will not appear if there is more than one endpoint on a single device or if there is more than one root in the service.	

Attribute	Description	Additional Information
Match	Select the type of tagging the traffic should have in order to enter the UNI: <ul style="list-style-type: none"> <li>• Dot1q—Mapping of 802.1q frames ingress on an interface to the service instance.</li> <li>• Dot1ad—Mapping of 802.1ad frames ingress on an interface to the service instance.</li> <li>• Default—Traffic that is not assigned to any other VC on this port.</li> <li>• Untagged—Frames that have no VLAN tag.</li> </ul>	
Auto Allocate VLAN	Check this check box to automatically allocate a VLAN ID for the UNI.	
VLAN(s)	VLAN identifier, an integer 1–4094. You can enter a range of VLAN IDs using a hyphen or a comma-separated series of VLAN IDs.	This field is not available if you have checked the Auto Allocate VLAN check box.
Inner VLAN(s)	VLAN identifier for the second level of VLAN tagging, an integer 1–4094. You can enter a range of VLAN IDs using a hyphen or a comma-separated series of VLAN IDs.	
Untagged Bundled	Enables traffic with no VLAN tags to be bundled together with VLAN tagged frames.	
Priority Tagged Bundled	Enables priority tagged traffic to be bundled together with VLAN tagged frames.	
Exact	Prevents admittance of traffic with additional inner VLAN tags other than those that are matched to be carried by the service.	Applicable for IOS-XR devices only.
Outer VLAN CoS	The outer VLAN Class of Service identifier that should be associated with the frame. The CoS ID can be an integer 0–7.	Applicable for IOS devices only.
Inner VLAN CoS	The inner VLAN Class of Service identifier that should be associated with the frame. The CoS ID can be an integer 0–7.	Applicable for IOS devices only.
E-Type	Limits the service to only carry frames of the specified Ethertype: <ul style="list-style-type: none"> <li>• IPv4</li> <li>• IPv6</li> <li>• PPPoE-All</li> <li>• PPPoE-Discovery</li> <li>• PPPoE-Session</li> </ul>	Applicable for IOS devices only.

Attribute	Description	Additional Information
Rewrite Definition Action	<p>The encapsulation adjustment to be performed when the frame enters the UNI:</p> <ul style="list-style-type: none"> <li>• None</li> <li>• Pop—Removes one or two VLAN tags from the frame on ingress and adds them on egress.</li> <li>• Push—Adds one or two VLAN tags from the frame on ingress and removes them on egress, either Dot1q or Dot1ad tags.</li> <li>• Translate—Replaces VLAN tags with new VLAN tags, either Dot1q or Dot1ad tags. The translation can be 1:1, 1:2, 2:1, or 2:2.</li> </ul>	The Translate action is applicable for IOS-XR devices only.

## Service OAM

On the service level, you can define EOAM (Ethernet Operations, Administration, and Management) parameters that allow monitoring and troubleshooting of the EVC. Effectively, you will be configuring Connectivity Fault Management (CFM) components on the endpoints of the EVC.

For a point-to-point EVC, you can define OAM parameters in one direction, that is, from UNI A to UNI Z or in both directions. For a multipoint EVC, you can define the source and destination MEP groups and then associate the EVC endpoints with a specific MEP group.

See [Configure EOAM Fault and Performance Monitoring](#) for more information about CFM and for device-level CFM configuration.

Use the Service OAM section in the Customer Service Details page of the Provisioning Wizard to define the specifications of the service frame to be monitored and to define the OAM profile to apply to that frame, as follows:

- From—The source of the traffic flow across the EVC.
- To—The destination of the traffic flow across the EVC.
- Direction (E-Tree only)—The direction of traffic flow between leaf and root, or root to root.



**Note** Your input in the From and To fields creates MEP groups, or ordered sets of UNIs. In the next page of the wizard, you will associate the UNI with one of these MEP groups.

- CoS—The Class of Service identifier that should be associated with the frame.
- OAM Profile—A set of OAM attributes that should be applied to the frame to enable performance monitoring. The following OAM profiles are available for selection:
  - Performance Monitoring 1: Enables continuity check and synthetic loss measurement. This profile supports both point-to-point and multipoint EVCs.
  - Performance Monitoring 2: Enables continuity check, synthetic loss measurement, and single-ended delay measurement. This profile supports both point-to-point and multipoint EVCs.

- Performance Monitoring 3: Enables continuity check, synthetic loss measurement, and dual-ended delay measurement. This profile supports both point-to-point and multipoint EVCs.
  - Performance Monitoring 4: Enables continuity check, synthetic loss measurement, and dual-ended delay measurement. This profile supports frame size of 64 (loss & delay), history interval 2 (delay) and 5(loss), aggregate interval 60.
  - Performance Monitoring 5: Enables continuity check, synthetic loss measurement, and dual-ended delay measurement. This profile supports frame size of 152 (loss & delay), history interval 10, aggregate interval 300 (5-min samples).
- Continuity Check Interval—The interval between continuity check messages.

## Configure a Device and Interface To Be a UNI

The User Network Interface (UNI) is the physical demarcation point between the responsibility of the Subscriber (the Customer Edge or CE) and the responsibility of the Service Provider (the Provider Edge or PE).

UNIs demarcate the endpoints of EVCs, so configuring device interfaces as UNIs is an essential part of VC provisioning. UNI configuration can be done during the VC creation process. Alternatively, you can configure UNIs independently of VC creation. These UNIs will be available for selection during VC creation.

To configure a UNI:

- 
- Step 1** Follow the instructions in [Create and Provision a New Carrier Ethernet EVC, on page 10](#) to access the Provisioning Wizard.
- Step 2** Select **Carrier Ethernet** from the Technology drop-down list.
- Step 3** Select **UNI** from the Service Types list.
- Step 4** Click **Next** to go to the Customer Service Details page.
- Step 5** Provide a unique name and description for the UNI, and associate it with a customer, if required.
- Step 6** Define the service attributes of the UNI, as follows:
- All to One Bundling—For port-based VCs where the UNI is dedicated to the VC. When enabled, all CE-VLAN IDs are bundled to one VC. When All to One Bundling is selected, Multiplexing and Bundling cannot be selected.
  - Service Multiplexing—For VLAN-based VCS where the UNI is shared between multiple VCs. When enabled, allows the UNI to participate in more than one EVC instance.
  - Bundling—Allows the use of multiple VLANs for this UNI. Multiple CE-VLAN IDs are bundled to one EVC.
- Step 7** Under Deploy, select whether you want to deploy the UNI immediately upon completion or first display a preview of the CLI that will be deployed to the device.
- Step 8** Click **Next** to go to the UNI Details definition page.
- Step 9** Select the device and port you want to configure as the UNI.
- Step 10** Configure the UNI attributes, as described in [New UNI Details Reference, on page 18](#).
- Step 11** Click **Submit**. If you previously chose to deploy the circuit upon completion, a job is created and the required CLI is deployed to the devices. If you chose to see a preview of the CLI before actually deploying to the devices, the preview

will be displayed now. Verify the CLI and if you want to change any of the attributes, click **Edit Attributes**. Else, click **Deploy**.

---

## Configure a Device and Interface To Be an ENNI

The External Network to Network Interface (ENNI) specifies the reference point that is the interface between two Metro Ethernet Networks (MENs) where each operator network is under the control of a distinct administration authority. The ENNI is intended to support the extension of Ethernet services across multiple operator MENs, while preserving the characteristics of the service.

When provisioning an E-Access VC, you need to define the ENNI that will carry traffic through to the adjacent network. ENNI configuration can be done during the VC creation process. Alternatively, you can configure ENNIs independently of VC creation. These ENNIs will be available for selection during VC creation.

To configure an ENNI:

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- Step 1** Follow the instructions in [Create and Provision a New Carrier Ethernet EVC, on page 10](#) to access the Provisioning Wizard.
  - Step 2** Select **Carrier Ethernet** from the Technology drop-down list.
  - Step 3** Select **ENNI** from the Service Types list.
  - Step 4** Click **Next** to go to the Customer Service Details page.
  - Step 5** Provide a unique name and description for the ENNI, and associate it with a customer/operator, if required.
  - Step 6** Under Deploy, select whether you want to deploy the ENNI immediately upon completion or first display a preview of the CLI that will be deployed to the device.
  - Step 7** Click **Next** to go to the ENNI Details definition page.
  - Step 8** Select the device and port(s) you want to configure as the ENNI.
  - Step 9** Define the following parameters for the ENNI:
    - MTU—The Maximum Transmission Size, in bytes, of a packet passing through the interface. The MTU of the ENNI must be greater than 1526.
    - Speed—If required, you can reduce the speed of the port if this is supported.
  - Step 10** Click **Submit**. If you previously chose to deploy the circuit upon completion, a job is created and the required CLI is deployed to the devices. If you chose to see a preview of the CLI before actually deploying to the devices, the preview will be displayed now. Verify the CLI and if you want to change any of the attributes, click **Edit Attributes**. Else, click **Deploy**.
- 

## Segment Routing

### Configure Segment Routing

Segment Routing (SR) is a flexible, scalable way of doing source routing. The source router chooses a path, either explicit or Interior Gateway Protocol (IGP) shortest path and encodes the path in the packet header as

an ordered list of segments. Segments represent subpaths that a router can combine to form a complete route to a network destination. Each segment is identified by a segment identifier (SID) that is distributed throughout the network using new IGP extensions.

Each router (node) and each link (adjacency) has an associated SID. Node segment identifiers are globally unique and represent the shortest path to a router as determined by the IGP. The network administrator allocates a node ID from a reserved block to each router. On the other hand, an adjacency segment ID is locally significant and represents a specific adjacency, such as egress interface, to a neighboring router. Routers automatically generate adjacency identifiers outside of the reserved block of node IDs. In an MPLS network, a segment identifier is encoded as an MPLS label stack entry. Segment IDs direct the data along a specified path. A node segment can be a multi-hop path while an adjacency segment is a one-hop path.




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**Note** SR policy visualization overlay is not supported for subinterfaces.

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## Create and Provision Segment Routing Policies

To create and provision SR Policies:

### Before you begin

Before you provision an SR policy, ensure that the following prerequisites are met:

- MPLS TE is enabled on the device and at the router protocol level (ISIS / OSPF)
- SR-TE should be configured as the preferred option for traffic-eng
- Label allocation at the block level and for the loopback interface

- 
- Step 1** In the left plane, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click the **Device Groups** button in the toolbar and select the group of devices you want to show on the map.
- Step 3** In the Circuits/VCS tab, click the '+' icon to open the Provisioning Wizard in a new pane to the right of the map.
- Step 4** Select **Segment Routing** in the Technology drop-down list. Cisco EPN Manager displays a list of relevant circuit/VC types in the Service Type area.
- Step 5** In the Service Type list, select **SR Policy**.
- Step 6** If you have defined profiles to set the attributes of the different services, select the required profile from the Select Profile drop-down list. See [Create Circuit/VC Profiles](#), on page 109.
- Step 7** Click **Next** to go to the Service Details page.
- Step 8** (Optional) Select the customer for whom the policy is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 9** Enter the Service Details.
- The service details consists of **Activate** check box, **Name**, and **Description**. Use the **Activate** check box to set the operational status of the policy to Up or Down.
- Step 10** Enter the policy details. For more information, see [Field References for Policy Details—SR Policy](#), on page 25.
- Step 11** Enter the Autoroute Settings details. For more information, see [Field References for Autoroute Settings Details—SR Policy](#), on page 25.



- Step 12** In the **Deployment Action** field, specify what you want to do when the policy creation process is completed. You can either request a preview of the configurations that will be deployed to the relevant devices before the actual deployment or you can deploy the configurations immediately upon completion. For more information see, [Save and Schedule a Provisioning Order, on page 81](#).
- Step 13** Click **Next** to go to the Path and Constraint Details page.
- Step 14** Specify the Candidate Paths, Path Details, and Path Constraint Details. For more information, see [Field References for Path and Constraint Details—SR Policy, on page 26](#).
- Step 15** Click **Next** to go to the Template Details page. For more details on the template, see [Extend a Circuit/VC Using Templates, on page 111](#).
- Step 16** Click **Submit**. Depending on the deployment action you have chosen, the relevant action will be performed. That is, if you have chosen to preview the configuration, the preview page will be displayed where you can view the configurations, and then click **Deploy**. If you have chosen to deploy, the configurations will be directly deployed to the relevant devices.

## Field References for Policy Details—SR Policy

The following table lists and describes the attributes that define the policy details for creating a Segment Routing Policy.

**Table 4: Policy Details Section Reference—SR Policy**

Attribute	Description
Policy Name	Enter a policy name.
Head End	Select the head end from the drop down list.
Color	The color value range is from 1 to 4294967295.
End Point	Select the end point from the drop down list.
Explicit Binding SID	The Explicit Binding SID range is from 16 to 1048575.
Bandwidth	The bandwidth value range depends on the value selected in the <b>Bandwidth Unit</b> field.
Bandwidth Unit	Choose a value from the drop-down list. The available options are <b>Kbps</b> , <b>Mbps</b> , and <b>Gbps</b> .



**Note** The **Bandwidth** and **Bandwidth Unit** field is only applicable for **Dynamic With PCE** path type.

## Field References for Autoroute Settings Details—SR Policy

The following table lists and describes the attributes that define the Autoroute Settings details for creating a Segment Routing Policy.

Table 5: Autoroute Settings Details Section Reference—SR Policy

Attribute	Description
Auto Metric Mode	Select a value from the drop down list. The available options are <b>Constant</b> and <b>Relative</b> .
Auto Metric Value	Depending on the value selected in the Auto Metric Mode field, the range of the Auto Metric Value changes. For Constant the range is from 1 to 2147483647. For Relative the range is from -10 to 10.
Allow All Prefixes	Select the check box if you want to allow all IP prefixes.
Allowed Prefixes	This field only appears if the Allow All Prefixes check box is not selected. Add the required prefixes to the table.

## Field References for Path and Constraint Details—SR Policy

The following table lists and describes the attributes that define the path constraint details for creating a Segment Routing Policy.

Table 6: Path Constraint Details Section Reference—SR Policy

Attribute	Description
Candidate Paths	
Path Type	Choose the required path for the SR Policy. The values are <b>Dynamic</b> , <b>Explicit</b> , and <b>Dynamic With PCE</b> .
Preference	The candidate path preference value ranges from 1 to 65535.
Path Details for Dynamic and Dynamic With PCE path type:	
Metric Type	Choose the required Metric Type. The values are <b>IGP</b> , <b>Latency</b> , <b>TE</b> , and <b>HopCount</b> .
Metric Margin Type	Choose the required Metric Margin Type. The values are <b>Absolute</b> and <b>Relative</b> .
Metric Margin Value	The Metric Margin Value range is from 0 to 2147483647.
Max SID Limit	The Max SID Limit is from 1 to 255.
Path Details for Explicit path type:	
New Segment List	Select the check box if you want to create a new segment list.
Segment List Name	This field appears if New Segment List check box is selected.
Existing Segment List	This field appears if the New Segment List check box is not selected. Select a segment list from the drop down list.
Weight	The weight range is from 1 to 4294967295.

Attribute	Description
<b>Note</b>	<p>When entering the path details, you must click the + icon and provide the <b>Segment List Name</b> and <b>Weight</b> to add details to the Segment list.</p> <p>The Segments table is active for editing if the New Segment List check box is selected.</p> <ul style="list-style-type: none"> <li>• You can add Segment by clicking +. Provide the <b>Index</b> value and select the <b>Device</b>, <b>Segment Type</b>, and <b>Interface</b> from the respective drop down lists.</li> <li>• If you have added multiple segments, you can place them in your desired queue by using the up or down arrow in the segments window.</li> <li>• You can also edit or delete a segment from the segments window only when you are creating it. Once the segment list is created, it cannot be modified.</li> <li>• You can also assign label for the interfaces which do not have label assigned to them.</li> </ul>
Path Constraint Details	
Affinity Operation	Individually select the applicable affinity operations and specify the related details. The values are <b>Exclude-Any</b> , <b>Include-Any</b> , and <b>Include-All</b> .
Exclude Any Affinity Names	Select the names from the drop-down list.
Include Any Affinity Names	This field appears if <b>Include-Any</b> is selected. Select the affinity name that you want to include from the drop down list.
Include All Affinity Names	This field appears if <b>Include-All</b> is selected. Select the affinity name that you want to include from the drop down list.
SID Algorithm	The SID Algorithm range is from 128 to 255.
Disjoint Group Type	Select a value from the drop-down list. The value are <b>Link</b> , <b>Node</b> , <b>Srlg</b> , and <b>Srlg-Node</b> .
Disjoint Group Id	The Disjoint Group Id range is from 1 to 65535.
Disjoint Sub Group Id	The Disjoint Sub Group Id range is from 1 to 65535.

## Create and Provision Carrier Ethernet Services with Segment Routing Policies

The Cisco EPN Manager supports provisioning of EPL, EVPL, Access EPL, Access EVPL carrier ethernet point-to-point services using Segment Routing traffic engineering(SR-TE) policy. You can modify SR-TE policy during modification of CE services. Related Circuits/VCS tab in Circuit/VCS 360\* can be used to view the SR policies associated to this service. For SR-policy, the backup path visualization is available in the overlay. You can expand the **Show Backup Path** and choose the nodes or links that you want to exclude. When you click **Apply**, the new backup path is displayed.

To create and Provision an EVPL Service with SR Policies:

**Step 1** In the left plane, choose **Maps > Topology Maps > Network Topology**.

**Step 2** Click the Device Groups button in the toolbar and select the group of devices you want to show on the map.

- Step 3** In the Circuits/VCS tab, click the '+' icon to open the Provisioning Wizard in a new pane to the right of the map.
- Step 4** Select **Carrier Ethernet** in the Technology drop-down list. Cisco EPN Manager displays a list of relevant circuit/VC types in the Service Type area. For example, Carrier Ethernet service types include EPL, EVPL, EP-LAN, and so on.
- Step 5** In the Service Type list, select the type of circuit/VC you want to create. For example, EVPL.
- Step 6** If you have defined profiles to set the attributes of the different services, select the required profile from the Select Profile drop-down list. See [Create Circuit/VC Profiles](#), on page 109.
- Step 7** Click **Next** to go to the Service Details page.
- Step 8** (Optional) Select the customer for whom the EVPL is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 9** Enter the Service Details. See [Service Details Reference](#), on page 17 for descriptions of the fields and attributes.
- Step 10** Click **Next**.
- Step 11** In the **Deployment Action** field, specify what you want to do when the EVPL creation process is completed. You can either request a preview of the configurations that will be deployed to the relevant devices before the actual deployment or you can deploy the configurations immediately upon completion. For more information see, [Save and Schedule a Provisioning Order](#), on page 81.
- Step 12** Click **Next** to go to the page(s) in which you define the UNI(s). In the case of E-Access, there is an additional page for defining the ENNI.
- Step 13** Identify the device and interface that will serve as the UNI:
- Note** If one of the endpoints is an interface on a device that is not managed by Cisco EPN Manager, select the Unmanaged check box and provide information for the unmanaged device. See [Provision a Circuit/VC with an Unmanaged Endpoint](#), on page 111
- Step 14** If you are creating a new UNI, enter the New UNI Details. See [New UNI Details Reference](#), on page 18 for descriptions of the fields and attributes.
- Step 15** Enter the UNI Service Details. See [UNI Service Details Reference](#), on page 19 for descriptions of the fields and attributes.
- Step 16** If one of the endpoints is an interface on a device that is not managed by Cisco EPN Manager, select the **Unmanaged** check box and provide information for the unmanaged device. See [Provision a Circuit/VC with an Unmanaged Endpoint](#), on page 111 for more information.
- Step 17** For E-LAN and E-TREE EVCs with H-VPLS as the core technology, select the devices that will serve as the primary and secondary hubs.
- Step 18** For E-Line and E-Access EVCs: In the Pseudowire Settings page, you can select SR-TE policy for segment routing over which the EVC will traverse, as follows:
- a. Check the **Static Preferred Path** check box to assign a static route for the service.
 

**Note** For E-access this check box is not applicable.
  - b. Click the **SR Policy** radio button.
  - c. Select the required SR-TE policy from the Preferred Path (A-Z) and Preferred Path (Z-A) drop-down lists.
 

**Note** Both Preferred Path(A-Z) and Preferred Path(Z-A) are optional fields.
  - d. Repeat steps 5 through 8 in [Create and Provision a New Carrier Ethernet EVC](#), on page 10.
- Step 19** Repeat steps 20 through 22 [Create and Provision a New Carrier Ethernet EVC](#), on page 10.
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# Provision Circuits in an Optical/DWDM Network

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- [Prerequisites for Provisioning Optical Circuits, on page 30](#)
- [Create and Provision an OCH Circuit, on page 31](#)
- [Create and Provision an OCH Trail Circuit Connecting IOS-XR Platform Based Devices Directly, on page 38](#)
- [Create and Provision Two Mutually Diverse OCH-Trail UNI Circuits, on page 40](#)
- [Create and Provision a Media Channel Group SSON Circuit, on page 41](#)
- [Create and Provision a Media Channel SSON Circuit, on page 43](#)
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- [Create and Provision an ODU Circuit, on page 51](#)

## Summary of Cisco EPN Manager Optical/DWDM Network Provisioning Support

Cisco EPN Manager supports the provisioning of Dense Wavelength Division Multiplexing (DWDM) optical channel (OCH) circuit types. The DWDM optical technology is used to increase bandwidth over existing fiber optic backbones. It combines and transmits multiple signals simultaneously at different wavelengths on the same fiber. In effect, one fiber is transformed into multiple virtual fibers.

Cisco EPN Manager supports the following optical circuits:

- Dense Wavelength Division Multiplexing (DWDM) optical channel (OCH) circuit—Following are the different optical channel circuit types:
  - Optical Channel Network Connection (OCHNC) WSON—OCHNC WSON circuits establish connectivity between two optical nodes on a specified C-band wavelength. For more information, see [Optical Channel Network Connection \(OCHNC\) WSON](#).
  - Optical Channel Client Connection (OCHCC) WSON—OCHCC WSON circuits extend the OCHNC WSON to create an optical connection from the source client port to the destination client port of the TXP/MXP cards. For more information, see [Optical Channel Client Connection \(OCHCC\) WSON](#).
  - Optical Channel (OCH) Trail WSON— OCH trail WSON circuits transport the OCHCC WSON circuits. For more information, see [Optical Channel \(OCH\) Trail WSON](#).
  - Optical Channel (OCH) Trail connecting NCS 1002, NCS 55xx, and ASR 9K devices—This OCH trail circuit creates an optical connection from the source trunk port of an NCS 1002, NCS 55xx, or ASR 9K device to the destination trunk port of another similar device. For more information, see [Optical Channel \(OCH\) Trail Connecting NCS 1002, NCS 55xx, and ASR 9K Devices](#).
  - Optical Channel (OCH) Trail User-to-Network Interface (UNI)—An OCH trail UNI circuit establishes connectivity between Cisco NCS 2000 series devices and Cisco NCS 4000 series devices. For more information, see [Optical Channel \(OCH\) Trail User-to-Network Interface \(UNI\)](#).

- Spectrum Switched Optical Network (SSON)—SSON circuits allow you to provide more channels in a span. Using the SSON functionality, the circuits are placed closer to each other if they are created within a media channel group. For more information, see [Spectrum Switched Optical Network \(SSON\) Circuits](#).
- Optical Transport Network (OTN)—An OTN circuit can be established statically or dynamically between ingress and egress nodes using Resource Reservation Protocol (RSVP) signaling. For more information, see [Optical Transport Network \(OTN\) Circuit](#).
  - Optical Channel Data Unit User-to-Network Interface (ODU UNI)—An ODU UNI circuit represents the actual end-to-end client service passing through the OTN architecture. For more information, see [Optical Channel Data Unit User-to-Network Interface \(ODU UNI\)](#).
  - Optical Channel Data Unit (ODU) Tunnel—ODU tunnel circuits transport the ODU UNIs. For more information, see [Optical Channel Data Unit \(ODU\) Tunnel](#).
  - Optical Channel Payload Unit (OPU) Over Optical Channel Data Unit (ODU)—OPU over ODU circuits provide a high-bandwidth point-to-point connection between two customer designated premises. These circuits uses ODU UNI circuits to carry client signals through the network. For more information, see [Optical Channel Payload Unit \(OPU\) Over Optical Channel Data Unit \(ODU\)](#).
  - Optical Channel Data Unit User-to-Network Interface (ODU UNI) Hairpin—An ODU UNI Hairpin circuit is similar to an ODU UNI circuit, but it is created in the management plane and it is an intra node circuit, that is, the source and destination is the same device but with different interfaces. For more information, see [Optical Channel Data Unit User-to-Network Interface \(ODU UNI\) Hairpin](#).
  - Optical Channel Data Unit (ODU)—Optical Channel Data Unit (ODU) is created as a sub controller of an OTU controller. ODU contains information for the maintenance and operational functions to support optical channels. For more information, see [Optical Channel Data Unit \(ODU\)](#).

## Prerequisites for Provisioning Optical Circuits

Following are the prerequisites for provisioning an optical circuit:

- Cisco EPN Manager supports both, Wavelength Switched Optical Network (WSON) and non-WSON circuits. However, for non-WSON circuits, Cisco EPN Manager supports only circuit discovery, which includes circuit overlay, circuit 360 view, multilayer trace view, and circuit details. Cisco EPN Manager does not support the provisioning, activation, deactivation, protection switch actions, and modification of non-WSON circuits.
- Communication between devices must be set up before you can provision an optical circuit.
- Inventory collection status for the devices on which the optical circuits will be provisioned must be *Completed*. To check this, go to **Inventory > Device Management > Network Devices**, and look at the status in the **Last Inventory Collection Status** column.
- DWDM grid unit must be set to either, wavelength or frequency. To do this, go to **Administration > Settings > System Settings > Circuits/VCS Display**, and under the DWDM Grid Unit area, choose either **Wavelength (Nanometer (nm))** or **Frequency (Terahertz (THz))**.
- Before you provision an OCHNC or a Media Channel NC circuit using NCS 2000 series devices running on software version 10.7 or later, ensure that you create a UNI config, either in Cisco Transport Controller (CTC) or in Cisco EPN Manager.

- Optionally, customers must be created in the system so that you can associate a circuit/VC to a customer during the circuit/VC creation and provisioning process. From the left sidebar, choose **Inventory > Other > Customers** to create and manage customers.
- For NC57-18DD-SE cards, use the following command format to reuse the ports 0-17 and 24-29 in 400G mode:

```
hw-module port-range <start port> <end port> location <loc> mode
<port_mode>
```

Example: `hw-module port-range 8 9 location 0/1/CPU0 mode 400`

## Create and Provision an OCH Circuit

To provision an OCH circuit, carry out these steps:

### Before you begin

For information about the prerequisites before you can provision an optical circuit, see [Prerequisites for Provisioning Optical Circuits, on page 30](#).

- 
- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click **Device Groups**, and select the location in which you want to create the OCH circuit.
- Step 3** Close the **Device Groups** dialog box.
- Step 4** In the **Network Topology** window, click **Circuits/VCS**.
- Step 5** Click the **Circuits/VCS** tab, then click the + (**Create**) icon in the **Circuits/VCS** pane toolbar. The Provisioning Wizard opens in a new pane to the right of the map.
- (You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.)
- Step 6** From the **Technology** drop-down list, choose **Optical**. Cisco EPN Manager displays a list of relevant circuit types in the Service Type area. For example, Optical service types for OCH circuits include OCHNC, OCHCC, OCH-Trail, OCHNC WSON, OCHCC WSON, OCH-Trail WSON, and OCH-Trail UNI.
- Step 7** In the **Service Type** area, choose the type of OCH circuit you want to create.
- Step 8** If you have defined profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles , on page 109](#).
- Step 9** Click **Next** to go to the **Customer Section** page.
- Step 10** (Optional) Select the customer for whom the circuit is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 11** Enter the circuit name and its description in the **Customer Section** page.
- Step 12** Click **Next** to go to the **Circuit Section** page.
- Note** If you select OCH-Trail UNI as the optical service type, the **Endpoint Section** page appears first, followed by the **Circuit Section** page.
- Step 13** Enter the circuit details. See [Circuit Section Reference for OCH Circuit Types, on page 33](#) for descriptions of the fields and attributes.
- Step 14** Click **Next** to go to the **Endpoint Section** page.
- Step 15** Select the bandwidth from the **Bandwidth** drop-down list.

**Step 16** Select a row in the Endpoint table, and click a device in the map to populate the Device Name column with the selected device. You can also click the row in the Endpoint table to edit the Device Name, Termination Point, Add/Drop Port, OCH-Trail, and Side columns. The Side column gets auto-populated based on the port selected. Only network elements that are available and compatible with the circuit type you chose is displayed.

Select the endpoints with the same FEC modes. If you select endpoints with different FEC modes, an error message is displayed.

**Note** The **Add Port** and **Drop Port** columns are available only for OCHNC WSON circuit. When you choose the port that must be added to the Add Port column, the values in the Drop Port and Side columns get auto populated. Also, you can manually edit the values in the Drop Port column.

**Step 17** Select a trail diversity for the OCH circuit. The OCH circuit that you are creating is diverse from the trail that you choose.

**Note** You cannot modify or delete the created trail diversity.

For OCHNC circuits you can select the **Diversity for PSM** check box and add the diversity.

**Step 18** Click **Next** to go to the **Constraints Section** page.

**Step 19** Click a device node or a link in the map to add it to the Constraints table. Alternatively, you can click the '+' button in the table toolbar to add a new row to the table and edit the Node/Link Name, Include/Exclude, and Route columns. Only network elements and links that are compatible with the chosen circuit type are displayed.

**Note** When the row is in the edit mode, you cannot click a device or a link in the map to populate the columns in the Constraints table. The following route constraint conditions apply to the OCHCC Trail WSON circuit:

- The modified route constraints are not applied immediately to the circuit but might cause a reroute. However, the modification is applied at the next route operation or restoration.
- The **Circuit Overlay** shows only the constraints applicable to current route, while the **Circuit Edit** wizard displays the currently configured constraints.
- The **Circuit Edit** wizard contains the constraints table displaying the different constraints with respect to constraints icon displayed using circuit overlay.
- While modifying the circuit, you can select the **Reroute Actions** from the drop-down list. You can select None, Working Path, or Protection path from the list.
- To include or exclude the associated OTS link in a working path, select the Source link termination point while selecting the OTS link termination point with the optical degree as a constraint. For example, consider a three-node topology, where all the three nodes (A, B, and C) are connected, and the circuit has A and B as a Source Node and Destination Node, respectively. If you want to include a working path link that connects B and C, then while selecting the constraint, select the link termination point listed with the optical degree that connects to C. For example, if optical degree 1 of node B is used to connect C, select constraint as B-1. This scenario is applicable for including or excluding the link in a working path.

**Step 20** Click **Next** to go to the **Alien Wavelength Section** page. The current Alien Wavelength configurations such as the Card, Trunk mode, and FEC mode for the source and destination nodes are displayed. You can choose to create new configurations of the Alien Wavelength for the source and destination nodes.

**Note** The **Alien Wavelength Section** is available only when you create OCHNC WSON circuits.



**Step 21** Click **Create Now** to create the circuit. If you chose to see a preview of the TL1 or CLI commands that are deployed to the devices, it is displayed on clicking **Preview**. You can either deploy the configurations to the device or cancel it but you cannot edit the attributes.

**Note** If you get an error message stating "Cannot validate the activation of the circuit. Time out expired ", it means that device is taking time to activate the circuit in control plane. The circuit is in missing state in EPNM. Deleting it on EPNM does not delete the circuit on the network. Device full synchronization from EPNM must be done if the circuit has to be shown as UP & discovered in EPNM. It has to be deleted from CTC so that it can be created again from EPNM.

**Step 22** The circuit is added to the list in the Circuits/VCS pane in the Network Topology window. To check the provisioning state, click the *i* icon next to the circuit/VC name to see the Circuit/VC 360 view.

**Note** If only an OCH-Trail is created, the Related Circuits tab in Circuit/VC 360 does not show any data. If an OCHCC is created, it also creates an OCH-Trail. For these circuits, in the Related Circuits tab OCHCC-WSO contains OCH-Trail WSON and OCH-Trail WSON contains OCHCC-WSO.

## Circuit Section Reference for OCH Circuit Types

*Table 7: Circuit Section Reference—OCH Circuit Types*

Attribute	Description	Enabled
<b>Circuit Details</b>		
Label	Unique name to identify the circuit.	
State	Administrative state for the circuit. Values are: <ul style="list-style-type: none"> <li>In Service—The circuit is in service and able to carry traffic.</li> <li>Out of Service—The circuit is out of service and unable to carry traffic.</li> </ul>	For all OCH circuit types.
Bidirectional	Check this check box to create a two-way circuit.	For OCHCC WSON and OCH Trail WSON circuit types.
Wait For Activation	Check this check box to wait for the set time for circuit activation.	For OCHCC WSON and OCH Trail WSON circuit types.

Attribute	Description	Enabled
Protection	<p>Protection mechanism for the circuit. Cisco EPN Manager supports the following protection mechanism based on the circuit type selected:</p> <ul style="list-style-type: none"> <li>• None—For unprotected circuits This value is available for all OCH circuit types.</li> <li>• PSM—When a Protection Switch Module (PSM) card is connected to a TXP card. This value is available for OCHNC WSON and OCHCC WSON circuit types.</li> <li>• Y-Cable—When a transponder or muxponder card protects the circuit. This value is available for OCHCC WSON circuit type.</li> <li>• Splitter—When a MXPP/TXPP card is used. The circuit source and destination are on MXPP_MR_2.5G and TXPP_MR_2.5G cards. These cards provide splitter (line-level) protection (trunk protection typically on TXPP or MXPP transponder cards). This value is available only for OCHCC WSON circuit type.</li> </ul>	For OCHNC WSON circuit type.
<b>Route Properties</b>		
Diverse From Tunnel	Select a tunnel to ensure that it is not used by the circuit you are provisioning. This is to ensure that if there is a failure in a tunnel, the same tunnel is not used by another circuit.	For OCH-Trail UNI circuit types when the Mutual Diversity check box is unchecked.
Validation	<p>Validation mode for the circuit. Values are:</p> <ul style="list-style-type: none"> <li>• Full—The circuit is created when the circuit validation result is greater than or equal to the acceptance threshold value.</li> <li>• None—The circuit is created without considering the acceptance threshold value.</li> </ul>	For all OCH circuit types.
Acceptance Threshold	<p>Protection acceptance threshold value set for the OCH protected circuits. Values are:</p> <ul style="list-style-type: none"> <li>• Green—Indicates that the restoration failure risk is 0%.</li> <li>• Yellow—Indicates that the restoration failure risk is between 0% and 16%.</li> <li>• Orange—Indicates that the restoration failure risk is between 16% and 50%.</li> <li>• Red—Indicates that the restoration failure risk is greater than 50%.</li> </ul>	For all OCH circuit types when the Validation field is set to Full.

Attribute	Description	Enabled
Protect Acceptance Threshold	Protection acceptance threshold value set for the OCH protected circuits. Values are: <ul style="list-style-type: none"> <li>• Green—Indicates that the restoration failure risk is 0%.</li> <li>• Yellow—Indicates that the restoration failure risk is between 0% and 16%.</li> <li>• Orange—Indicates that the restoration failure risk is between 16% and 50%.</li> <li>• Red—Indicates that the restoration failure risk is greater than 50%.</li> </ul>	For OCHNC WSON circuit type when: <ul style="list-style-type: none"> <li>• Protection field is set to PSM, Y-Cable, or Splitter.</li> <li>• Validation field is set to Full.</li> </ul>
Ignore Path Alarms	Check the check box to ignore path alarms.	For OCHCC WSON, OCHNC WSON, and OCH-Trail WSON circuit types.
Allow Regeneration	Check the check box to allow the network elements to regenerate the signal.	For all OCH circuit types.
Soak Time	Period that the circuit on the restored path waits before switching to the original path after a failure is fixed.	For OCHCC WSON, OCHNC WSON, and OCH-Trail WSON circuit types when Revert is set to Manual or Automatic.
Restoration	Check this check box to restore the failed OCH circuit to a new route.	For all OCH circuit types.
Restoration Frequency	Select the restoration frequency type by checking the <b>Preferred</b> or <b>Required</b> radio button.	For OCH-Trail circuit type when the Restoration check box is checked.
Priority	Prioritize the restoration operation for the failed OCH circuit. Values are High, Priority 1, Priority 2, Priority 3, Priority 4, Priority 5, Priority 6, and Low.	For all OCH circuit types when the Restoration check box is checked.
Restoration Validation	Validation mode for the restoration operation. Values are: <ul style="list-style-type: none"> <li>• None—The circuit is restored without considering the restoration acceptance threshold value.</li> <li>• Inherited—The restoration circuit inherits the validation and acceptance threshold values from the primary circuit.</li> <li>• Full—The circuit is restored when the restoration validation result is greater than or equal to the restoration acceptance threshold value.</li> </ul>	For all OCH circuit types when the Restoration check box is checked.

Attribute	Description	Enabled
Restoration Acceptance Threshold	Acceptance threshold value set for the restoration operation for OCH circuits. Values are: <ul style="list-style-type: none"> <li>• Green—Indicates that the restoration failure risk is 0%.</li> <li>• Yellow—Indicates that the restoration failure risk is between 0% and 16%.</li> <li>• Orange—Indicates that the restoration failure risk is between 16% and 50%.</li> <li>• Red—Indicates that the restoration failure risk is greater than 50%.</li> </ul>	For all OCH circuit types when: <ul style="list-style-type: none"> <li>• Restoration check box is checked.</li> <li>• Restoration Validation field is set to Full.</li> </ul>
Restoration Protect Acceptance Threshold	Protection acceptance threshold value set for the restoration operation for OCH protected circuits. Values are: <ul style="list-style-type: none"> <li>• Green—Indicates that the restoration failure risk is 0%.</li> <li>• Yellow—Indicates that the restoration failure risk is between 0% and 16%.</li> <li>• Orange—Indicates that the restoration failure risk is between 16% and 50%.</li> <li>• Red—Indicates that the restoration failure risk is greater than 50%.</li> </ul>	For OCHNC WSON circuit type when: <ul style="list-style-type: none"> <li>• Protection field is set to PSM, Y-Cable, or Splitter.</li> <li>• Restoration check box is checked.</li> <li>• Restoration Validation field is set to Full.</li> </ul>
Restoration Soak Time	Period that the circuit on the optical path waits before restoring to a new path after a failure alarm is raised.  The default restoration soak time is 2 minutes.	For OCH-Trail and OCH-NC, when Restoration is selected.
Revert	Reverts the circuit from the restored path to the original path after a failure is fixed. Values are None, Manual, and Automatic.	For OCHCC WSON, OCHNC WSON, OCH-Trail and OCH-Trail WSON circuit types when the Restoration check box is checked.
Revert Soak Time	Period that the circuit on the optical path waits before reverting to the original path after a failure is fixed.  The default revert soak time is 1 minute.	For OCH-Trail and OCH-NC, when Revert is set to Automatic.
Admin State	Select the admin state of the circuit as <b>Up</b> or <b>Down</b> . This impacts the circuit's operability and determines whether the circuit can be activated or deactivated.	For OCH-Trail UNI circuit type.
<b>Optical Properties</b>		

Attribute	Description	Enabled
Grid Type	Choose the desired grid type from the drop-down list. You can choose from <b>Flex 6.25 GHz</b> , <b>Fixed 50 GHz</b> , <b>Flex 100 MHz</b> , and <b>Fixed 75 GHz</b> .	For OCH-Trail circuit type.
Wavelength (nm)/ Frequency (THz)	Choose the wavelength from the drop-down list.	For OCH-Trail circuit type.
Main Frequency	Select the frequency type by clicking the <b>Preferred</b> or <b>Required</b> radio button.	For OCH-Trail circuit type.
<b>Preferred Wavelength Properties</b>		
Wavelength Options	Wavelength options for the circuit. Values are <b>Do Not Set</b> , <b>Set To Default</b> , and <b>Set Preferred Wavelength</b> .	For OCH-Trail UNI circuit type.
<b>Work Port Properties</b>		
Auto Provisioning	Check this check box to enable the Auto Provisioning feature.	For all OCH circuit types
C Band	Conventional wavelength window to provision the circuit. Values are: <ul style="list-style-type: none"> <li>• Odd—The odd position in the ITU grid.</li> <li>• Even—The even position in the ITU grid.</li> </ul>	<ul style="list-style-type: none"> <li>• For all OCHCC WSON, OCHNC WSON, and OCH-Trail WSON circuit types when the Auto Provisioning check box is unchecked.</li> <li>•</li> <li>• In Service—The circuit is in service and able to carry traffic.</li> <li>• Out of Service—The circuit is out of service and unable to carry traffic.</li> </ul>

Attribute	Description	Enabled
Wavelength/Frequency	Wavelength or frequency of the circuit. This value is applicable for the C Band that you chose.  <b>Note</b> You must set the DWDM grid unit to either wavelength or frequency. To do this, go to <b>Administration &gt; Settings &gt; System Settings &gt; Circuits/VCS Display</b> , and under the DWDM Grid Unit area, choose either <b>Wavelength (Nanometer (nm))</b> or <b>Frequency (Terahertz (THz))</b> .	For all OCH circuit types when the C Band field is set to Odd or Even.
Preferred/Required	Select to determine whether the values set in the C Band and Wavelength/Frequency fields are preferred or required to provision the circuit.	For all OCH circuit types when the Auto Provisioning check box is unchecked.
<b>Protect Port Properties</b>		
Copy from Work Port	Check this check box to copy the values set in the Work Port Properties section.	For all OCH circuit types when the Protection field is set to PSM, Y-Cable, or Splitter.



**Note** EPNM supports the following parameters for legacy circuit color validation while creation OCH-Trail:

- AmpliGainRange
- ChPwr
- Gain
- Tilt
- WkgMode - OpticalAmplificationSettings tableVoaAttenuation
- Attenuator - OpticalTransportSettings table

Reactive inventory will not get triggered if these port parameters changed on the device. You have to trigger sync operation to get the parameters updated in EPNM.

## Create and Provision an OCH Trail Circuit Connecting IOS-XR Platform Based Devices Directly

To create and provision an OCH trail circuit connecting the IOS-XR platform-based devices directly:

### Before you begin

For information about the prerequisites that must be met before you can provision an optical circuit, see [Prerequisites for Provisioning Optical Circuits, on page 30](#).

- 
- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click **Device Groups**, and then select the location in which you want to create the OCH circuit.
- Step 3** Close the **Device Groups** dialog box.
- Step 4** In the **Network Topology** window, click **Circuits/VCS**.
- Step 5** Click the **Circuits/VCS** tab, then click the + (**Create**) icon in the **Circuits/VCS** pane toolbar. The Provisioning Wizard opens in a new pane to the right of the map.
- You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.
- Step 6** From the **Technology** drop-down list, choose **Optical**. Cisco EPN Manager displays a list of relevant circuit types in the Service Type area. For example, Optical service types for OCH circuits include OCHNC WSON, OCHCC WSON, OCH-Trail WSON, and OCH-Trail UNI.
- Step 7** In the **Service Type** area, choose the type of OCH circuit you want to create.
- Step 8** If you have defined profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles , on page 109](#).
- Step 9** Click **Next** to go to the **Customer Section** page.
- Step 10** (Optional) Select the customer for whom the circuit is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 11** Enter the circuit name and its description in the **Customer Section** page.
- Step 12** Click **Next** to go to the **Circuit Section** page.
- Note** If you select OCH-Trail UNI as the optical service type, the **Endpoint Section** page appears first followed by the **Circuit Section** page.
- Step 13** Enter the circuit details. See [Circuit Section Reference for OCH Circuit Types, on page 33](#) for descriptions of the fields and attributes.
- Step 14** Click **Next** to go to the **Endpoint Section** page.
- Step 15** Select a row in the Endpoint table, and then click a device in the map to populate the Device Name column with the selected device. Alternatively, you can click the row in the Endpoint table to edit the Device Name, Termination Point, Add/Drop Port, OCH-Trail, and Side columns. The Side column gets autopopulated based on the port selected. Only network elements that are available and compatible with the circuit type you chose will be displayed.
- Note** The **Add Port** and **Drop Port** columns are available only for OCHNC WSON circuit. Once you choose the port that must be added to the Add Port column, the values in the Drop Port and Side columns get autopopulated. Also, you can manually edit the values in the Drop Port column.
- Step 16** Select a trail diversity for the OCH circuit. The OCH circuit that you are creating will be diverse from the trail that you choose.
- Note** You cannot modify or delete the trail diversity once it is created.
- Step 17** Click **Next** to go to the **Constraints Section** page.

**Step 18** Click a device node or a link in the map to add it to the Constraints table. Alternatively, you can click the '+' button in the table toolbar to add a new row to the table and edit the Node/Link Name, Include/Exclude, and Route columns. Only network elements and links that are compatible with the circuit type you chose will be displayed.

**Note** When the row is in the edit mode, you cannot click a device or a link in the map to populate the columns in the Constraints table. The following route constraint conditions apply to the OCHCC Trail WSON circuit:

- The modified route constraints are not applied immediately to the circuit but might cause a reroute. However, the modification is applied at the next route operation or restoration.
- The **Circuit Overlay** shows only the constraints applicable to current route, while the **Circuit Edit** wizard displays the currently configured constraints.
- The **Circuit Edit** wizard contains the constraints table displaying the different constraints with respect to constraints icon displayed using circuit overlay.

**Step 19** Click **Next** to go to the **Alien Wavelength Section** page. The current Alien Wavelength configurations such as the Card, Trunk mode, and Fec mode for the source and destination nodes are displayed. You can choose to create new configurations of the Alien Wavelength for the source and destination nodes.

**Note** The **Alien Wavelength Section** is available only when you create OCHNC WSON circuits.

**Step 20** Click **Create Now** to create the circuit. If you chose to see a preview of the TL1 or CLI commands that will be deployed to the devices, it will be displayed on clicking **Preview** and now, you can either deploy the configurations to the device or cancel it but you cannot edit the attributes.

**Step 21** The circuit should be added to the list in the Circuits/VCS pane in the Network Topology window. To check the provisioning state, click the *i* icon next to the circuit/VC name to see the Circuit/VC 360 view.

## Create and Provision Two Mutually Diverse OCH-Trail UNI Circuits

Use this procedure to create two OCH-Trail UNI circuits that are mutually diverse from each other. Both the circuits must originate from the same device. You can create both the circuits quickly using the Provisioning wizard in a single workflow .

### Before you begin

For information about the prerequisites that must be met before you can provision an optical circuit, see [Prerequisites for Provisioning Optical Circuits, on page 30](#).

**Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.

**Step 2** Click **Device Groups**, and then select the location in which you want to create the OCH circuit.

**Step 3** Close the **Device Groups** dialog box.

**Step 4** In the **Network Topology** window, click **Circuits/VCS**.

**Step 5** Click the **Circuits/VCS** tab, then click the + (**Create**) icon in the **Circuits/VCS** pane toolbar. The Provisioning Wizard opens in a new pane to the right of the map.

You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.

**Step 6** From the **Technology** drop-down list, choose **Optical**.



- Step 7** In the **Service Type** area, choose **OCH-Trail UNI**.
- Step 8** If you have defined profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles , on page 109](#).
- Step 9** Click **Next** to go to the **Customer Section** page.
- Step 10** Check the **Mutual Diversity** check box to create two OCH-Trail UNI circuits that are mutually diverse from each other.
- Step 11** Enter the circuit name and its description in the **Customer Section** page.
- Step 12** Click **Next** to go to the **Endpoint Section** page.
- Step 13** Select a row in the Endpoint table, and then click a device in the map to populate the Device Name column with the selected device. Alternatively, you can click the row in the Endpoint table to edit the Device Name and Interface.
- Note** When the row is in the edit mode, you cannot click a device in the map to populate the **Device Name** column.
- Step 14** Click **Next** to go to the **Circuit Section** page.
- Step 15** Enter the circuit details. See [Circuit Section Reference for OCH Circuit Types, on page 33](#) for descriptions of the fields and attributes.
- Step 16** Click **Next** to go to the **Constraints Section** page.
- Step 17** Click a device node or a link in the map to add it to the Constraints table. Alternatively, you can click the '+' button in the table toolbar to add a new row to the table and edit the Node/Link Name, Include/Exclude, and Route columns. Only network elements and links that are compatible with the circuit type you chose will be displayed.
- Note** When the row is in the edit mode, you cannot click a device or a link in the map to populate the columns in the Constraints table.
- Step 18** Click **Next**. The **Customer Section** page for the second circuit is displayed.
- Step 19** Repeat Step 11 to Step 17 to create the second circuit.
- Step 20** Click **Create Now** to create the circuit. If you chose to see a preview of the TL1 or CLI commands that will be deployed to the devices, it will be displayed on clicking **Preview** and now, you can either deploy the configurations to the device or cancel it but you cannot edit the attributes.
- Step 21** The circuits should be added to the list in the Circuits/VCS pane in the Network Topology window. To check the provisioning state, click the *i* icon next to the circuit/VC names to see the Circuit/VC 360 view.
- 

## Create and Provision a Media Channel Group SSON Circuit

To create and provision a Media Channel Group SSON circuit:

### Before you begin

For information about the prerequisites that must be met before you can provision an optical circuit, see [Prerequisites for Provisioning Optical Circuits, on page 30](#).

---

- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click **Device Groups**, and then select the location in which you want to create the Media Channel Group SSON circuit.
- Step 3** Close the **Device Groups** popup window.
- Step 4** In the **Network Topology** window, click **Circuits/VCS**.

- Step 5** Click the **Circuits/VCs** tab, then click the + (**Create**) icon in the **Circuits/VCs** pane toolbar. The Provisioning Wizard opens in a new pane to the right of the map.
- You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.
- Step 6** From the **Technology** drop-down list, choose **Optical**. Cisco EPN Manager displays a list of relevant circuit types in the Service Type area.
- Step 7** In the **Service Type** area, choose **Media Channel Group SSON**.
- Step 8** If you have defined profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles](#), on page 109.
- Step 9** Click **Next** to go to the **Customer Section** page.
- Step 10** (Optional) Select the customer for whom the circuit is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 11** Enter the circuit name and its description in the **Customer Section** page.
- Note** A maximum of only 80 characters are allowed for the Circuit Name field.
- Step 12** Click **Next** to go to the **Endpoint Section** page.
- Step 13** Select a row in the Endpoint table, and then click a device in the map to populate the Device Name column with the selected device. Alternatively, you can click the row in the Endpoint table to edit the Device Name, Termination Point, and Add/Drop Port columns. Only network elements that are available and compatible with the circuit type you chose will be displayed.
- Note** When the row is in the edit mode, you cannot click a device in the map to populate the **Device Name** column.
- Step 14** Click **Next** to go to the **Circuit Section** page.
- Step 15** Choose the required circuit width.
- Step 16** To set the **Central Wavelength/Frequency Properties**, do one of the following:
- Check the **Auto Provisioning** check box.
  - Choose the required **Wavelength** for the circuit and then choose either **Preferred** or **Required** option to determine whether the values set in the **Wavelength** field is preferred or required to provision the circuit.
- Step 17** Click **Next** to go to the **Constraints Section** page.
- Step 18** Click a device node or a link in the map to add it to the Constraints table. Alternatively, you can click the '+' button in the table tool bar to add a new row to the table and edit the Node/Link Name, Include/Exclude, and Route columns. Only network elements and links that are compatible with the circuit type you chose will be displayed.
- Note** When the row is in the edit mode, you cannot click a device or a link in the map to populate the columns in the Constraints table.
- The **Alternate Constraints** check-box is available for selection if the **Restoration** check-box is selected and the **Revert** is set to **None** in the **Optical Properties**.
- Step 19** Click **Create Now** to create the circuit. If you chose to see a preview of the TL1 or CLI commands that will be deployed to the devices, it will be displayed on clicking **Preview** and now, you can either deploy the configurations to the device or cancel it, but you cannot edit the attributes.

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The circuit should be added to the list in the Circuits/VCs pane in the Network Topology window. To check the provisioning state, click the *i* icon next to the circuit/VC name to see the Circuit/VC 360 view.

# Create and Provision a Media Channel SSON Circuit

To create and provision a Media Channel SSON circuit:

## Before you begin

- Ensure that a Media channel group SSON is already created to associate the Media Channel SSON circuits with the Media channel group. See [Create and Provision a Media Channel Group SSON Circuit, on page 41](#).
- For information about the prerequisites that must be met before provisioning an optical circuit, see [Prerequisites for Provisioning Optical Circuits, on page 30](#).

- 
- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click **Device Groups**, and select the location where you want to create the Media Channel SSON circuit.
- Step 3** Close the **Device Groups** pop-up window.
- Step 4** In the **Network Topology** window, click **Circuits/VCS**.
- Step 5** Click the **Circuits/VCS** tab, and click the + (**Create**) icon in the **Circuits/VCS** pane toolbar. The Provisioning Wizard opens in a new pane.
- You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.
- Step 6** From the **Technology** drop-down list, choose **Optical**. Cisco EPN Manager displays a list of relevant circuit types in the Service Type area. For example, optical service types for Media Channel SSON circuits include Media Channel NC SSON, Media Channel Trail SSON, and Media Channel CC SSON.
- Step 7** In the **Service Type** area, choose the type of Media Channel SSON circuit you want to create.
- Step 8** If you have defined the profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles , on page 109](#).
- Step 9** Click **Next** to go to the **Customer Section** page.
- Step 10** (Optional) Select the customer for whom the circuit is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 11** Enter the circuit name and description in the **Customer Section** page.
- Note** For the Media Channel NC SSON and Media Channel Trail SSON circuits, a maximum of 77 characters are allowed in the Circuit Name field. Out of the 77 characters, three characters are reserved for the carrier suffix.
- For the Media Channel CC SSON circuits, a maximum of 71 characters are allowed in the Circuit Name field.
- Step 12** Click **Next** to go to the **Endpoint Section** page.
- Step 13** Select a row in the Endpoint table, and click a device in the map to populate the Device Name column with the selected device. Alternatively, you can click the row in the Endpoint table to edit the Device Name and Termination Point columns. The Side column gets autopopulated based on the termination point. Only network elements that are available and compatible with the chosen circuit type will be displayed.
- Note** The MCH-Trail Name column is available only when you create a Media Channel CC SSON circuit.
- Step 14** Select a media channel diversity for the MCH circuit. The MCH circuit that you are creating will be diverse from the media channel that you choose.

**Note** You cannot modify or delete the media channel diversity once it is created.

**Step 15** Click **Next** to go to the **Circuit Section** page.

**Note** For the Media Channel CC SSON circuits, the **Circuit Section** page is not available if you have entered an MCH-Trail Name in the Endpoints table.

**Step 16** Choose the Media Channel Group that you want to associate the Media Channel SSON circuit with.

**Step 17** Enter the circuit details. See [Circuit Section Reference for Media Channel SSON Circuit Types, on page 44](#) for descriptions of the fields and attributes.

**Step 18** Click **Next** to go to the **Constraints Section** page.

**Note** For MCHNC SSON circuits, you can add NCS1K and NCS2K devices in Regen mode as constraints.

**Step 19** Click a device node or a link in the map to add it to the Constraints table. Alternatively, you can click the '+' button in the table toolbar to add a new row to the table and edit the Node/Link Name, Include/Exclude, and Route columns. Only network elements and links that are compatible with the chosen circuit type will be displayed.

**Note** When the row is in the edit mode, you cannot click a device or a link in the map to populate the columns in the Constraints table.

**Step 20** Click **Create Now** to create the circuit. If you chose to see a preview of the TL1 or CLI commands that will be deployed to the devices, click **Preview**. You can either deploy the configurations to the device or cancel it, but you cannot edit the attributes.

---

The circuit will be added to the list in the Circuits/VCs pane in the Network Topology window. To check the provisioning state, click the *i* icon next to the circuit/VC name to see the Circuit/VC 360 view.

## Circuit Section Reference for Media Channel SSON Circuit Types

The following table lists and describes the attributes that define the Media Channel SSON circuit types.

**Table 8: Circuit Section Reference—Media Channel SSON Circuit Types**

Attribute	Description	Enabled
<b>Central Wavelength/Frequency Properties</b>		
Auto Provisioning	Check this check box to automatically set the wavelength or frequency properties for the circuit.	For all Media Channel SSON circuit types.
Wavelength (nm)	Wavelength or frequency of the circuit.  <b>Note</b> You must set the DWDM grid unit to either wavelength or frequency. To do this, go to <b>Administration &gt; Settings &gt; System Settings &gt; Circuits/VCs Display</b> , and under the DWDM Grid Unit area, choose either <b>Wavelength (Nanometer (nm))</b> or <b>Frequency (Terahertz (THz))</b> .	For all Media Channel SSON circuit types when the Auto Provisioning check box is unchecked.

Attribute	Description	Enabled
Preferred/Required	Select to determine whether the values set in the Wavelength field is preferred or required to provision the circuit.	For all Media Channel SSON circuit types when the Auto Provisioning check box is unchecked.
<b>Optical Properties</b>		
Validation	Validation mode for the circuit. Values are: <ul style="list-style-type: none"> <li>• Full—The circuit is created when the circuit validation result is greater than or equal to the acceptance threshold value.</li> <li>• None—The circuit is created without considering the acceptance threshold value.</li> </ul>	For all Media Channel SSON circuit types.
Acceptance Threshold	Protection acceptance threshold value set for the circuit. Values are: <ul style="list-style-type: none"> <li>• Green—Indicates that the restoration failure risk is 0%.</li> <li>• Yellow—Indicates that the restoration failure risk is between 0% and 16%.</li> <li>• Orange—Indicates that the restoration failure risk is between 16% and 50%.</li> <li>• Red—Indicates that the restoration failure risk is greater than 50%.</li> </ul>	For all Media Channel SSON circuit types when the Validation field is set to Full.
Ignore Path Alarms	Check the check box to ignore path alarms.	For all Media Channel SSON circuit types.
Allow Regeneration	Check the check box to allow the network elements to regenerate the signal.	For all Media Channel SSON circuit types.
Restoration	Check this check box to restore the failed Media Channel SSON circuit to a new route.	For all Media Channel SSON circuit types.
Priority	Prioritize the restoration operation for the failed circuit. Values are High, Priority 1, Priority 2, Priority 3, Priority 4, Priority 5, Priority 6, and Low.	For all Media Channel SSON circuit types when the Restoration check box is checked.
Restoration Validation	Validation mode for the restoration operation. Values are: <ul style="list-style-type: none"> <li>• None—The circuit is restored without considering the restoration acceptance threshold value.</li> <li>• Inherited— The restored circuit inherits the validation and acceptance threshold values from the primary circuit.</li> <li>• Full—The circuit is restored when the restoration validation result is greater than or equal to the restoration acceptance threshold value.</li> </ul>	For all Media Channel SSON circuit types when the Restoration check box is checked.

Attribute	Description	Enabled
Restoration Acceptance Threshold	Acceptance threshold value set for the restoration operation for the circuit. Values are: <ul style="list-style-type: none"> <li>• Green—Indicates that the restoration failure risk is 0%.</li> <li>• Yellow—Indicates that the restoration failure risk is between 0% and 16%.</li> <li>• Orange—Indicates that the restoration failure risk is between 16% and 50%.</li> <li>• Red—Indicates that the restoration failure risk is greater than 50%.</li> </ul>	For all Media Channel SSON circuit types when: <ul style="list-style-type: none"> <li>• Restoration check box is checked.</li> <li>• Restoration Validation field is set to Full.</li> </ul>
Revert	Reverts the circuit from the restored path to the original path after a failure is fixed. Values are None, Manual, and Automatic.	For all Media Channel SSON circuit types when the Restoration check box is checked.
Soak Time	Period that the circuit on the restored path waits before switching to the original path after a failure is fixed.	For all Media Channel SSON circuit types when the Revert option is set to Manual or Automatic.

## Create and Provision an OTN Circuit

To provision an OTN circuit:

### Before you begin

For information about the prerequisites that must be met before you can provision an optical circuit, see [Prerequisites for Provisioning Optical Circuits, on page 30](#).

- 
- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click **Device Groups**, and then select the location in which you want to create the OTN circuit.
- Step 3** In the **Network Topology** window, click **Circuits/VCS**.
- Step 4** Click the **Circuits/VCS** tab, then click the + (**Create**) icon in the **Circuits/VCS** pane toolbar. The Provisioning Wizard opens in a new pane to the right of the map.
- You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.
- Step 5** From the **Technology** drop-down list, choose **Optical**. Cisco EPN Manager displays a list of relevant circuit types in the Service Type area. For example, service types for OTN circuits include ODU UNI, ODU Tunnel, OPU over ODU, and ODU UNI Hairpin.
- Step 6** In the **Service Type** area, choose the type of OTN circuit you want to create.
- Step 7** If you have defined profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles, on page 109](#).
- Step 8** Click **Next** to go to the **Customer Details** page.

- Step 9** (Optional) Select the customer for whom the circuit is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 10** Enter the circuit name and its description in the **Customer Details** page.
- Step 11** Click **Next** to go to the **Circuit Details** page.
- Step 12** Enter the circuit details. See [Circuit Section Reference for OTN Circuit Types, on page 47](#) for descriptions of the fields and attributes.
- Step 13** Click **Next** to go to the **Endpoint Section** page.
- Step 14** Select a row in the Endpoint table, and then click a device in the map to populate the Device Name column with the selected device. Alternatively, you can click the row in the Endpoint table to edit the Device Name and Interface/Termination Point columns. Only network elements that are available and compatible with the circuit type you chose will be displayed.
- Note** When the row is in the edit mode, you cannot click a device in the map to populate the Device Name column.
- Step 15** Enter the protection type and path options for the circuit. See [Endpoint Section Reference for OTN Circuit Types, on page 48](#) for descriptions of the fields and attributes.
- Step 16** Click **Create Now** to create the circuit. If you chose to see a preview of the TL1 or CLI commands that will be deployed to the devices, it will be displayed on clicking **Preview**. After seeing the preview of the TL1 or CLI commands, you can either deploy the configurations to the devices or cancel the provisioning operation.

The circuit should be added to the list in the **Circuits/VCS** tab in the **Network Topology** window. To check the provisioning state, click the *i* icon next to the circuit/VC name to see the Circuit/VC 360 view.

## Circuit Section Reference for OTN Circuit Types

The following table lists and describes the attributes that define the OTN circuit types.

**Table 9: Circuit Section Reference—OTN Circuit Types**

Attribute	Description	Enabled
<b>Circuit Properties</b>		
Bandwidth	Bandwidth required to provision the OTN circuit. See <a href="#">Table 11: Value Mapping—Bandwidth and Service Type for ODU UNI Circuits</a> for the mapping of values in the Bandwidth, and Service Type fields.	For all OTN circuit types.
A-End Open Ended	Check this check box to create an open-ended circuit, in which the source end point is connected to an ODU subcontroller, instead of a client payload controller.  <b>Note</b> Checking this checkbox will not deploy ODU subcontrollers on the Cisco NCS 4000 devices. You must configure the ODU subcontrollers on the Cisco NCS 4000 devices before adding the devices to Cisco EPN Manager. For more information about the open ended ODU UNIs and how to configure ODU subcontrollers on Cisco NCS 4000 devices, see <a href="#">Open Ended ODU UNI</a> .	For ODU UNI circuit type when the Bandwidth field is set to ODU0, ODU1, ODU2, or ODU2E.

Attribute	Description	Enabled
Z-End Open Ended	<p>Check this check box to create an open-ended circuit, in which the destination end point is connected to an ODU subcontroller, instead of a client payload controller.</p> <p><b>Note</b> Checking this checkbox will not deploy ODU subcontrollers on the Cisco NCS 4000 devices. You must configure the ODU subcontrollers on the Cisco NCS 4000 devices before adding the devices to Cisco EPN Manager. For more information about the open ended ODU UNIs and how to configure ODU subcontrollers on Cisco NCS 4000 devices, see <a href="#">Open Ended ODU UNI</a>.</p>	For ODU UNI circuit type when the Bandwidth field is set to ODU0, ODU1, ODU2, or ODU2E.
Service Type	<p>Service types supported for the selected bandwidth.</p> <p>See <a href="#">Table 11: Value Mapping—Bandwidth and Service Type for ODU UNI Circuits</a> for the mapping of values in the Bandwidth and Service Type fields.</p>	For ODU UNI circuit type.
<b>Route Properties</b>		
Bit Rate	Total number of bits per second.	For all OTN circuit types (except ODU UNI Hairpin) when the Bandwidth field is set to ODUFLEX.
Framing Type	<p>The elementary signal of the requested service. Values are:</p> <ul style="list-style-type: none"> <li>• CBR—Constant bit rate.</li> <li>• GFP-F-Fixed—Fixed and frame mapped generic framing procedure.</li> </ul>	For all OTN circuit types (except ODU UNI Hairpin) when the Bandwidth field is set to ODUFLEX.
Record Route	Check this check box to record the circuit route.	For all OTN circuit types (except ODU UNI Hairpin).

## Endpoint Section Reference for OTN Circuit Types

The following table lists and describes the attributes that define the protection type and path options for OTN circuit types.



Table 10: Endpoint Section Reference—OTN Circuit Types

Attribute	Description	Enabled
<b>Endpoints</b>		
Device Name	A end and Z end devices of the circuit.  <b>Note</b> For ODU UNI Hairpin circuits, both A end and Z end will be the same device but with different termination points.	For all OTN circuit types.
Interface	Interface names for the A end and Z end devices.	For ODU UNI circuits.
Termination Point	Termination point for the cards.	For OPU over ODU and ODU UNI Hairpin circuits.
Protection Type	Protection type for the OTN circuit. Values are: <ul style="list-style-type: none"> <li>• 1+0—Unprotected card. If a failure is detected in the working path, it results in loss of data.</li> <li>• 1+1—Both primary and secondary path carry traffic end to end and the receiver receives and compares both the traffic. When the egress node detects failure in one path, it switches the traffic to the unaffected path.</li> <li>• 1+R—When the primary path fails, the restored path is calculated and traffic is switched to the restored path. If the primary path is non-revertible, the restored path becomes the new primary path.</li> <li>• 1+1+R—Both primary and secondary path carry traffic. When the egress node detects failure in one path, it switches the traffic to the unaffected path. The restored path is calculated and traffic is switched to the restored path. If the primary or secondary path is non-revertible, the restored path becomes the new primary or secondary path.</li> </ul> <b>Note</b> This protection type is not supported for Cisco NCS 4000 series devices.	For all OTN circuit types (except ODU UNI Hairpin).
Diverse From Tunnel ID	Select a tunnel to ensure that it is not used by the circuit you are provisioning. This is to ensure that if there is a failure in a tunnel, the same tunnel is not used by another circuit.	For all OTN circuit types(except ODU UNI Hairpin).

**Working Path, Protected Path, and Restored Path**

The Protected Path field group is available for all OTN circuit types (except ODU UNI Hairpin) only when the Protection Type field is set to 1+1 or 1+1+R.

The Restored Path field group is available for all OTN circuit types (except ODU UNI Hairpin) only when the Protection Type field is set to 1+R or 1+1+R.

Attribute	Description	Enabled
Type	Choose the type of working path or protected path for the circuit. Values are Dynamic and Explicit.	For all OTN circuit types (except ODU UNI Hairpin).
New	Check this check box to create a new explicit working or protected path for the circuit.	For all OTN circuit types (except ODU UNI Hairpin) when the Type field is set to Explicit.
Select Existing EP	Choose an existing explicit working or protected path for the circuit.	For all OTN circuit types (except ODU UNI Hairpin) when the Type field is set to Explicit and the New check box is unchecked.
New Name	Enter a name for the explicit path that you are creating. In the table below the New Name field, click the '+' button to add a new row to the table, and then select a device and an explicit path controller as the interface for the device.	For all OTN circuit types (except ODU UNI Hairpin) when the Type field is set to Explicit and the New check box is checked.

#### Protection Profile

The Protection Profile field group is available for all OTN circuit types (except ODU UNI Hairpin) only when the Protection Type field is set to 1+1, 1+R, or 1+1+R and a valid A end device is selected.

Protection Profile	<p>The profile used to manage the protection of the circuit. This protection profile must be configured on the A end node of the circuit.</p> <p><b>Note</b> You can enter the protection profile that was configured on the device.</p> <p>The details of the protection profile such as the protection type, SNC, hold off, wait to restore, and whether the circuit is revertive are displayed.</p>	
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## Bandwidth and Service Type Value Mapping for ODU UNI Circuits.

The following table maps the values in the Bandwidth and Service Type fields for the ODU UNI circuits

Table 11: Value Mapping—Bandwidth and Service Type for ODU UNI Circuits

Bandwidth	Service Type
ODU0	<ul style="list-style-type: none"> <li>Ethernet OPU0 GMP</li> </ul>
ODU1	<ul style="list-style-type: none"> <li>OTN OPU1</li> <li>Sonet OPU1 BMP</li> <li>SDH OPU1 BMP</li> </ul>
ODU1E	<ul style="list-style-type: none"> <li>Ethernet OPU1e BMP</li> <li>OTN OPU1e</li> </ul>
ODU1F	<ul style="list-style-type: none"> <li>OTN OPU1f</li> </ul>
ODU2	<ul style="list-style-type: none"> <li>Ethernet OPU2 GFP_F</li> <li>Ethernet OPU2 GFP_F_EXT</li> <li>Ethernet OPU2 WIS</li> <li>OTN OPU2</li> <li>Sonet OPU2 AMP</li> <li>Sonet OPU2 BMP</li> <li>SDH OPU2 AMP</li> <li>SDH OPU2 BMP</li> </ul>
ODU2E	<ul style="list-style-type: none"> <li>Ethernet OPU2e BMP</li> <li>OTN OPU2e</li> </ul>
ODU2F	<ul style="list-style-type: none"> <li>OTN OPU2f</li> </ul>
ODU4	<ul style="list-style-type: none"> <li>OTN OPU4</li> <li>Ethernet OPU4 GFP_F</li> <li>Ethernet OPU4 GMP</li> </ul>
ODUFLEX	<ul style="list-style-type: none"> <li>OTN OPUFlex</li> <li>Ethernet OPUFlex GFP_F</li> </ul>

## Create and Provision an ODU Circuit

To create and provision an ODU circuit:

### Before you begin

- For information about the prerequisites that must be met before provisioning an optical circuit, see [Prerequisites for Provisioning Optical Circuits, on page 30](#).
- To create managed links among devices, see [Manually Add Links to the Topology Map](#).

**Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.

**Step 2** Click **Device Groups**, and select the location where you want to create the ODU circuit.

- Step 3** Close the **Device Groups** pop-up window.
- Step 4** In the **Network Topology** window, click **Circuits/VCS**.
- Step 5** Click the **Circuits/VCS** tab, then click the + (**Create**) icon in the **Circuits/VCS** pane toolbar. The Provisioning Wizard opens in a new pane.
- You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.
- Step 6** From the **Technology** drop-down list, choose **Optical**. Cisco EPN Manager displays a list of relevant circuit types in the Service Type area.
- Step 7** In the **Service Type** area, choose **ODU**.
- Step 8** If you have defined profiles to set the attributes of different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles](#), on page 109.
- Step 9** Click **Next** to go to the **Customer Section** page.
- Step 10** (Optional) Select the customer for the circuit. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and restart the Provisioning Wizard.
- Step 11** Enter the circuit name and description in the **Customer Section** page.
- Step 12** Click **Next** to go to the **Circuit Section** page.
- Step 13** You can create two types of ODU circuits here: **Remote** ODU circuit and **Local** ODU circuit.
- To create a **Remote** ODU circuit (ODU circuit between two different devices):
- a) Uncheck the **Local Cross Connect** check box.
- Choose one of the following protection type for the circuit:
- None**—No protection type for the circuit.
- 1+1**—Both primary and secondary paths carry the traffic end to an end. The receiver receives the traffic from primary and secondary paths, and compares both the traffic. When the egress node detects failure in one path, it switches the traffic to the unaffected path.
- Note** If you have selected 1+1 as the protection type, the Connection Mode is set to SNC-N, by default.
- To create a **Local** ODU circuit (cross-connection within the same device):
- Step 14** Choose the required Reversion Time and Hold off Timer for the circuit.
- Note** These fields are available only if you have selected 1+1 as the protection type.
- Step 15** Click **Next** to go to the **Endpoint Section** page.
- Step 16** Select a row in the Endpoint table, and then click a device in the map to populate the Device Name column with the selected device. Alternatively, you can click the row in the Endpoint table to edit the Device Name and Termination Point columns. Only network elements that are available and compatible with the chosen circuit type will be displayed.
- Note** When the row is in the edit mode, you cannot click a device in the map to populate the **Device Name** column.
- Step 17** Click **Next** to go to the **Constraints Section** page.
- Step 18** Click a device node in the map to add it to the Constraints table. Alternatively, you can click the '+' button in the table toolbar to add a new row to the table and edit the Node/Link Name, Include/Exclude, and Route columns. Only network elements that are compatible with the ODU circuit type will be displayed.
- Note** You cannot provide links as constraints for ODU circuits.

- Step 19** (Optional) Click **Calculate Path** to verify if there is a valid working path between the selected endpoints. If a valid working path exists between the selected endpoints, the path appears with a 'W' label on the topology map. If a valid working path does not exist between the selected endpoints, a Path Calculation Result section appears that displays the reason why a working path cannot be established between the selected endpoints.
- Step 20** Click **Create Now** to create the circuit. If you want to see a preview of the TL1 or CLI commands that will be deployed to the devices, click **Preview**. You can either deploy the configurations to the device or cancel it, but you cannot edit the attributes.
- Step 21** To create a **Local** ODU circuit (cross-connection within the same device):
- Check the **Local Cross Connect** check box.
  - Select the circuit properties such as **Bandwidth** and **Service type**.
  - Choose one of the following protection type for the circuit:
    - None**—No protection type for the circuit.
    - 1+1**—Both primary and secondary paths carry the traffic end to an end. The receiver receives the traffic from primary and secondary paths, and compares both the traffic. When the egress node detects failure in one path, it switches the traffic to the unaffected path.
- Note** If you have selected 1+1 as the protection type, the Connection Mode is set to SNC-N, by default.
- Choose the required Reversion Time and Hold off Timer for the circuit.
    - Note** These fields are available only if you have selected 1+1 as the protection type.
  - Click **Next** to go to the **Endpoint Section** page.
  - Select the **Device Name**, inside which you want to provision an ODU circuit.
  - Select the **Source**, **Secondary Source/Destination**, and **Destination** ports. Select the **ODU** slices.
    - Note** **Secondary Source/Destination** is only available if you have selected 1+1 as the protection type.
  - Click **Create Now** to create the circuit. If you choose to see a preview of the circuit, click **Preview**. You can either deploy the configuration to the device or cancel it, but you cannot edit the attributes.

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The circuit will be added to the list in the Circuits/VCS pane in the Network Topology window. To check the provisioning state, click the *i* icon next to the circuit/VC name to see the Circuit/VC 360 view.

## Discovery and Provisioning of ODU Circuits Between Cisco NCS 2000 Series and Cisco NCS 4000 Series Devices

Cisco EPN Manager supports provisioning of end-to-end ODU circuits between Cisco NCS 2000 series and Cisco NCS 4000 series devices.

ODU circuit provisioning between Cisco NCS 2000 series and Cisco NCS 4000 series devices involves discovery of OTU links between their end nodes, after which the circuit can be provisioned.

To discover OTU links between Cisco NCS 2000 series and Cisco NCS 4000 series devices, see [Discovering OTU Links Between Cisco NCS 2000 Series Devices and Cisco NCS 4000 Series Devices](#), on page 54.

To create an ODU circuit between any endpoints, see [Create and Provision an ODU Circuit](#).

Prerequisites to provision ODU circuits:

- To provision end-to-end circuits, the client ports must have free endpoints.

Cisco EPN Manager supports the following scenarios for discovering and provisioning ODU circuits between Cisco NCS 2000 series and Cisco NCS 4000 series devices:

- **Brownfield discovery with ODU UNI circuits (between Cisco NCS 4000 series devices) and local ODU XC circuits (between Cisco NCS 2000 series devices).**

In this scenario, an ODU circuit is provisioned between Cisco NCS 2000 series devices with Cisco NCS 4000 series devices as the mid-nodes. To provision this ODU circuit:

1. Create local ODU cross-connects on the nodes of participating Cisco NCS 2000 series devices.
2. Create ODU UNI circuits on the nodes of participating Cisco NCS 4000 series devices.
3. Use the OCH-Trials (discovered on OCH-NC WSON circuits) to connect the nodes of Cisco NCS 2000 series and Cisco NCS 4000 series devices. On successful OCH-Trial connection between these nodes, an OTU link will be discovered.
4. An ODU circuit will be discovered on top of the above-mentioned circuits with the circuit name: *E2E:<local odu xc name Aend>---<local odu xc name Zend>*.




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**Note** Promote/Modify/Delete operations are not supported on Brownfield ODU circuits.

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**Note** Brownfield discovery is not supported when static cross-connects exist on the Cisco NCS 4000 series devices.

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**Note** ODU UNI circuits must not be created on the ports of Cisco NCS 4000 series devices that form a part of the ODU circuit.

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- **Greenfield discovery between Cisco NCS 2000 series and Cisco NCS 4000 series devices.**

In this scenario, ODU circuits are provisioned between Cisco NCS 2000 series devices, or between Cisco NCS 2000 series devices and Cisco NCS 4000 series devices.

In this case:

- OTU links are discovered on top of an OCH-Trial WSON (Cisco NCS 2000 series devices to Cisco NCS 2000 series devices), or on top of an OCH-Trial (Cisco NCS 2000 series devices to Cisco NCS 4000 series devices). Create an ODU circuit on top of these discovered OTU links.
- You can choose OTU links as constraints.

## Discovering OTU Links Between Cisco NCS 2000 Series Devices and Cisco NCS 4000 Series Devices

To provision a successful end-to-end ODU circuit between the Cisco NCS 2000 series and Cisco NCS 4000 series devices, an OTU link must be discovered.

To successfully discover an OTU link:

1. Create GMPLS LMP circuits between the participating Cisco NCS 2000 series and Cisco NCS 4000 series devices (Trunk and ADD/DROP ports). OCH links appear in the topology between the trunk and ADD/DROP ports.
2. Create OCH-NC WSON circuits between the participating Cisco NCS 2000 series devices (ADD/DROP ports).
3. On successful creation of OCH-NC WSON circuits, an OCH-Trail is discovered between the devices, which prompts the discovery of an OTU link between the trail endpoints.




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**Note** To successfully discover an OTU link, the OCH-Trail must be in the FULL state.

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**Note** If an OCH-Trail is discovered on the ports of an existing OTU link (created using the managed link), then the existing OTU link (Managed) is converted into the discovered OTU link.

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## Provision L3VPN Services

- [Features and Limitations of L3VPN Provisioning, on page 55](#)
- [Prerequisites for L3VPN Provisioning, on page 57](#)
- [L3VPN Service Discovery, on page 58](#)
- [Create and Provision a New L3VPN Service, on page 58](#)
- [View L3VPN Service Details, on page 70](#)
- [Modify L3VPNs and VRFs, on page 73](#)
- [Add and Copy VRFs to an L3VPN Service, on page 74](#)
- [Example Configuration: Provisioning an L3VPN Service, on page 69](#)

## Features and Limitations of L3VPN Provisioning

To know more about supported L3VPN services, see [Supported L3VPN Services](#).

**Cisco EPN Manager supports the following L3VPN features:**

- Creation of VRFs
- Automatic allocation of Route Target IDs
- Automatic allocation of route distinguishers
- Discovery of VPNs consisting of several VRFs, based on multiple criteria (VPN ID, common name, and provisioning naming conventions)

You can select devices for L3VPN provisioning using the Point and Click method of provisioning.

- Definition of IP endpoints attached to a VRF
- Associating ethernet subinterfaces with VRFs
- Provisioning of BGP and/or OSPF neighbors between CE and PE
- Attaching QoS profiles to the endpoint interfaces
- Adding new VRFs to existing VPNs
- Modifying VPNs and associated VRFs created and deployed (or discovered and promoted)
- Overlays in the Network Topology for L3VPN services
- Promotion of L3VPN services discovered directly from the device
- Using route targets with OSPF dual AS routing
- Using integrated routing and bridging to provision L3VPN services using BDI/BVI interfaces (subinterfaces)
- Associating IP Service Level Agreements (SLAs) and CLI templates with L3VPN services
- Route redistribution between the PE-CE link and the MP-BGP core using connected, static, RIP, or OSPF routes
- Provisioning L3VPN services using LAG interfaces
- Provisioning L3VPN services using HSRP
- Mapping of L2 circuits to L3VPN services

You can see these L2VPNs under the **Circuit/VCS 360 view > Related Circuits/VCS** tab.

To show or hide the L2 circuits associated with the L3VPN service in the **Network Topology** overlay, navigate to **Administration > Settings > System Settings > Discovery Settings > L3L2 Circuit Mapping** tab, and enable/disable the checkbox **Enable L3L2 Mapping**.

#### Cisco EPN Manager has the following L3VPN limitations:

- For the list of devices that support VRFs, see [Cisco Evolved Programmable Network Manager Supported Devices](#).
- You cannot provision multicast VPNs, only unicast VPNs are supported.
- While creating the L3VPN service, you may add any number of VRFs to the VPN. However, it is not recommended to add more than 5 VRFs. You can add more VRFs later to the VPN using the **Modify VRF** and **Add VRF** options. An L3VPN service can contain a maximum of 15 endpoints, if it is provisioned through a green field.
- Only one VRF per device is supported. You can create multiple VRFs but on different devices (with the same VRF name or different VRF names).
- Route policies can be selected but cannot be defined within the L3VPN service.
- Only BGP, OSPF, and OSPFv3 routing protocols are supported in PE-CE.
- There is no support for multiple attached PEs, so there is no Site of Origin support.



- Deleting an L3VPN service deletes the IP SLA operations associated with the service from the device. The associated operations that are deleted will not be available for future usage.
- The Integrated Routing and Bridging (IRB) is not supported for Cisco Catalyst 6500 series switches.
- Modification of Route Distinguisher through Modify VRF flow is supported only for IOS XR devices.
- Maximum of 15 endpoints are supported in Modification/Deletion of a fully discovered L3VPN service post promotion. To configure the **Maximum Number of Endpoints** for L3VPN promotion, navigate to **Administration > Settings > System Settings** and select **Discovery Settings** in the **Circuits/VCs**.
- Maximum of 50 endpoints are supported while mapping L2 circuits to L3VPNs. To configure the **Number of L3L2 Endpoints**, navigate to **Administration > Settings > System Settings > Discovery Settings > L3L2 Circuit Mapping** tab.

## Prerequisites for L3VPN Provisioning

Before you begin provisioning L3VPN services, ensure that the following prerequisites are followed.

Following are the prerequisites for provisioning an L3VPN service:

- BGP must be set up on all devices. Typically all devices must communicate with each other via a pair of route reflectors.
- Preconfiguration changes required to set up BGP:

Configure the BGP router-id as shown in the example below:

```
router bgp 65300
  bgp router-id 10.1.1.1
```

Set Vpn4 and Vpn6 as the parent address family using these commands:

```
router bgp 100
  address-family vpnv4 unicast
  address-family vpnv6 unicast
```

- MPLS reachability must be set up between the devices. MPLS core network configuration must be set up.
- Inventory collection status for the devices on which the L3VPN services will be provisioned must be 'Completed'. To check the status of devices, go to **Inventory > Network Devices**, and look at the status in the **Last Inventory Collection Status** column.
- Before you provision a L3VPN service with IPv6 address family on XE devices, IPv6 routing must be enabled. To enable IPv6 routing, configure the command:  

```
ipv6 unicast-routing
```
- (Optional) Customers must be created in the system so that you can associate the L3VPN service to a customer during L3VPN service provisioning. To create and manage customers, choose **Inventory > Other > Customers**.

## L3VPN Service Discovery

The Cisco EPN Manager supports the discovery of large L3VPN circuits with upto 40,000 endpoints and 4000 VRFs.

The Cisco EPN Manager associates multiple VRFs into a single VPN using multiple criteria:

- If VRFs were configured with a VPN ID, then the VPN service is discovered using the VPN ID to identify the VRFs that belong to the same VPN. If you have VPNs that you need to discover, where different VRF names are used within one VPN, then the Cisco EPN Manager discovers VRFs by the VRF names.

If one VRF is created per device, it is common practice to simply use the same VRF name everywhere across the VPN. If the Cisco EPN Manager sees multiple VRFs with the same name and no VPN ID, then it considers them as a single VPN, and the VPN name will be the name of the VRFs.

- VRFs with the same names and numbers will belong to the same VPN. For example, these are VRFs belonging to a VPN called 'ABC':  
V1:ABC, V2:ABC, V4:ABC-s, V22:ABC-h, V001:ABC, and so on.
- If VRF has no VPN ID and has a unique name that doesn't match other names according to the provisioning convention, it will be placed as an individual VPN. The name of the VPN will be the name of the VRF.

The provisioning naming convention feature is driven by a regular expression that is embedded in the product. If configuring a VPN is not an option for you and you have a naming convention that can be matched with a regular expression, it is possible to change it. To change the regular expression, please contact your Cisco Advanced Services representative.

## Create and Provision a New L3VPN Service

The process of creating and provisioning a unicast L3VPN involves:

- (Optional) Associating a customer to the VPN.
- Defining the attributes that influence how traffic that is delivered over the L3VPN and through its endpoints will be treated.
- Specifying the endpoints and route redistribution values of the L3VPN.
- (Optional) Configuring IP Service Level Agreements (SLAs) operation to monitor end-to-end response time between devices using IPv4 or IPv6.
- (Optional) Associating user-defined CLI templates with the L3VPN service.

Note: Only Unicast L3VPN services are supported in this release.

To create a new L3VPN service:

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**Step 1** From the left pane, choose **Maps > Topology Maps > Network Topology**.

The network topology window opens.

**Step 2** From the toolbar, click **Device Groups** and then select the group of devices you want to show on the map.

**Step 3** Click the **Circuits/VCs** tab, then click the + (**Create**) icon in the **Circuits/VCs** pane toolbar.

The Provisioning Wizard opens in a new pane to the right of the map. You can also access the L3VPN Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.

- Step 4** From the **Technology** drop-down list, select **L3VPN**. A list of supported L3VPN service types is displayed.
- Step 5** In the **Service Type** section, choose **Unicast** and click **Next** to enter the customer and service details. In this release, the only supported service type is Unicast L3VPN.
- Step 6** If you have defined profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list.
- Step 7** (Optional) Select the customer that you want to associate with the VPN. If there are no customers in the drop-down list, you can go to **Inventory > Other > Customers** to create the customer and return to this step.
- Step 8** Specify the basic L3VPN parameters:
- Use the **Activate** check box to specify whether the service must be in active (check box enabled) or inactive (check box disabled) state. The Active state enables traffic to pass through the circuit and automatically sets the Service State for all associated IP endpoints to True. In the Inactive state, you can choose to set the service state for IP endpoints to true or false.
  - Provide a unique name for the service and optionally enter a description.
  - Enter a unique VPN ID for the service. The VPN ID must be in the format OUI:VPN Index. For example, 36B:3. Here, 36B is the Organization Unique Identifier (OUI) and 3 is the VPN Index.
  - In the **IP MTU** field, enter a value between 1500 (default) and 9216. The service MTU is the size in bytes of the largest IP packet that can be carried unfragmented across the L3VPN. It does not include layer 2 headers.  
 The configured interface MTU is the service MTU plus the size of any layer 2 headers. For Ethernet, this adds 14 plus 4 bytes per VLAN header.  
 The value of the UNI MTU depends on the service MTU and outer and inner VLAN values:
    - If both outer and inner VLANs are present, then the UNI MTU value is greater than the Service MTU + 14 + (4\*2)
    - If only the outer VLAN is present, then the UNI MTU value is greater than the Service MTU + 14 + (4 \*1)
    - If no VLANs are present, then the UNI MTU value is greater than the Service MTU + 14.
  - (Optional) To create a full mesh topology for this service, select the **Create Full Mesh** check box and enter the full mesh prefix manually in the **New Prefix** field or select a value from the **Existing Prefix** drop-down list. The available options depend on the full mesh prefix values that are discovered in the selected device.
  - Select the address family as **IPv4**, **IPv6**, or **Both** in the **Full Mesh Address Family** drop-down list.
- Step 9** Use the **Route Target Allocation** section to manually specify the route target address families (**IPv4**, **IPv6**, or **Both**) and their associated route target values. You can create multiple route targets for the L3VPN service. These route targets can be associated with any VRF that you attach to this L3VPN service in the following steps.
- Note** The route targets associated with a VRF must also be associated with the L3VPN the VRFs belong to.
- Note** The configured route policy is listed in the **Export** drop-down list of the route policy.
- Step 10** In the **Deployment Action** drop-down list, specify the task that must be taken up when the service creation process is completed. Your options are:
- Preview:** allows you to review the configuration that is generated before it is deployed to the device.
  - Deploy:** allows you to deploy the configuration to the relevant devices immediately upon completion.
- Step 11** Click **Next** to associate VRFs to the L3VPN service.

**Step 12** Select the required VRFs from the **VRFs** drop-down list or add a new VRF as explained below, and then click **Next**. During L3VPN service creation, you can associate up to five VRFs with the VPN. To associate more VRFs to the VPN, see [Add and Copy VRFs to an L3VPN Service, on page 74](#). To create a new VRF:

- a. Click the '+' icon to add the VRF details manually. To auto populate the VRF details, click the respective device on the map. The device details and a new name for the VRF are automatically populated on the Add VRFs page.
- b. To manually specify the VRF details, select the required device in the **Device** drop-down list. You can then manually enter the VRF name and description, and check the **RD Auto** check box.

**Note** If multiple VRFs are created on the same device, you must name them differently to ensure that they are not part of the same VPN. You cannot create multiple VRFs with the same names on the same device.

**Step 13** Specify the IPv4 and IPv6 route targets and route distribution details:

- a. **Route Targets:** Select the route targets for this VRF in the **Route Target** drop-down list. The options in this drop-down list are available based on the route targets associated with this service in Step 7.
- b. Select the direction in which the route targets must be applied. Depending on the device you select, choose **Import**, **Export**, **Both**, or **None**.

Choose the directions depending on the type of device that is selected. For example, for Cisco IOS-XR devices, you cannot choose 'None' as the route target direction.

- c. In the **Route Policy** section, select the import and export policy for the route targets.

**Note** **Route Policy** which has Opaque Extended Community that is attached is applicable only for export.

- d. In the **Route Distribution** section, specify the protocol that must be associated with the VRF, the protocol's metric value, the routing process ID, the relevant route policies and the route match type.

- **Protocol-** Choose the source protocol from which routes must be redistributed. Your options are Static, Connected, RIP, and OSPF.
- **Metric-** (Optional) Enter a numeric value for the metric which is used when redistributing from one routing process to another process on the same router.
- **Routing Process ID-** (applicable only to OSPF and RIP) Specify the unique numerical value that identifies the instance of the routing process on the device.
- **Route Policy-** (Optional) Select one of the route policies present on the selected device. You cannot create route policies using Cisco EPN Manager.

**Note** **Route Policy** which has Opaque Extended Community that is attached cannot be used in Redistribute.

- **Route Match Type** (applicable only to OSPF)- Select the appropriate match type in the drop-down list associated with the selected route policy.

**Step 14** Specify the IP endpoints and UNIs' values manually as follows:

- If the endpoint interface has already been configured as a UNI, uncheck the **New UNI** check box and select the required UNI from the **UNI Name** drop-down list.
- To create a new UNI:

- a. Select the **New UNI** check box.
- b. In the **UNI Name** field, enter a unique name for the UNI.
- c. In the **Device** drop-down, select the device, its required interface, and provide a description for the UNI.
- d. Check the **Service Multiplexing** check box to enable more than one L3VPN or Carrier Ethernet service to be supported at the UNI.
- e. Specify the IP Maximum Transmission Unit (MTU) for the UNI., the speed and duplex settings for the UNI.
- f. Either check the **Auto Negotiation** check box to automatically adjust the speed and duplex settings for the UNI or uncheck the **Auto Negotiation** check box and specify the speed and duplex settings manually.
- g. Choose the UNI QoS profiles for ingress or egress traffic on the UNI. The list of profiles includes policy maps that were configured on the device and discovered by the system, and user-defined QoS profiles. If you select a UNI QoS profile, you cannot add individual QoS policies to the service endpoint in the upcoming steps. If you want to add specific QoS policies to the endpoint, leave the UNI Ingress and Egress QoS Profile fields blank.

**Note** You can choose two different discovered QoS profiles for the ingress and egress directions, however, in case of user-defined QoS profiles, only a single QoS profile can be chosen for both directions.

- h. Select **Enable Link OAM** to enable IEEE 803.1ah link operation and maintenance. If Link OAM is enabled, you will see events relating to the state of the link between this UNI and the customer's access switch.
- i. Select **Enable Link Management** to enable the customer access switch to get information about this UNI, VLAN IDs, services on the UNI, and so on.

For a detailed description of the fields and attributes in the UNI table, see [New UNI Details Reference, on page 18](#).

### Step 15

Specify the service endpoint to be associated with the L3VPN by providing the following details, and then click **Next**:

- **VRF Name:** Choose one of the available VRFs that can be associated with this VPN.
- **IPv4 and IPv6 address:** Enter the IP addresses and network masks of the service endpoint. The masks can be entered simply as an integer that represents the length of the network mask (or in CIDR format).
- **VLAN and Inner VLAN:** Enter the inner and outer VLAN identifiers using integers between 1 and 4094. Inner VLAN is the identifier for the second level of VLAN tagging.
- **QoS Policy:** (Optional) Select the QoS policy that must be applied to the service endpoint. This field is disabled if you have associated UNI Ingress/Egress QoS profiles to the service in the above step. For information on creating QoS profiles, see [Configure Quality of Service \(QoS\)](#).

**Note** You can choose two different discovered QoS policies for the ingress and egress directions, however, in case of user-defined QoS policies, only a single QoS policy can be chosen for both directions.

- **Service State:** Specify whether the service state for associated IP endpoints must be set to true or false. If the L3VPN is in Activate state (specified in Step 6 above), this check box is disabled and all service state values are automatically set to True.
- **Use Integrated Routing & Bridging:** Specify whether the VRF and IP addresses must be configured under the subinterfaces or under the BVI (virtual) interfaces.

**Note** This check box is enabled only when you select devices such as Cisco ASR 90XX devices, which support integrated routing and bridging. For Cisco ASR90x and other IOS-XE devices you cannot uncheck the **Use Integrated Routing & Bridging** check box because configuration is taken care by the BDI interface..

- (Optional) Check the **Enable HSRP** check box to specify the HSRP details. See [HSRP Details Reference, on page 65](#)

**Step 16** Click **Next** to go to the **PE-CE Routing** page.

**Step 17** Click the '+' icon to add the PE-CE routing details. See [PE-CE Routing Details References, on page 66](#).

**Step 18** (Optional) Select existing IP SLA parameters from the list, or specify the IP SLA operation parameters that are described in the table below and then click **Next**.

IP SLA Settings	IP SLA Parameters	Descriptions
Operation Settings	Name	Enter a unique name to identify the IP SLA operation for the selected L3VPN service.
	Type	Select the type of IP SLA operation that must be generated for the devices participating in this L3VPN service. Your options are: <ul style="list-style-type: none"> <li>• <b>UDP Echo:</b> Configures an IP SLAs User Datagram Protocol (UDP) Echo operation to measure response times and to test end-to-end connectivity between a Cisco device and devices using IPv4 or IPv6.</li> <li>• <b>ICMP Echo:</b> Allows you to measure end-to-end network response time between a Cisco device and other devices (source and destination values, as described below) using IPv4 or IPv6. With an IP SLA operation of type ICMP Echo, you cannot associate the 'Connection Loss' action variable.</li> <li>• <b>UDP Jitter:</b> Configures the UDP jitter operation which analyzes round-trip delay, one-way delay, one-way jitter, one-way packet loss, and connectivity in networks that carry UDP traffic in IPv4 or IPv6 networks.</li> </ul>
	Source	Specify the device which acts as the source point from which the IP SLA configuration is generated. The IP SLA responses are generated based on the connectivity between this source device and the target device. The VRF values for this operation are automatically selected based on your Source selection.
	Source Port	Enter a numeric value between 0 and 65535 to specify the source port value for which the IP SLA operation must be configured.
	Destination	Specify the device which acts as the target point from which the IP SLA configuration is generated. The IP SLA responses are generated based on the connectivity between the source device and this target device.
	Destination Port	Enter a numeric value between 0 and 65535 to specify the destination port value for which the IP SLA operation must be generated.
	VRF	The VRF details are automatically selected based on the device that you specify as the IP SLA operation Source.

IP SLA Settings	IP SLA Parameters	Descriptions
Reaction Settings	Action Variable	<p>Select the variable based on which the IP SLA reactions must be triggered. For example, when a monitored value exceeds or falls below a specified level, or when a monitored event (such as a timeout or connection loss) occurs.</p> <ul style="list-style-type: none"> <li>• <b>Connection Loss:</b> Indicates that an event must be triggered when a connection loss occurs. This value is not displayed if you select ICPM Echo as the type of operation.</li> <li>• <b>Round Trip Time:</b> If you choose this action variable, you must enter the <b>Upper Threshold Value</b> and the <b>Lower Threshold Value</b> which indicates that an event must be triggered when a monitored value exceeds or falls below the upper and lower threshold values that you specify.</li> <li>• <b>Time Out:</b> Indicates that an event must be triggered after a given set of consecutive timeouts occur.</li> <li>• <b>Verify Error:</b> Indicates that an event must be triggered after an error of type 'VerifyError' occurs.</li> </ul>
	Action Type	<p>Select one of the following actions that must be taken based on the conditions set in the Action Variable field:</p> <ul style="list-style-type: none"> <li>• <b>None:</b> No action is taken.</li> <li>• <b>Trap and Trigger:</b> Triggers both an SNMP trap and starts another IP SLAs operation when the violation conditions are met, as defined in the Trap Only and Trigger Only options below.</li> <li>• <b>Trap Only:</b> Sends an SNMP logging trap when the specified violation type occurs for the monitored element.</li> <li>• <b>Trigger Only:</b> Changes the state of one or more target operation's Operational state from 'pending' to 'active' when the violation conditions are met. A target operation continues until its life expires (as specified by the target operation's configured lifetime value). A triggered target operation must finish its life before it can be triggered again.</li> </ul>
	Threshold Type	

IP SLA Settings	IP SLA Parameters	Descriptions
		<p>Select the threshold type based on which the IP SLA events are generated.</p> <ul style="list-style-type: none"> <li>• <b>Average:</b> If you choose this threshold type, enter the <b>N Value</b> which specifies that an event must be triggered when the averaged total value of N probes is reached either when specified upper-threshold value is exceeded, or when it falls below the lower-threshold value.</li> <li>• <b>Consecutive:</b> If you choose this threshold type, enter the <b>Consecutive Values</b> as part of the reaction settings. This threshold type triggers an event only after a violation occurs a specified number of times consecutively. For example, if you enter 5 as the consecutive value, the consecutive violation type is used to configure an action to occur after a timeout occurs 5 times in a row, or when the round-trip-time exceeds the upper threshold value 5 times in a row.</li> <li>• <b>Immediate:</b> Triggers an event immediately when the value for a reaction type (such as response time) exceeds the upper threshold value or falls below the lower threshold value, or when a timeout, connection loss, or verify that error event occurs.</li> <li>• <b>Never:</b> Never triggers an event.</li> <li>• <b>X out of Y occurrences:</b> If you choose this threshold type, enter the <b>X Values</b> and <b>Y Values</b> to specify the number of occurrences. This triggers an event after some number (x) of violations within some other number (y) of probe operations (x of y).</li> </ul>
Simple Schedule	-	<p>Enter the scheduling parameters for an individual IP SLAs operation by entering the following values:</p> <ul style="list-style-type: none"> <li>• <b>Frequency:</b> Enter the elapsed time within which the operation must repeat, in seconds.</li> <li>• <b>Life Time:</b> Enter the overall time until when the operation must be active, in seconds. A single operation repeats at the specified frequency for the lifetime of the operation.</li> <li>• <b>Age Out:</b> Enter the length of time to keep an operation active, in seconds. For example, an age out value of 43200 will ensure that the operation will age out after 12 hours of inactivity.</li> <li>• <b>Start Now</b> and <b>Start After:</b> Enable the Start Now check box to schedule the IP SLA operation to be executed immediately on Save. Or use the Start After field to specify the number of minutes after which the operation can be executed.</li> </ul>

**Step 19** (Optional) Use the Service Template page to append a template with additional CLI commands that will be configured on the devices participating in the service. See [Extend a Circuit/VC Using Templates, on page 111](#) for more information.

**Step 20** When you have provided all the required information for the service, click **Submit**. If you chose to see a preview of the CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the L3VPN attributes. Otherwise, the configurations will be deployed to the devices immediately.



In case of a deploy failure on even a single device that is part of the service, the configuration is rolled back on all devices participating in the service. To delete the endpoints associated with the service, see, [Delete an L3VPN Service Endpoint](#). To add more VRFs to this L3VPN service, see [Add and Copy VRFs to an L3VPN Service, on page 74](#).

## HSRP Details Reference

Hot Standby Router Protocol (HSRP) is Cisco's standard method of providing high network availability by providing first-hop redundancy for IP hosts on an IEEE 802 LAN configured with a default gateway IP address. Hot Standby Router Protocol (HSRP) provides redundancy for IP networks, ensuring that user traffic immediately and transparently recovers from first hop router failures. HSRP allows multiple routers on a single LAN to share a virtual IP and MAC address which is configured as the default gateway on the hosts. In the group of routers configured in an HSRP group, there is one router that is elected as the active router and another as a standby router. The active router assumes the role of forwarding packets that are sent to the virtual IP address. If the active router fails, the standby router takes over as the new active router. In Cisco EPN Manager, HSRP for IPv4 is supported on switches running the IP base or IP Services image and HSRP for IPv6 is supported on unicast routing. HSRP is not supported in IOS-XE devices for address family IPv6. The following table lists and describes the attributes of HSRP.

**Table 12: HSRP Settings**

Attribute	Description
Group Number	Enter the standby group number of either IOS-XE or IOS-XR device. The recommended range values are: <ul style="list-style-type: none"> <li>• Range value for IOS-XE: 0–255.</li> <li>• Range value for IOS-XR: 1–4095.</li> </ul>
Virtual IP	Enter the IPv4/IPv6 address. Ensure that the Virtual IP address and SEP address should be entered within the same subnet.
Priority	Enter the priority to decide which router is to be the primary router. Priority range value: 0–255.
Hello Timer	Enter the time between hello packets in seconds. <b>Note</b> Hold Timer and Reload Delay values should be entered mandatorily for an IOS-XR device for the specified Hello Timer and Minimum Delay values. Hello time range value: 1–255.
Minimum Delay	Enter the minimum delay time in seconds. Delay range value: 0–10000.
Preempt Minimum Delay	Specify the preempt delay on the router. Delay range value: 0–3600.
Authentication Key	Enter the authentication key if the group number is between 1–255. This allows the authentication messages to be included in the HSRP multicast. This ensures that only authorized routers can become part of the HSRP group.

Attribute	Description
Hold Timer	Enter the hold time in seconds. Hold time range value: 1–255. <b>Note</b> Hold down time should be more than hello timer for XE device.
Reload Delay	Enter the delay time to reload. Delay range value: 0–10000.
Preempt Reload Delay	Enter the preempt reload delay. Delay range value: 0–3600. This field is not supported for an IOS-XR device.

## PE-CE Routing Details References

The following table lists and describes the attributes that define the PE-CE details for provisioning a Layer 3 VPN service.

**Table 13: PE-CE Routing Reference**

Attribute	Description
<b>Routing Protocol Settings</b>	
PE Device	Name of the pseudowire device.
VRF	The VRF name that you specified in the VRF page of the wizard is populated.
Routing Protocol Type	Choose <b>BGP OSPF</b> , or <b>OSPFv3</b> as the routing protocol for the Layer 3 VPN service. <b>Note</b> Based on the routing protocol chosen, either the <b>BGP Neighbor Information</b> section or the <b>OSPF Process Information</b> section will be displayed.  For XR and XE devices the PE-CE authentication is based on the Routing Protocol Type and Authentication Type selection. For more information see, <a href="#">PE-CE Authentication</a> Table.
Address Family	Choose the address family as IPv4 or IPv6. <b>Note</b> IPv6 is not supported for the OSPF routing protocol.
Authentication Type	Choose the authentication type. Only the MD5 authentication type is supported. <b>Note</b> Authentication Type field is available only when you select OSPF or OSPFv3 as the routing protocol.
<b>BGP Neighbor Information</b>	
<b>Note</b>	This section is available only when you select BGP as the routing protocol.

Attribute	Description
Neighbor Address	Enter the IP address of the neighbor.
Neighbor AS	Enter the autonomous system number of this neighbor, which is the unique identifier used to establish a peering session with a BGP neighbor.
Ingress Route Policy	Enter the route policy applied to any BGP routes received from this neighbor.
Egress Route Policy	Enter the route policy applied to any routes sent to this neighbor.
Local AS	Enter the unique local identifier used to establish a peering session with a BGP neighbor.
AS Action	<p>Select one of the following action types that must be associated with the local autonomous-system (AS) number:</p> <ul style="list-style-type: none"> <li>• <b>Prepend:</b> Use this option to configure BGP such that it prepends the AS number to routes received from the neighbor.</li> <li>• <b>No Prepend:</b> Use this option to configure BGP such that it does not prepend the AS number to routes received from the neighbor.</li> <li>• <b>No Prepend, Replace AS:</b> Use Replace AS to prepend only the local AS number (as configured with the ip-address) to the AS_PATH attribute. The AS number from the local BGP routing process is not prepended.</li> <li>• <b>No Prepend, Replace AS, Dual AS:</b> Use the Dual AS option to configure the eBGP neighbor to establish a peering session. You can do this by using the AS number (from the local BGP routing process) or the AS number configured with the ip-address argument (local-as).</li> </ul>

#### OSPF Process Information

**Note** This section is available only when you select OSPF or OSPFv3 as the routing protocol.

Auto Generate Process ID	<p>By default, this check box is selected to auto generate process IDs.</p> <p><b>Note</b> This check box is only applicable for IOS-XR devices.</p>
Existing Process ID	You can select from the existing process IDs when you uncheck the <b>Auto Generate Process ID</b> check box.
Router ID	Specify an IPv4 address for the OSPF protocol.
Area ID	Define an area for the OSPF protocol. The valid range is 0 to 4294967295.
Metric	Specify a numeric value for the OSPF protocol.
Domain Type	Select the required domain type.
Domain Value	Enter the domain value in the 6 Octet Hexadecimal format. For example, 00000000000F.

Attribute	Description
BFD Min Interval	Enter the minimum interval between which control packets are sent to the neighbor. The range is 3–30000 milliseconds.
BFD Min Rx	Enter the minimum Rx value. The range is 3–30000 milliseconds.
BFD Multiplier	The multiplier is the number of times a packet is missed before BFD declares the neighbor down. The range for the OSPF protocol is 2–50 for Cisco IOS-XR and 3–50 for Cisco IOS-XR devices.
BFD Fast Detect	Check this check box to quickly detect failures in the path between adjacent forwarding engines.



**Note** EPNM allows only one OSPF process to be created for PE-CE routing of a given L3VPN instance. This should be sufficient for XE platforms as single OSPFv3 process can manage both IPv4 and IPv6 address family. But, on IOS-XR platforms, OSPFv3 supports only IPv6 and not IPv4. If customer uses both IPv4 and IPv6 address family, there will be the need for both OSPF and OSPFv3 processes to be created from EPNM.

## PE-CE Authentication

The following table lists the relevant combinations of Routing Protocol and authentication types for PE-CE authentication based on the XE and XR devices selection.

*Table 14: PE-CE Authentication Reference*

Device	Routing Protocol	Authentication Type	Password Type
XE	BGP	—	Click either one of the following radio buttons <ul style="list-style-type: none"> <li>• Plain Text — Enable to enter the password</li> <li>• Encrypted — Enable to enter an hexadecimal value as the password</li> </ul>
	OSPF	—	—
	OSPFv3	Only Key chain authentication type is available.  From the Key Chain drop-down list, choose the authentication key chain that is configured on the device.	—

Device	Routing Protocol	Authentication Type	Password Type
XR	BGP	—	Click either one of the following radio buttons <ul style="list-style-type: none"> <li>• Plain Text — Enable to enter the password</li> <li>• Encrypted — Enable to enter an hexadecimal value as the password</li> </ul>
	OSPF	Choose MD5 or Keychain	Click either one of the following radio buttons <ul style="list-style-type: none"> <li>• Plain Text — Enable to enter the password</li> <li>• Encrypted — Enable to enter an hexadecimal value as the password .</li> </ul>
	OSPFv3	Choose either IPSec - MD5 or IPSec-SHA1 as the authentication type.	Click either one of the following radio buttons <ul style="list-style-type: none"> <li>• Plain Text — Enable to enter the password</li> <li>• Encrypted — Enable to enter an hexadecimal value as the password .</li> </ul>

## Example Configuration: Provisioning an L3VPN Service

The following are examples of the configuration deployed to a Cisco ASR 9000 device with the following parameters:

- Creation of VRF and IP addresses (both IPv4 and IPv6) under the BDI (virtual) interface.
- Redistribution of OSPF protocol to the BGP protocol.

Example: Provisioning an L3VPN service on a Cisco ASR 9000 device's BVI enabled interface (subinterface).

```
vrf vrfrbvibdi9k
vpn id aaaaaa:21
address-family ipv4 unicast
  import route-target
    6:55
address-family ipv6 unicast
  import route-target
    6:55
  export route-target
    6:55
interface GigabitEthernet0/0/0/17
  no shutdown
  exit
interface GigabitEthernet0/0/0/17.1
  encapsulation dot1q 1198
  shutdown
interface BVI 1
  vrf vrfrbvibdi9k
  ipv4 address 88.7.6.4 255.224.0.0
  l2vpn
```

```

bridge group BDI1
  bridge-domain 1
    routed interface BVI 1
    interface GigabitEthernet0/0/0/17.1
router bgp 140
  vrf vrfrbvibdi9k
    rd auto
    address-family ipv6 unicast
    address-family ipv4 unicast
    exit
  exit
exit

```

**Example:** Using a BVI enabled interface for provisioning an L3VPN service with OSPF route distribution (using dual AS):

```

vrf definition VRF2-2VRF-2UNI-BDI
  vpn id AAAAAA:2
  rd 532533:2
  address-family ipv4
    route-target import 6:5
    route-target export 6:5
  address-family ipv6
    route-target export 6:5
interface GigabitEthernet0/0/0
  duplex full
  service instance 2 ethernet
  encapsulation dot1q 761
  bridge-domain 14
  shutdown
exit
interface BDI14
  vrf forwarding VRF2-2VRF-2UNI-BDI
  ip address 5.44.3.7 255.255.0.0
router bgp 120
  address-family ipv4 vrf VRF2-2VRF-2UNI-BDI
    neighbor 55.4.3.2 remote-as 71
    neighbor 55.4.3.2 activate
    redistribute rip metric 6
    neighbor 55.4.3.2 local-as 387
  address-family ipv6 vrf VRF2-2VRF-2UNI-BDI
    neighbor c5::98 remote-as 50
    neighbor c5::98 activate
    redistribute ospf 65 match external metric 2
    neighbor c5::98 local-as 324 no-prepend replace-as dual-as
  exit
exit

```

## View L3VPN Service Details

Using Cisco EPN Manager, you can view detailed information about an L3VPN service:

- **Circuit/VC 360 View:** The Circuit/VC 360 view provides detailed information available for a specific L3VPN that is created using the Cisco EPN Manager. See [View Circuit/VC Details](#). The different parameters associated with the L3VPN service are displayed in five different tabs: Summary, VRFs, Site Details, HSRP, and PE-CE Routing. You can use **Advanced Filters** to search large L3VPN circuits.



---

**Note** To view the extended details of HSRP during service discovery, click the **Site Details** tab and choose a row from the IP endpoints. Also, to view the 6VPE authentication properties for the selected OSPFv3 routing protocol type and IPv6 address family, click the **PE-CE Routing** tab.

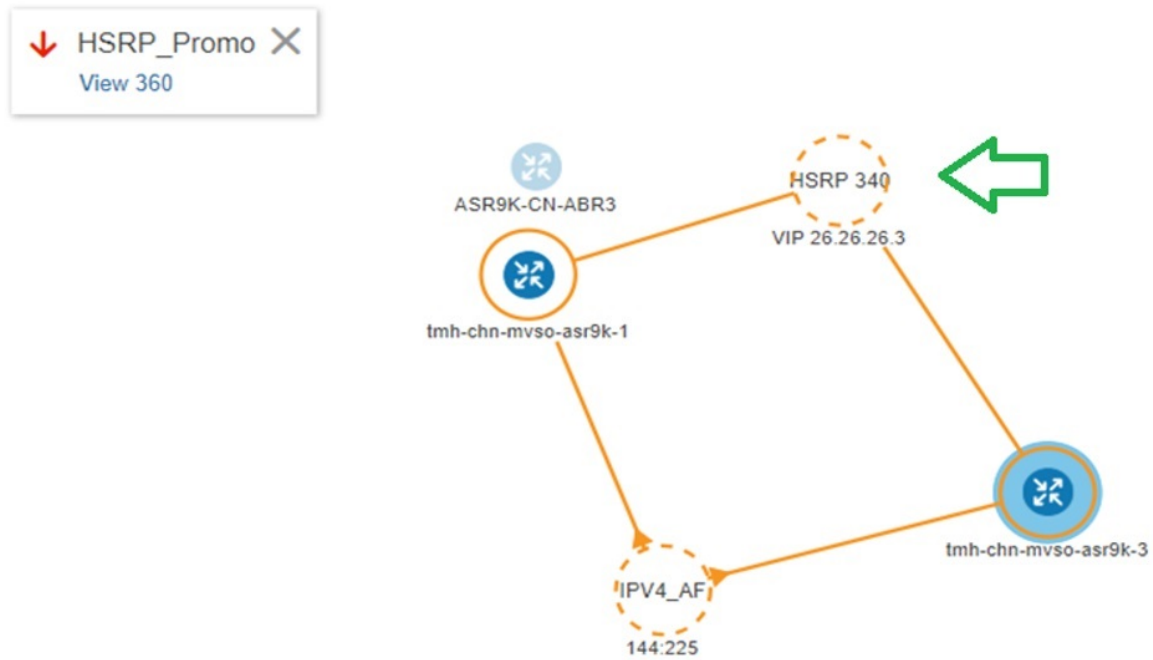
---

- **Network Topology and Service Details View:** The Network Topology window presents a graphical, topological map view of devices, links between them, and active alarms on the devices or links. It also enables you to visualize L3VPNs within the displayed topology map.
  - To view a complete list of L3VPNs and its details, see [Circuit/VC 360 View](#).
  - To view the L3VPN service details for a specific device, see [View Circuits/VCS In Which a Specific Device Participates](#).
- **Using the Alarms Table:** The Alarms Table in the Cisco EPN Manager displays information about any problems encountered by L3VPN services. See [Check Circuits/VCS for Faults](#).

## View HSRP Extended Details

After creating an L3VPN service with Hot Standby Routing Protocol (HSRP) details you can view HSRP properties in the Circuit 360/extended details view.

- 
- Step 1** From the left pane, choose **Maps > Topology Maps > Network Topology**.  
The network topology window opens.
- Step 2** From the toolbar, click **Device Groups** and then filter an L3VPN service to view.
- Step 3** Choose the L3VPN service to view the Overlay of HSRP as shown in the Figure.

Figure 1: Overlay-*HSRP*

**Step 4** Click the HSRP node or the links connected to it to view details relevant to the HSRP as shown:

Figure 2: *HSRP Details*

### GigabitEthernet0/0/0/6.706

Device Name	VRF Name	Interface	IP Address
ASR9K-CN-ABR3	sd_l3vpn_6	GigabitEthernet0/0/...	77.6.0.1
ASR9K-CN-ABR4	sd_l3vpn_6	GigabitEthernet0/0/...	77.6.0.1

**Step 5** To view extended details of HSRP:

- Click the View 360 hyperlink. The Circuit/VC 360\* page appears.
- Choose **View > Details**.
- In the **Circuit-VC Details** window, click the **Site Details** tab.
- Choose an IP Endpoint and then click the **HSRP** tab to view the properties.



Figure 3: Extended Details

Circuit-VC Details - HSRP\_Promo

Summary VRFs Site Details PE-CE Routing

IP Endpoints Select a row from the IP Endpoints list to view its details. Selected 1 / Total 2

Show Quick Filter

	UNI Name	Device Name	Interface	IP Address/Sub...	VRF
<input checked="" type="radio"/>	UNI-HSRP_Test-2	tmh-chn-mvso-asr9k-1.cis...	GigabitEthernet0/0/0/15.1	26.26.26.2/28	HSRP_Test
<input type="radio"/>	UNI-HSRP_Test-1	tmh-chn-mvso-asr9k-3.cis...	GigabitEthernet0/0/0/10.1	26.26.26.4/28	HSRP_Test

Site Details HSRP

Group Number 340  
 Virtual Address 26.26.26.3  
 Priority 30  
 Hello Timer 100 Hold Timer 122  
 Minimum Delay 455 Reload Delay 145  
 Preempt Minimum Delay 500 Preempt Reload Delay No data available  
 Authentication Key No data available

## Modify L3VPNs and VRFs

You can modify L3VPN services that are created and deployed using Cisco EPN Manager. While the full mesh prefix, QoS profiles, Route Target values, and the OSPF configurations associated with the service can be modified, you cannot modify parameters such as the customer details, VPN name, and service MTU values associated with the service. To modify these parameters, delete the service, and re-create it with new values. You can also modify the VRFs associated with L3VPN services.

To modify L3VPN services and VRFs:

### Before you begin

To modify L3VPN services that are discovered and promoted using Cisco EPN Manager, you must ensure that the route distinguisher for the L3VPN service is specified in the format **rd device\_ip:number**. For example:

```
vrf definition vdvvgfr420
  rd 10.104.120.133:420
  vpn id 36B:420
  !
address-family...
```

If the route distinguisher is specified in any other format, you will not be able to edit the service.

**Step 1** Navigate to **Maps > Network Topology**.

- Step 2** Click the **Circuits/VCs** tab, and select the L3VPN service that you want to modify.
- Step 3** Click the pencil (**Modify**) icon.
- Step 4** To modify the selected L3VPN, choose **Modify VPN** and click **Next**.  
The Provisioning wizard displays the VRFs, endpoints, and other details associated with the selected L3VPN.
- Step 5** If required, you can modify the **IP MTU** value.
- Step 6** To modify the VRFs associated with the selected L3VPN, choose **Modify VRF** and click **Next**.  
The Provisioning wizard displays the VRFs, endpoints, and other details associated with the selected L3VPN. Along with modifying existing VRF parameters, you can also associate new Route Target values to the VRF.  
While modifying VRFs, you cannot modify the QoS profiles associated with the UNIs, however, you can modify the QoS policies associated with the service endpoints.
- Note** You cannot modify the VRF name and device associated with the selected L3VPN.
- Step 7** Make the required changes and click **Submit** to preview the configuration that will be deployed to the device.
- Note** When you modify a VPN, you cannot change the VRFs associated with the VPN. To modify the VRFs, see [Add and Copy VRFs to an L3VPN Service, on page 74](#).
- Step 8** Review your changes and click **Deploy** to deploy your changes to the device.  
In case of a deploy failure on even a single device that is part of the service, the configuration is rolled back on all devices participating in the service.
- Step 9** To verify that your changes were saved, view the L3VPN service details. See [View L3VPN Service Details, on page 70](#).

## Add and Copy VRFs to an L3VPN Service

Using Cisco EPN Manager you can create and associate new VRFs to existing L3VPN services. You can also copy the route target and other details from existing VRFs to create new VRFs for the L3VPN service.

To associate new VRFs with an L3VPN service:

- Step 1** Navigate to **Maps > Topology Maps > Network Topology**.
- Step 2** Click the **Circuits/VCs** tab and select the L3VPN service to which you want to associate new VRFs.  
You can also access the L3VPN Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.
- Step 3** Click the pencil (**Modify**) icon.  
The L3VPN Provisioning wizard is displayed.
- Step 4** Select **Add VRF** and click **Next**.
- Step 5** Click the + icon to add the new VRF details manually. To auto populate the VRF details, click the device on the map to select it. The device details and a new name for the VRF are automatically populated on the VRF's page.
- Step 6** You can copy VRF details from an existing VRF by clicking the **Copy From** drop-down list and selecting the required VRF.

Only those VRFs that are associated with the selected L3VPN are displayed along with the VRFs route target, and route redistribution details.

**Step 7** Otherwise, manually specify the details of the VRFs that you want to add to the selected VPN service. For more information about the different VRF parameters, see, [Create and Provision a New L3VPN Service](#).

**Step 8** Make any required changes such as adding endpoint and BGP neighbor details and click **Submit**.

**Step 9** Preview the configuration that is to be deployed to the device, make the required changes, and click **Deploy** to deploy the changes to the device.

To verify that your changes were deployed, view the selected L3VPN service's details. See [View L3VPN Service Details](#).

For more information on modifying and deleting L3VPN services, see [Delete an L3VPN Service Endpoint](#) and [Modify L3VPNs and VRFs, on page 73](#).

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## Provision Circuit Emulation Services

- [Summary of Cisco EPN Manager CEM Provisioning Support, on page 75](#)
- [Prerequisites for CEM Provisioning, on page 75](#)
- [Create and Provision a New CEM Service, on page 76](#)
- [Save and Schedule a Provisioning Order, on page 81](#)
- [Provision an EM-Voice CEM Service , on page 83](#)

## Summary of Cisco EPN Manager CEM Provisioning Support

Cisco EPN Manager supports the provisioning of Circuit Emulation (CEM) services. CEM provides a bridge between the traditional TDM network and the packet switched network (PSN). It encapsulates the TDM data into packets, provides appropriate header, and send the packets through PSN to the destination node. For more information, see [Supported Circuit Emulation Services](#).

You can also assign a MPLS TE tunnel to a CEM service to allow the CEM service to traverse through the network. Use the **Preferred Path** drop-down list in the Provisioning Wizard to assign a MPLS TE tunnel for a CEM service. For more information, see [CEM Service Details References, on page 77](#).



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**Note** Provisioning of CEM services will fail if the tunnel selected in preferred-path is not having sufficient available bandwidth.

---

## Prerequisites for CEM Provisioning

The following prerequisites must be met before you can provision a CEM service:

- IP/MPLS connectivity must be enabled on the originating and terminating endpoints in a CEM service.
- CEM configurations such as loopback interface and ACR groups must be configured on the devices that will be used in the CEM service. For more information, see [Configure Circuit Emulation](#).

- Inventory collection status for the devices on which the CEM service will be provisioned must be *Completed*. To check this, go to **Inventory > Device Management > Network Devices**, and look at the status in the **Last Inventory Collection Status** column.
- Optionally, customers can be created in the system so that you can associate a CEM service to a customer during the service creation and provisioning process. From the left sidebar, choose **Inventory > Other > Customers** to create and manage customers.

## Create and Provision a New CEM Service

The process of creating and provisioning a CEM service in Cisco EPN Manager involves:

- Specifying endpoints of the CEM service.
- Defining the attributes that influence how traffic that is delivered over the CEM service and through its endpoints will be treated.

### Before you begin

For information about the prerequisites that must be met before you can provision a CEM service, see [Prerequisites for CEM Provisioning, on page 75](#).

- 
- Step 1** In the left sidebar, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click **Device Groups**, and then select the location in which you want to create the CEM service.
- Step 3** Close the **Device Groups** popup window.
- Step 4** In the **Network Topology** window, click **Circuits/VCS**.
- Step 5** Click the '+' icon to open the Provisioning Wizard in a new pane to the right of the map.  
You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.
- Step 6** From the **Technology** drop-down list, choose **Circuit Emulation**.
- Step 7** From the **Service Type** drop-down list, choose the required CEM service type depending on the rate at which you want the circuit to transmit the data. For a list of CEM service types that Cisco EPN Manager supports, see [Supported Circuit Emulation Services](#).
- Step 8** If you have defined profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles , on page 109](#).
- Step 9** Click **Next** to go to the **Customer Service Details** page.
- Step 10** (Optional) Select the customer for whom the EVC is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then go to the Provisioning Wizard to start provisioning the CEM service.
- Step 11** Check the **Activate** check box to activate the interface associated with the service that you are provisioning.
- Step 12** Enter the service name and its description.
- Step 13** In the **Deployment Action** field, specify what you want to do when the CEM service creation process is completed. You can either request a preview of the configurations that will be deployed to the relevant devices before the actual deployment or you can deploy the configurations immediately upon completion.  
If you choose Deploy, then click one of the following deployment options:
- Deploy Now—Directly deploys the provisioning order

- Deploy Later—Saves the created provisioning order and deploys the same order at later period of time.
- Schedule Deployment—Schedules the provisioning order and to be deployed at the scheduled time. If you click this **Schedule Deployment** radio button, specify the following:
  - Deploy Schedule Time—Specify a schedule time for deployment of provision order.
  - Server Time—Displays the current server time.

**Step 14** Click **Next**, and then enter the A End and Z End configurations, and the transport settings for the CEM service. See [CEM Service Details References, on page 77](#) for descriptions of the fields and attributes.

**Step 15** If one of the endpoints is an interface on a device that is not managed by Cisco EPN Manager, check the **Unmanaged Device** check box and provide information for the unmanaged device. See [Provision a Circuit/VC with an Unmanaged Endpoint, on page 111](#) for more information.

**Note** The **Unmanaged Device** check box is available only in the Z End Configurations page.

**Step 16** (Optional) If you want to append a template with additional CLI commands that will be configured on the devices participating in the service, do so in the **Template Details** page. See [Extend a Circuit/VC Using Templates, on page 111](#) for more information.

**Step 17** When you have provided all the required information for the service, click **Submit**. If you chose to see a preview of the CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the attributes. Otherwise, the configurations will be deployed to the devices immediately.

---

The CEM service should be added to the list in the Circuits/VCS pane in the **Network Topology** window, to check the provisioning state, click on the *i* icon next to the circuit/VC name to see the Circuit/VC 360 view. Also, you can view the saved provisioning job in the Planned Circuits/VCS tab from **Inventory > Other > Circuits/VCS & Network Interfaces > Planned Circuits/VCS**.

## CEM Service Details References

The following table lists and describes the attributes that define the CEM service types.

*Table 15: Circuit Section Reference—CEM Service Types*

Attribute	Description
<b>A End and Z End Configurations</b>	
Device	Name of the source and destination devices in the CEM service.
<b>Working Path and Protecting Path</b>	
Port Name or Interface Name	<p>Name of the interface on the source and destination devices in the CEM service. You can choose either the port name or the port group.</p> <p>When you choose the port name under the <b>Protecting Path</b> area, the unidirectional path switched ring (UPSR) protection mechanism is enabled.</p> <p>When you choose the port group under the <b>Protecting Path</b> area, the Automatic Protection Switching (APS) protection mechanism is enabled. For more information about how to configure protection groups, see <a href="#">Configure APS or MSP and UPSR or SNCP Protection Groups</a>.</p>

Attribute	Description
Higher Order Path	When a SONET/SDH line is channelized, it is logically divided into smaller bandwidth channels called higher order paths (HOP) and lower order paths (LOP). HOP or synchronous transport signal (STS) path is used to transport TDM data of higher bandwidth. HOPs can also contain LOPs within it.  Select the path and path mode available for the CEM service.
Lower Order Path	LOPs or virtual tributary (VT) path is used to transport TDM data of lower bandwidth.
DS0 Time Slot	Choose one or more time slots available in the DS0 group.  <b>Note</b> This field is available only if you select <b>DS0</b> in the <b>Service Type</b> field.
<b>Clocking</b>	
The nodes in a network may be at different clock rates. Differences in timing at nodes may cause the receiving node to either drop or reread information sent to it. Clocking is essential to synchronize all nodes to the same clock rate. For more information about clocking, see <a href="#">Configure Clocking for CEM</a> .	
Clock Source	Enables to recover the clock rate from single source so that all nodes can be synchronized at the same clock rate. Values are: <ul style="list-style-type: none"> <li>• Internal – Clock rate recovered from the host.</li> <li>• Line – Clock rate recovered from the SONET/SDH line.</li> <li>• Adaptive Clock Recovery – Clock rate is recovered based on the dejitter buffer fill level. Due to delay variations, the dejitter buffer fill levels keep varying continuously. The TDM service clock is recovered after filtering the variations. The accuracy of the recovered clock depends on the delay variations.</li> <li>• Differential Clock Recovery – Clock rate is recovered from a primary clock using Sync-E. For more information about how to setup the primary clock for your network, see <a href="#">Synchronize the Clock Using Sync-E, BITS, and PTP</a>.</li> </ul>
<b>QoS</b>	
The list of profiles available for selection includes policy maps that were configured on the device and discovered by the system, as well as user-defined QoS profiles.	
Ingress QoS Profile	Select the ingress QoS policies that are configured on the A end and Z end devices.
<b>Unmanaged Device Details</b>	
<b>Note</b> The below fields are available only for Z End Configurations.	
Unmanaged Device	Check this check box to include a device that is not managed by Cisco EPN Manager and create partial service.
New Device	Check this check box to create a new unmanaged device.

Attribute	Description
Device	Choose an unmanaged device from the drop-down list.  <b>Note</b> This field is available only when the <b>New Device</b> check box is unchecked.
Device Name	Enter a unique name for the new unmanaged device that you want to create.  <b>Note</b> This field is available only when the <b>New Device</b> check box is checked. If the <b>New Device</b> check box is unchecked, the name of the unmanaged device that you chose in the <b>Device</b> drop-down list is populated in this field.
Device IP	Enter the IP address of the new unmanaged device that you want to create.  <b>Note</b> This field is available only when the <b>New Device</b> check box is checked. If the <b>New Device</b> check box is unchecked, the IP address of the unmanaged device that you chose in the <b>Device</b> drop-down list is populated in this field.
LDP IP	Enter a valid LDP IP for the unmanaged device.
VC ID	Enter a unique Virtual Circuit (VC) ID for the unmanaged device.
<b>Transport Settings</b>	
Frame Type	This field is display-only and is auto-populated based on the CEM service type that you chose when creating the CEM service. The values are CESoPSN, SAToP, FRAMED_SAToP and CEP.  For T1, T3, E1 and E3 CEM service types, choose the frame type as SAToP or FRAMED_SAToP.  You can choose the frame type CEP for the service type E3 over E3 controllers.  <b>Note</b> View the CLI changes for T1/T3 and E1/E3 services over SONET framed mode with SDH in the <b>Device Preview Config</b> after deployment of a CEM service. The FRAMED-SAToP frame type is supported on NCS42xx or ASR9xx device.
Payload Size	Number of bytes put into each IP packet. The valid range is 64 – 1312. The range will vary based on the device capability, level of support and the configured dejitter buffer size value.
Dejitter Buffer Size	Determines the ability of the emulated circuit to tolerate network jitter. The valid range is 1 - 32. The range will vary based on the device capability, level of support and the configured payload size value.
Idle pattern	Idle pattern to transmit the data when the service goes down. The valid range is 0x00 - 0xFF.
Dummy Mode	Enables you to set a bit pattern for filling in for lost or corrupted frames. The values are last-frame and user-defined.

Attribute	Description
Dummy Pattern	<p>The bit pattern used for filling in for lost or corrupted frames. The valid range is 0x00 - 0xFF. The default is 0xFF.</p> <p><b>Note</b> This field is enabled only if you choose the Dummy Mode as user-defined.</p>
RTP Header Enabled	Check this check box to enable the Real-Time Transport Protocol (RTP) header for the CEM service.
RTP Compression Enabled	Check this check box to compress the IP header in a packet before the packet is transmitted. It reduces network overhead and speeds up the transmission of RTP.
<b>Pseudowire Settings</b>	
Preferred Path Type	Choose the Preferred Path Type as Bidirectional or Unidirectional.
Preferred Path	<p>Select the MPLS bidirectional TE tunnel through which you want the CEM service to pass through.</p> <p><b>Note</b> This field is available only if you selected <b>Bidirectional</b> as the Preferred Path Type.</p>
Preferred Path (A-Z)	<p>Select the required unidirectional tunnel through which you want the CEM service to travel from the A endpoint to the Z endpoint.</p> <p><b>Note</b> This field is available only if you selected <b>Unidirectional</b> as the Preferred Path Type.</p>
Preferred Path (Z-A)	<p>Select the required unidirectional tunnel through which you want the CEM service to travel from the Z endpoint to the A endpoint.</p> <p><b>Note</b> This field is available only if you selected <b>Unidirectional</b> as the Preferred Path Type.</p>
Allow Fallback to LDP	<p>Check this check box to ensure that the CEM service falls back to the default MPLS Label Distribution Protocol (LDP) when the selected preferred path goes down.</p> <p><b>Note</b> This check box is available only when you select a valid MPLS TE tunnel in the <b>Preferred Path</b> field.</p>
Send Control Word	Check this check box if you want a control word to be used to identify the pseudowire payload on both sides of the connection.
Internetworking Options	Choose an option if one of the endpoints in the EVC is an unmanaged device
Bandwidth (Kbps)	Enter the required bandwidth for the pseudowire.
PWID	Enter a pseudowire identifier. This ID is displayed in the Pseudowire settings for point-to point services.



## Modify a CEM Service

You can modify the CEM services that are created and deployed using Cisco EPN Manager.

### Before you begin

- 
- Step 1** In the left sidebar, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click **Device Groups**, select the location in which you want to modify the CEM service, and then click **Load**.
- Step 3** Close the **Device Groups** popup window.
- Step 4** In the **Network Topology** window, click **Circuits/VCs** tab and select the CEM services that you want to modify.
- Step 5** Click the pencil (Modify) icon.
- The Modify CEM window appears. You can only modify the **Z Endpoint** details.
- Step 6** To modify the **Device**, you can select a device from the **Device** drop down list.
- Step 7** To modify the **Working Path**, you can select the **Interface Name** from the drop down list.
- Step 8** To modify the **Higher Order Path**, you can select the **Available Paths** and **Path Mode** from the drop down list.
- Step 9** To modify the **Lower Order Path**, you can select the **Available Paths** from the drop down list.
- Step 10** Make the required changes and click **Submit** to preview the configuration that will be deployed.
- Step 11** Review your changes and click **Deploy** to deploy your changes to the device.
- 

## Save and Schedule a Provisioning Order

When you create, modify, or delete provisioning services such as Circuits/VCs, MPLS tunnels or L3VPN service technologies you can either preview or deploy services. You can choose deploy options such as Deploy Now, Deploy Later, and Schedule Deployment before you save or schedule a provisioning order.

View the saved provisioning orders in the **Planned Circuits/VCs** tab and if necessary you can modify the planned services or create succeeded services. Following are some of the limitations:

- If the planned version exists all modify and delete operations for live circuits are disabled. Also, you cannot amend services under **Inventory > Circuits/VCs&Network Interfaces** for planned order. For more information, see the What to do Next section.
- If you edit the order from Planned circuits, Cisco EPNM allows modification against planning.
- The delete action from Planned circuits deletes the planned service that is reverted to the last attempted provisioned version. For scheduled orders, if the time is updated from the Job dashboard then the same time will not reflect in the **Planned Circuits**.

To save and schedule deployment:

- 
- Step 1** Create a planned provisioning order through one of the following paths:  
Choose **Maps > Topology Maps > Network Topology**  
—Or—

## Inventory > Circuits/VCS&Network Interfaces

- Step 2** Repeat steps 2–12 from the [Provision Circuits/VCS in Cisco EPN Manager](#) topic.
- Step 3** To save and schedule deployment:
- Under the Deploy area, click the **Deploy Later** radio button to save the provisioning order.
  - Under the Deploy area, click the **Schedule Deployment** radio button to save the order for future deployment at the designated time provided by you. Specify the following values.
    - **Deploy Schedule Time**—Specify a schedule time for deployment of a provisioning order.
    - **Server Time**—Displays the current server time.
  - Click **Next** to choose the endpoints and define the attributes based on the technology you have selected.
  - Click **Submit**. Depending on the deployment action that you have chosen, the relevant action will be performed. That is, if you have chosen to preview the configuration, the preview page will be displayed where you can view the configurations, and then click **Deploy**. If you have chosen to deploy, the configurations are directly deployed to the relevant devices. After you receive the Deployment Saved/Schedule successful message, click **Close**.
- Step 4** In the left pane, click the CircuitVCS hyperlink. The Locations/All Locations/Unassigned extended view window appears.
- Step 5** Click the **Planned Circuit VC** tab to view the newly created provisioning service details. The status of the newly created provisioning service is displayed as "Create Planned". View the deployment schedule time, type and name of service to be provisioned, customer name and the last modified date and time. If necessary, you can modify the service again. For the planned service you can perform multiple amendses until deployment. The status will be displayed as "Modify Planned".
- Note** The **Planned Circuit /VCS** tab is available only when you click the CircuitVCS from the **Maps > Topology > Network Topology**. For **Deploy Later** option the deployment schedule time is not displayed.
- During multiple amends the latest version is captured. In due course, if there is a scheduled order and the latest version is set to deploy later then all the previous scheduled order will be deleted from the Job dashboard.
- Step 6** Click the create planned order and then choose **Actions > Deploy** to directly deploy the service.
- Step 7** (Optional) You can perform other actions, if required:
- Click the + icon to create a new provisioning workflow.
  - Click **X** icon to delete the planned service. A successful or failure message is displayed at the bottom-right corner of the window after the service is deleted.
  - Deploy Later service is deleted if **X** is clicked and no traces are saved in the EPNM about this planned undeployed service.
  - If a deployed scheduled service is deleted, the corresponding job and service is cleared.
- Step 8** To view the Scheduled provisioning job, choose **Administration > Dashboard > Job Dashboard**. The status is displayed as Scheduled and you can view the next start time of deployment and so on.
- (Optional) Click the **Edit Schedule** to edit the schedule order.
    - In the **Schedule** window, modify the schedule time and other details, if necessary.
    - Click **Save** and return to the Job Dashboard window.
  - (Optional) Click the **X** icon to delete the job.

After the job is successfully deployed, the entry is listed in the job dashboard. For Deploy Later option, a job will not be created as the time is not defined.

### What to do next

Choose **Inventory > Circuits/VCS&Network Interfaces** to view the Planned Circuits/VCS. You can create a new provisioning workflow, deploy the existing service or amend the service for a given provisioning order. After the deployment is successful the provisioning order entry is cleared from the **Planned Circuits/VCS** tab.



**Note** View the deployed Circuit /VCS in the **Circuits/VCS** tab and the Planned Circuits in the **Planned Circuit /VCS** tab.

You cannot perform modify or delete operation for live Circuits/VCS. This is because you have to first clear the planned version before making further amends to the deployed version. Click the **Planned Circuits/VCS** to make amends to the selected Circuits/VCS or deploy the planned version.

### Delete Operation

When you delete the planned version, a successful message or failure message is displayed at the bottom-right corner of the window. After the service is deleted in the **Circuit/VCS** tab the status is displayed as "Modify Plan Canceled," and "Delete Plan Canceled".

If you delete a service from the **Planned Circuit/VCS** tab, the associated UNIs will also be deleted from the **Network Interfaces** tab. The deleted UNIs will be available for reuse.

### Preview Config

During creation of new provisioning Circuits/Vcs, if the **Deployment Action** is chosen as **Preview** then you have the option to choose either **Deploy Now** or **Deploy Later** or **Schedule Deployment** in the **Deploy** page.

### View Network Interfaces

In the **Circuits/VCS** tab, click Network Interfaces to view network interface details for provisioning services. You can modify or delete an interface using a Wizard.

## Provision an EM-Voice CEM Service

On EM IM, ports 0-3 form one group and ports 4 and 5 form another group, the applicable EM types for each of these groups will now be reflected in EPNM during service provisioning, and you can view the list of applicable type for every port.

To provision a CEM service for the selected service type EM-Voice:

- Step 1** In the left pane, choose **Maps > Topology Maps > Network Topology**.
- Step 2** Click **Device Groups**, and then select the location where you want to create the CEM service.
- Step 3** Close the **Device Groups** popup window.
- Step 4** In the **Network Topology** window, click **Circuits/VCS**.
- Step 5** Click the '+' icon to open the Provisioning Wizard in a new pane to the right of the map.

You can also access the Provisioning wizard by choosing **Configuration > Network > Service Provisioning**.

- Step 6** From the **Technology** drop-down list, choose **Circuit Emulation**.
- Step 7** From the **Service Type** drop-down list, choose **EM-Voice** to transmit the data. For a list of CEM service types that Cisco EPN Manager supports, see [Supported Circuit Emulation Services](#).
- Step 8** If you have defined profiles to set the attributes of the different services, select the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles](#), on page 109.
- Step 9** Click **Next** and then enter the service name and its description.
- Step 10** Click **Next** and then enter the A End configurations for the CEM service. See [CEM Service Details References](#), on page 77 for descriptions of the fields and attributes.
- From the **Port Name** drop-down list, choose the interface name. Based on the configurations on the device, the ports are listed and you can view the list of applicable type for every port.
  - From the **EM Type** drop-down list, choose the type that can be configured on a port.
- Note** The **Type** will be listed based on the Interface name and **Applicable Type** that you have chosen in the **Port Name** field.
- Step 11** Click **Next**, and then enter the Z End configurations for the CEM service.
- Note** EM Type must be same as A Endpoint EM Type.
- Step 12** Click **Submit** to push the configuration to the device. If you chose to see a preview of CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the attributes. Otherwise, the configurations will be deployed to the devices immediately.
- 

## Provision MPLS Traffic Engineering Services

- [Summary of Cisco EPN Manager MPLS TE Provisioning Support](#), on page 84
- [MPLS TE Service Provisioning Features](#), on page 84
- [Prerequisites for Provisioning an MPLS TE Service](#), on page 91
- [Create and Provision an MPLS TE Tunnel](#), on page 91
- [Create and Provision an MPLS TE Layer 3 Link](#), on page 85

## Summary of Cisco EPN Manager MPLS TE Provisioning Support

Cisco EPN Manager supports the provisioning of MPLS Traffic Engineering 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](#).

## MPLS TE Service Provisioning Features

Cisco EPN Manager supports the following MPLS TE features:

- Support for explicit routing, constraint-based routing, and trunk admission control.

- Provision for path protection mechanism against link and node failures.
- Usage of Resource Reservation Protocol (RSVP) to establish and maintain label-switched path (LSP).
- Ability to advertise TE links using OSPF and ISIS.

Following are the MPLS TE limitations in Cisco EPN Manager:

- MPLS TE tunnel is supported only on NCS 4206, 4216 devices, NCS4K, NCS 5500, ASR9k, and ASR9XX. However, inventory support is provided for NCS 4201 and NCS 4202.
- OSPF and ISIS are supported as the IGP for implementing MPLS TE.
- Wrap protection, BFD and fault-oam are not supported in NCS5500 device.
- MPLS TE attributes are available and populated in database only if the attributes are provisioned through the Cisco EPN Manager web-interface.



**Note** For the list of devices that support the provisioning of MPLS TE tunnel, see [Cisco Evolved Programmable Network Manager Supported Devices](#)

## Create and Provision an MPLS TE Layer 3 Link

To provision an MPLS TE Layer 3 Link:

### Before you begin

For information about the prerequisites that must be met before you can provision an MPLS TE Layer 3 Link, see [Prerequisites for Provisioning an MPLS TE Service, on page 91](#).

- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**
- Step 2** Click **Device Groups**, and then select the location in which you want to create the MPLS TE Layer 3 Link.
- Step 3** Close the **Device Groups** popup window.
- Step 4** In the **Network Topology** window, click **Circuits/VCS**.
- Step 5** Click the '+' icon to open the Provisioning Wizard in a new pane to the right of the map.
- Step 6** From the **Technology** drop-down list, choose **MPLS TE**. Cisco EPN Manager displays a list of relevant service types in the **Service Type** area.
- Step 7** In the **Service Type** area, choose **Layer 3 Link**.
- Step 8** If you have defined profiles to set the attributes of the different services, choose the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles , on page 109](#).
- Step 9** Click **Next** to go to the **Link Settings** page.
- Step 10** Enter a name and description for the layer 3 link.
- Step 11** Choose the **A End Device**, **A End Interface**, **Z End Device**, and **Z End Interface** fields using one of the following ways:
  - Click a link on the map to automatically populate the **A End Device**, **A End Interface**, **Z End Device**, and **Z End Interface** fields.

- Click a device node on the map to automatically populate the **A End Device** field. If the A End Device is connected to only one device, the **Z End Device** field is populated automatically. If the **A End Device** is connected to more than one device, you must choose the **Z End Device** manually.

**Step 12** Enter the IP address and mask for the A End and Z End devices.

**Step 13** Choose an L2 Discovery Protocol from the following options:

- **NONE**—No L2 discovery protocol to be enabled for the layer 3 link.
- **CDP**—Cisco Discovery Protocol to be enabled for the layer 3 link to facilitate communication between Cisco devices connected to the network.
- **LLDP**—Link Layer Discovery Protocol to be enabled for the layer 3 link to support non-Cisco devices and to allow for interoperability between other devices that supports the IEEE 802.1AB LLDP.
- **ALL**—Both, CDP and LLDP to be enabled for the layer 3 link.

**Step 14** Choose the required routing protocol for the layer 3 link. The values are BGP, ISIS, and OSPF. For information about how to configure the routing protocols, see [Configure Routing Protocols and Security](#)

**Step 15** (Optional) Enter a Link VLAN ID for the layer 3 link.

**Step 16** (Optional) Check the **Enable MPLS TE** check box to support MPLS TE on the layer 3 link that you are provisioning.

**Note** This check box is available only when you choose OSPF or ISIS as your routing protocol.

**Step 17** Click **Next**, and then enter the A End and Z End details. See [Field References for A End Details and Z End Details in MPLS TE Layer 3 Link, on page 86](#) for descriptions of the fields and attributes.

**Step 18** In the **Deployment Action** field, specify what you want to do when the MPLS layer 3 link creation process is completed. You can either request a preview of the configurations that will be deployed to the relevant devices before the actual deployment or you can deploy the configurations immediately upon completion.

**Step 19** Click **Submit**. If you chose to see a preview of the CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the attributes. Otherwise, the configurations will be deployed to the devices immediately.

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The service should be added to the list in the **Circuits/VCs** tab in the Network **Topology** window. To check the provisioning state, click the **i** icon next to the circuit/VC name to see the Circuit/VC 360 view.

## Field References for A End Details and Z End Details in MPLS TE Layer 3 Link

The following table lists and describes the attributes that define the MPLS TE Layer 3 Link.

**Table 16: Field References for A End and Z End Details—MPLS TE Layer 3 Link**

Attribute	Description	Available when the routing protocol is:
Same as A End	Check this check box if you want to have the same routing and MPLS-TE configurations for both A end and Z end devices.  <b>Note</b> This check box is available only in the Z End Details page of the Provisioning Wizard.	BGP, ISIS, and OSPF

Attribute	Description	Available when the routing protocol is:
BGP AS Number	Choose the unique BGP autonomous system number assigned for your network.	BGP
Route Policy	Choose the routing policy to control which routes the BGP stores in and retrieves from the routing table.	BGP
Route Reflector Client	Check this check box to configure the BGP neighbor as the route reflector client for the local route reflector to advertise the available routes.	BGP
Use AIGP	Check this check box to use the Accumulated Interior Gateway Protocol (AIGP) metric attribute for the layer 3 link. The AIGP is the BGP attribute that carries the accumulated end-to-end metrics for the paths in the network.	BGP
Update Source	Choose the required source interface.  <b>Note</b> This field is available only when the <b>Use AIGP</b> check box is unchecked.	BGP
ISIS Process ID	Choose an ISIS routing process ID that is available to both A end and Z end devices. For information about how to configure an ISIS process, see <a href="#">Configure an IS-IS</a> .	ISIS
Network	The network ID is automatically populated based on the ISIS process ID selected.	ISIS
Circuit Type	Choose the type of adjacency required for the layer 3 link from the following options: <ul style="list-style-type: none"> <li>• NONE—No adjacency is established.</li> <li>• Level-1—Establishes a level 1 adjacency if there is at least one area address in common between the selected device and its neighbors.</li> <li>• Level-2-only—Establishes a level 2 adjacency on the circuit. If the neighboring device is a level 1 only device, no adjacency will be established.</li> <li>• Level-1-2—Establishes a level 1 and 2 adjacency if the neighbor is also configured as a level 1-2 device and there is at least one area in common. If there is no area in common, a level 2 adjacency is established.</li> </ul>	ISIS

Attribute	Description	Available when the routing protocol is:
Level 1 Metric	Enter the metric that must be used in the SPF calculation for Level 1 (intra-area) routing.  <b>Note</b> This field is available only when you choose the <b>Circuit Type</b> as <b>Level-1</b> or <b>Level-1-2</b> .	ISIS
Level 2 Metric	Enter the metric that must be used in the SPF calculation for Level 2 (inter-area) routing.  <b>Note</b> This field is available only when you choose the <b>Circuit Type</b> as <b>Level-2</b> or <b>Level-1-2</b> .	ISIS
OSPF Process ID	Choose an OSPF routing process ID. For information about how to configure an OSPF process, see <a href="#">Configure OSPF</a> .  <b>Note</b> You cannot modify the OSPF routing process for the Z end device.	OSPF
OSPF Area	Enter the area in which you want to deploy the OSPF routing process.	OSPF
Metric	Enter the routing metric used by the OSPF routing process.	OSPF
BFD Template	Choose a BFD template for the layer 3 link. A BFD template defines the set of configurable parameters used by a BFD session. These include the transmit and receive timers used for BFD control and echo packets, the transmit timer interval used when the session is providing a CV function, the multiplier value, and the echo-receive interval.  <b>Note</b> BFD Template is applicable for IOS-XE devices.	ISIS, and OSPF
BFD Min Interval	Enter the minimum control packet interval for BFD sessions for the corresponding BFD configuration scope.  <b>Note</b> This field is available only if you have not chosen the <b>BFD Template</b> .	BGP, ISIS, and OSPF



Attribute	Description	Available when the routing protocol is:
BFD Multiplier	Enter the BFD multiplier. This value along with the BFD minimum interval is used to determine the intervals and failure detection times for both control and echo packets in asynchronous mode on bundle member links.  <b>Note</b> This field is available only if you have not chosen the <b>BFD Template</b> .	BGP, ISIS, and OSPF
BFD Fast Detect	Check this check box to quickly detect failures in the path between adjacent forwarding engines.  <b>Note</b> This is applicable only for IOS-XR devices.	BGP, ISIS and OSPF
Authentication Mode	Choose the required authentication mode used to send and receive ISIS packets.  <b>Note</b> The authentication fields are available only when you select Cisco IOS XE devices. Available options are NONE, HMAC_MD5, and TEXT. By default, NONE is selected.	ISIS
Authentication Key Chain	Choose the authentication key chain. This enables authentication for routing protocols and identifies a group of authentication keys.	ISIS
Authentication for Send Only	Check this check box to perform authentication only for ISIS packets that are being sent.  <b>Note</b> This is applicable only for IOS-XE devices.	ISIS
Password Type	Choose the password type as <b>Encrypted</b> or <b>Plain Text</b> .	BGP
Password	Type the desired password. Password is required to establish connection between two peers.	BGP
<b>MPLS-TE</b>		
Loopback Interface	Choose a loopback interface address for the layer 3 link. For information about how to configure a loopback interface, see Configure Loopback Interfaces.	ISIS and OSPF
Administrative Weight	Enter the MPLS TE tunnel metric with mode absolute.	ISIS and OSPF

Attribute	Description	Available when the routing protocol is:
TE Attributes	Enter the MPLS TE Link attribute to be compared with a tunnel's affinity bits during path selection.	ISIS and OSPF
Is Percentage	Check this check box to assign the bandwidth in percentage for the layer 3 link.	ISIS and OSPF
Global Bandwidth	Enter the regular TE tunnel bandwidth that will be reserved for the layer 3 link for CBR.  For example, if you want to assign 10% as the global bandwidth for the layer 3 link, select the <b>Is Percentage</b> check box and enter the value 10 in the <b>Global Bandwidth</b> field. Whereas, if you want to assign 50 Kbps as the global bandwidth, uncheck the <b>Is Percentage</b> check box, choose Kbps from the <b>Bandwidth Unit</b> drop-down list, and then enter the value 50 in the <b>Global Bandwidth</b> field.	ISIS and OSPF
Subpool Bandwidth	Enter the subpool bandwidth that is reserved from the global pool bandwidth.  For example, if you want to assign 10% as the subpool bandwidth for the layer 3 link, select the <b>Is Percentage</b> check box and enter the value 10 in the <b>Subpool Bandwidth</b> field. Whereas, if you want to assign 50 Kbps as the subpool bandwidth, uncheck the <b>Is Percentage</b> check box, choose Kbps from the <b>Bandwidth Unit</b> drop-down list, and then enter the value 50 in the <b>Subpool Bandwidth</b> field.	ISIS and OSPF
Auto Tunnel Backup	Check this check box to enable a router to dynamically build backup tunnels on the interfaces that are configured with MPLS TE tunnels.	ISIS and OSPF
Exclude SLRG for Backup Tunnel	Check this check box to enable the exclusion of SRLG values on a given link for the AutoTunnel backup associated with a given interface.	ISIS and OSPF
BFD Fast Detect	Check this check box to quickly detect failures in the path between adjacent forwarding engines.	ISIS and OSPF
<b>QoS</b>		
Ingress Policy	Select the ingress QoS policies that are configured on the A end and Z end devices.	BGP, ISIS, and OSPF
Egress Policy	Select the egress QoS policies that are configured on the A end and Z end devices.	BGP, ISIS, and OSPF
<b>Additional Settings</b>		

Attribute	Description	Available when the routing protocol is:
Enable MPLS TE	Check this check box to support MPLS on the layer 3 link that you are provisioning.	ISIS and OSPF
Enable SyncE	Check this check box to enable Synchronous Ethernet at the interface level for the layer 3 link.  <b>Note</b> This is applicable only for IOS-XE devices.	BGP, ISIS, and OSPF

## Prerequisites for Provisioning an MPLS TE Service

The following prerequisites must be met before you can provision an MPLS TE service:

- OSPF or IS-IS must be configured on the devices that participate on the MPLS TE service.
- LLDP / CDP must be enabled before provisioning MPLS TE L3 Link.
- All links that will be used for MPLS TE service provisioning must be TE enabled.
- The TE enabled links must be operationally up.
- The tunnel's source and destination nodes must be reachable.
- You can set up WAE parameters REST call from EPN Manager automatically.
- MPLS reachability must be set up between the devices. MPLS core network configuration must be set up.
- Inventory collection status for the devices on which the MPLS TE service will be provisioned must be Completed. To check this, go to **Inventory > Device Management > Network Devices**, and look at the status in the **Last Inventory Collection Status** column.
- Optionally, customers can be created in the system so that you can associate an MPLS TE service to a customer during the service creation and provisioning process. From the left sidebar, choose **Inventory > Other > Customers** to create and manage customers.

## Create and Provision an MPLS TE Tunnel

To provision an MPLS TE tunnel:

### Before you begin

For information about the prerequisites that must be met before you can provision an MPLS TE tunnel, see [Prerequisites for Provisioning an MPLS TE Service, on page 91](#)

- 
- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.
  - Step 2** Click **Device Groups**, and then select the location in which you want to create the MPLS TE tunnel.
  - Step 3** Close the **Device Groups** popup window.
  - Step 4** In the **Network Topology** window, click **Circuits/VCS**.

- Step 5** Click the '+' icon to open the Provisioning Wizard in a new pane to the right of the map.
- Step 6** From the **Technology** drop-down list, choose **MPLS TE**. Cisco EPN Manager displays a list of relevant service types in a **Service Type** area.
- Step 7** In the **Service Type** area, choose **Unidirectional TE Tunnel** or **Bidirectional TE Tunnel**.
- Step 8** If you have defined profiles to set the attributes of the different services, choose the required profile from the **Select Profile** drop-down list. See [Create Circuit/VC Profiles](#), on page 109.
- Step 9** Click **Next** to go to the **Customer Service Details** page.
- Step 10** (Optional) Select the customer for whom the service is being provisioned. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning wizard.
- Step 11** Enter the service name and its description, and then enter the service details. See [Field References for Service Details—MPLS TE Tunnel](#), on page 92.
- Note**
- If you do not provide a service name, Cisco EPN Manager assigns a service name in the following format:
    - If the source and destination devices have a common tunnel ID, the service name is assigned in the <SourceDeviceName>\_<TunnelId>\_<DestinationDeviceName> format.
    - If the source and destination devices have unique tunnel IDs, the service name is assigned in the <SourceDeviceName>\_<ATunnelId>\_<ZTunnelId>\_<DestinationDeviceName> format.
  - The signaled name of the tunnel must be unique across different devices in the system.
- Step 12** Click **Next**, and then enter the tunnel creation parameters. See [Field References for Tunnel Creation—MPLS TE Tunnel](#), on page 94 for descriptions of the fields and attributes.
- Step 13** Click **Next**, and then enter the path constraint details. See [Field References for Path Constraint Details—MPLS TE Tunnel](#), on page 99 for descriptions of the fields and attributes.
- Step 14** Click **Submit**. If you chose to see a preview of the CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the attributes. Otherwise, the configurations will be deployed to the devices immediately.

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The service should be added to the list in the Circuits/VCS pane in the **Network Topology** window. To check the provisioning state, click the *i* icon next to the circuit/VC name to see the Circuit/VC 360 view.

## Field References for Service Details—MPLS TE Tunnel

The following table lists and describes the attributes that define the service details for creating an MPLS TE tunnel.

**Table 17: Service Details Section Reference—MPLS TE Tunnel**

Attribute	Description
Activate	By default, this checkbox is checked. It enables the tunnel to be activated when deployed.

Attribute	Description
Enable FRR	<p>Check this check box to enable the fast reroute feature that provides link and node protection for your MPLS TE tunnel.</p> <p><b>Note</b> This check box is available only when you create a unidirectional TE tunnel.</p>
Enable Auto Bandwidth	<p>Check this check box to automatically assign maximum and minimum bandwidth to the TE tunnel based on the traffic.</p>
Wrap Protection	<p>Check this check box to detect midlink failure scenarios.</p> <p><b>Note</b> This check box is available only when you create a bidirectional TE tunnel.</p>
Enable Fault OAM	<p>Check this check box to enable the fault OAM protocols and messages that support the provisioning and maintenance of MPLS TE tunnels.</p> <p><b>Note</b> This check box is available only when you create a bidirectional TE tunnel.</p>
Enable Autoroute	<p>Check this check box to enable autoroute for the tunnel.</p>
Enable BFD Settings	<p>Check this check box to enable the Bidirectional Forwarding Detection (BFD) protocol. BFD provides fast forwarding path failure detection time and a consistent failure detection method.</p>
Protection Type	<p>Choose one of the following protection mechanisms for the TE tunnel:</p> <ul style="list-style-type: none"> <li>• Working—The tunnel has only a working path.</li> <li>• Working+Protected—The tunnel has a working and a protected path, wherein if the working path fails, the traffic flow is automatically routed to the protected path without the links going down.</li> <li>• Working+Restore—The tunnel has a working and a restore path, wherein if the working path fails, the link goes down and then the traffic flow is routed to the restore path.</li> <li>• Working+Protected+Restore—The tunnel has a working, protected, and restore path, wherein, if the working path fails, the traffic flow is routed to the protected path. If the protected path also fails, the link goes down and then the traffic flow is routed to the restore path.</li> </ul>
Deployment Action	<p>Choose one of the following options to specify what happens when the MPLS TE tunnel creation process is completed:</p> <ul style="list-style-type: none"> <li>• Preview—Previews the configurations that will be deployed to the relevant devices before the actual deployment.</li> <li>• Deploy—Deploys the configurations immediately upon completion.</li> </ul>

## Field References for Tunnel Creation—MPLS TE Tunnel

The following table lists and describes the attributes that define the MPLS TE tunnel creation.

**Table 18: Tunnel Creation Section Reference—MPLS TE Tunnel**

Attribute	Description
<b>Create Tunnel</b>	
Source	Source or A endpoint of the tunnel.
Source routing Process	OSPF or ISIS routing process that is TE enabled and configured on the source endpoint selected. You can determine the router ID and loopback address configured on the source endpoint based on the OSPF or ISIS routing process.
Destination	Destination or Z endpoint of the tunnel.
Destination Routing Process	OSPF or ISIS routing process that is TE enabled and configured on the destination endpoint selected. You can determine the router ID and loopback address configured on the destination endpoint based on the OSPF or ISIS routing process.
<b>Tunnel Setting</b>	
Global ID	<p>The global ID assigned to both, source and destination endpoints. This ID must be the same to bind two unidirectional tunnels into a bidirectional TE tunnel. The default value is 0.</p> <p><b>Note</b> This attribute is available only when you create a bidirectional TE tunnel. EPNM supports a global id only within the range of 1–2147483647.</p>
Affinity Bits	The affinity bit determines the link attribute that the bidirectional TE tunnel uses when configuring the dynamic backup paths.
Affinity Mask	<p>The affinity mask determines which link attributes the router must check.</p> <p>You can use affinity bits and affinity mask to include or exclude link attributes when configuring the dynamic backup paths. If a bit in the mask is 0, the value of the associated link attribute for that bit is irrelevant. In this case, the link attribute is excluded when configuring the dynamic backup paths. If a bit in the mask is 1, the value of the associated link attribute must match the affinity of the tunnel for that bit. In this case, the link attribute is included when configuring the dynamic backup paths.</p>
Setup Priority	<p>Setup priority assigned to an LSP for the unidirectional or bidirectional TE tunnels. Based on this priority, the LSP can determine which existing tunnels or LSPs with low priority can be blocked.</p> <p>Valid values are 0–7. A lower number indicates a higher priority. For example, an LSP with a setup priority of 0 can block any LSP with a setup priority 1–7.</p> <p><b>Note</b> Setup priority cannot be higher than the hold priority.</p>

Attribute	Description
Hold Priority	<p>Hold priority assigned to an LSP for the unidirectional or bidirectional TE tunnels. Based on this priority, the LSP can determine whether it must be blocked by another signaling LSP with a high setup priority.</p> <p>Valid values are 0–7. A lower number indicates a higher priority. For example, an LSP with a hold priority of 0 cannot be blocked by another LSP.</p>
Bandwidth Pool Type	<p>Bandwidth pool used to manage the reservable bandwidth on each link for constraint-based routing (CBR) in MPLS TE. Values are:</p> <ul style="list-style-type: none"> <li>• Global – Regular TE tunnel bandwidth</li> <li>• Subpool – A portion of the global pool. The subpool bandwidth is not reserved from the global pool if it is not in use. Subpool tunnels require a higher priority than global pool tunnels.</li> </ul> <p><b>Note</b> This field is available only when you uncheck the <b>Enable Auto Bandwidth</b> check box.</p>
Bandwidth	<p>Bandwidth for the bidirectional TE tunnel. You can choose the unit of the bandwidth from the drop-down list. The available units are Kbps, Mbps, and Gbps.</p> <p>For example, if you want to assign a bandwidth of 1000000 Kbps for the tunnel, enter the value as 1000 Gbps.</p> <p><b>Note</b> This field is available only when you uncheck the <b>Enable Auto Bandwidth</b> check box.</p>
Auto Bandwidth Max	<p>Cisco EPN Manager automatically assigns the maximum bandwidth for the TE tunnel based on the traffic. However, you can change the bandwidth if required. You can choose the unit of the bandwidth from the drop-down list. The available units are Kbps, Mbps, and Gbps.</p> <p><b>Note</b> This field is available only when you check the <b>Enable Auto Bandwidth</b> check box in the <b>Customer Service Detail</b> screen.</p>
Auto Bandwidth Min	<p>Cisco EPN Manager automatically assigns the minimum bandwidth for the TE tunnel based on the traffic. However, you can change the bandwidth, if required. You can choose the unit of the bandwidth from the drop-down list. The available units are Kbps, Mbps, and Gbps.</p> <p><b>Note</b> This field is available only when you check the <b>Enable Auto Bandwidth</b> check box in the <b>Customer Service Detail</b> screen.</p>
Bandwidth Change Frequency (Sec)	<p>Enter the bandwidth change frequency in seconds. The valid range is 300–604800.</p> <p><b>Note</b> This field is available only when you check the <b>Enable Auto Bandwidth</b> check box in the <b>Customer Service Detail</b> page when you create tunnels.</p>

Attribute	Description
Adjustment Threshold	<p>Enter the bandwidth adjustment threshold in percentage to trigger an adjustment if the largest sample percentage is higher or lower than the current tunnel bandwidth. Adjustment threshold is the percentage of the current tunnel bandwidth and an absolute (minimum) bandwidth. Both the thresholds must be fulfilled for the automatic bandwidth to resignal the tunnel. The tunnel bandwidth is adjusted if the difference between the largest sample output rate and the current tunnel bandwidth is larger than the adjustment thresholds.</p> <p>The valid range for the tunnels that connect the Cisco IOS-XR devices is 1–100. The range for the tunnels that connect the Cisco IOS-XE devices is 1–99.</p> <p><b>Note</b> This field is available only when you check the <b>Enable Auto Bandwidth</b> check box in the <b>Customer Service Detail</b> page when you create tunnels.</p>
Overflow Threshold	<p>Enter the overflow threshold in percentage to trigger the overflow detection. It is the percentage of the actual signaled tunnel bandwidth. An overflow detection is triggered if the difference between measured bandwidth and actual bandwidth is larger than overflow threshold percentage for N consecutive times. This is also known as the overflow limit.</p> <p>The valid range for the tunnels that connect the Cisco IOS-XR devices is 1–100 and the range for the tunnels that connect the Cisco IOS-XE devices is 1–99.</p> <p><b>Note</b> This field is available only when you check the <b>Enable Auto Bandwidth</b> check box in the <b>Customer Service Detail</b> page when you create tunnels.</p>
Overflow Limit	<p>Enter the number of consecutive collection periods during which the difference between the measured bandwidth and the actual bandwidth of a tunnel can exceed the overflow threshold defined for the tunnel.</p> <p>The valid range is 1–10.</p> <p><b>Note</b> This field is available only when you check the <b>Enable Auto Bandwidth</b> check box in the <b>Customer Service Detail</b> page when you create tunnels.</p>
Collect Bandwidth	<p>Check this check box to collect the bandwidth information for the tunnel.</p> <p><b>Note</b> This field is available only when you check the <b>Enable Auto Bandwidth</b> check box in the <b>Customer Service Detail</b> page when you create tunnels.</p>
<b>BFD Settings</b>	
New BFD	<p>This checkbox is selected by default when you select the <b>Enable BFD Settings</b> checkbox. Allows you to create a new BFD template for both bidirectional (Flex LSP) and unidirectional tunnels during provisioning.</p>
BFD Template Name	<p>Enter the name for the new BFD template.</p>



Attribute	Description
BFD Template	<p>Displays the selected BFD template name by concatenating the device name. For example, from A-End and/or Z-End devices. Choose an existing template from the existing template name and the related Min Interval and Multiplier range values are displayed by default.</p> <p>Alphabets, digits, and special characters _ (underscore), -(hyphen), .(dot) are allowed, and BFD Template name should be fewer than 32 characters long.</p> <p>The BFD template name should not have .(dots) or digits or combination of digits and .(dots).</p> <p><b>Note</b> This field is available only when you clear the <b>New BFD</b> checkbox.</p>
Min Interval	<p>BFD uses intervals and multipliers to specify the periods at which control and echo packets are sent in asynchronous mode. It also detects their corresponding failure detection. A failure detection timer is started based on the following formula, where <math>I</math> specifies the minimum interval, and <math>M</math> is the multiplier: <math>(I \times M)</math>.</p> <p><b>Note</b> These fields are available only when you check the <b>Enable BFD Settings</b> check box and <b>New BFD</b> check box.</p> <p>Min Interval and Multiplier values are displayed for both new and existing BFD. For the existing BFD, you cannot edit the values.</p>
Multiplier	

## Logic for BFD Template Usage

Use the BFD template configuration for unidirectional and FLEX LSP tunnels for XE devices. Use inline configuration for unidirectional and FLEX LSP tunnels for XR devices. EPNM provides an option either to create a new BFD template or to re-use an existing BFD template based on the following logic.



**Note** FLEX LSP tunnels are referred as Bidirectional Tunnels.

The following table lists the logic for using BFD template.

**Table 19: Logic for BFD Template—MPLS TE Tunnel**

Unidirectional	
Device Name Combination	Configuration Logic Description

<p>XE-XE XE-XR</p>	<p>If you have chosen XE device as Source and destination (or XR device as destination), the logic works as a BFD Template configuration.</p> <p>To create a new BFD template:</p> <ol style="list-style-type: none"> <li>1. EPNM displays <b>New BFD</b> checkbox selected by default.</li> <li>2. Enter the name of BFD template.</li> <li>3. Enter the Min interval range value between 4-1000.</li> <li>4. Enter the Multiplier range value between 3-50.</li> </ol> <p>To re-use the existing BFD template:</p> <ol style="list-style-type: none"> <li>1. Clear the <b>New BFD</b> checkbox.</li> <li>2. From the <b>BFD Template</b> drop-down list, choose an existing BFD template. All existing BFD template names from A-End devices are listed.</li> <li>3. The Min Interval and Multiplier range values are displayed.</li> <li>4. Click <b>Submit</b>.</li> </ol>
<p>XR-XR XR-XE</p>	<p>If you have chosen an XR device as a source and destination (or XE device as destination), the logic works as an inline configuration. EPNM displays only <b>Min Interval</b> and <b>Multiplier</b> fields.</p>
<p><b>Bidirectional</b></p>	
<p>XE-XE</p>	<p>If you have chosen XE devices as source and destination, the logic works as a BFD Template configuration.</p> <p>To create a BFD template:</p> <ol style="list-style-type: none"> <li>1. EPNM displays <b>New BFD</b> checkbox selected by default.</li> <li>2. Enter the name of BFD template.</li> <li>3. Enter the Min interval range value between 4-1000.</li> <li>4. Enter the <b>Multiplier</b> range value between 3-50.</li> </ol> <p>To re-use the existing BFD template:</p> <ol style="list-style-type: none"> <li>1. Clear the <b>New BFD</b> checkbox.</li> <li>2. From the <b>BFD Template</b> drop-down list, choose an existing BFD template. All existing BFD template names from <b>A-End</b> and <b>Z-End</b> devices are listed.</li> <li>3. The Min Interval and Multiplier range values are displayed.</li> <li>4. Click <b>Submit</b>.</li> </ol>

XE-XR	<p>If you have chosen XE devices as Source and XR device as destination, the logic works as a BFD Template configuration.</p> <p>To create a new BFD Template:</p> <ol style="list-style-type: none"> <li>1. EPNM displays <b>New BFD</b> checkbox selected by default.</li> <li>2. Enter the BFD template name.</li> <li>3. Enter the Min interval range value between 4-1000.</li> <li>4. Enter the Multiplier range value between 3-10.</li> </ol> <p>To re-use the existing BFD template:</p> <ol style="list-style-type: none"> <li>1. Clear the <b>New BFD</b> checkbox.</li> <li>2. From the <b>BFD Template</b> drop-down list, choose an existing BFD template. This will list all existing BFD template names from A-End device.</li> <li>3. The <b>Min Interval</b> and <b>Multiplier</b> range values are displayed.</li> <li>4. Click <b>Submit</b>.</li> </ol>
XR-XR	<p>If you have chosen an XR device as a Source and destination, the logic works as an inline configuration. EPNM displays only <b>Min interval</b> and <b>Multiplier</b> fields.</p>
XR-XE	<p>If you have chosen an XR device as a source and XE device as a destination the logic works as a BFD Template configuration..</p> <p>To create a new BFD template:</p> <ol style="list-style-type: none"> <li>1. EPNM displays <b>New BFD</b> checkbox selected by default.</li> <li>2. Enter the name of BFD template.</li> <li>3. Enter the Min interval range value between 4-1000.</li> <li>4. Enter the Multiplier range value between 3-10.</li> </ol> <p>To re-use the existing template:</p> <ol style="list-style-type: none"> <li>1. Clear the <b>New BFD</b> checkbox.</li> <li>2. From the <b>BFD Template</b> drop-down list, choose an existing BFD template. All existing BFD template names from <b>Z-End</b> device are listed.</li> <li>3. The <b>Min Interval</b> and <b>Multiplier</b> range values are displayed.</li> <li>4. Click <b>Submit</b>.</li> </ol>

## Field References for Path Constraint Details—MPLS TE Tunnel

The following table lists and describes the attributes that define the path constraint details for creating a MPLS TE tunnel.

Table 20: Path Constraint Details Section Reference—MPLS TE Tunnel

Attribute	Description
Path Type	Choose the required path for the TE tunnel. The values are <b>Working</b> , <b>Protected</b> , and <b>Restore</b> . Based on the value you choose in the <b>Path Type</b> field, the <b>Working Path</b> , <b>Protection Path</b> , and <b>Restore Path</b> field group is available.
Enable Lock Down	Select this check box if you do not want to reoptimize the working LSP.
Enable SRLG	Select the check box if you want to enable the SRLG. <b>Note</b> It can be configured only on the protect path.
Enable Sticky	Select this check box if you do not want to switch to a new LSP when there is a tunnel path change. <b>Note</b> It can be configured for the working path only when the lock down is enabled.
Enable Non-Revertive	Select this check box if you do not want to revert back to the initial working path from the protected path even if the working path is restored. <b>Note</b> It can be configured only on the protect path.
Type	Choose the type of working path or protected path for the tunnel. Values are <b>Dynamic</b> and <b>Explicit</b> .
New Path	Check this check box to create a new explicit working, protected, or restore path for the tunnel. <b>Note</b> All the below fields are available only when you select <b>Explicit</b> in the <b>Type</b> field.
Select Existing Path	Choose an existing explicit working, protected, or restore path for the tunnel. <b>Note</b> This field is available only when you uncheck the <b>New Path</b> check box.
Choose path from WAE server	Check this check box to specify the WAE networks and paths. <b>Note</b> This field is available only when you check the <b>New Path</b> check box.  You can check or uncheck this check box if you have chosen <b>Dynamic</b> type and Path type as <b>Working</b> . It is recommended to check this check box if the explicit paths are to be read from the WAE server directly and not to be configured manually.
Select WAE Network	Click the down arrow to choose a WAE network from the dialog box. <b>Note</b> This field is available only when you check the <b>Choose path from WAE server</b> check box.

Attribute	Description
Select the WAE Path	<p>Click the down arrow to choose an explicit path.</p> <p><b>Note</b> This field is available only when you check the <b>Choose path from WAE server</b> check box.</p>
Path Name	<p>Enter a name for the explicit path that you are creating. In the <b>Working Path</b>, <b>Protection Path</b>, or <b>Restore Path</b> table, click the '+' button to add a new row to the table, and then select a MPLS-enabled device, an explicit path controller as the interface for the device, and a path constraint type.</p> <p>In the path table, you can select any MPLS-enabled device except the source and destinations devices. Cisco EPN Manager supports only strict path constraint type.</p> <p><b>Note</b> This field is available only when you check the <b>New</b> check box.</p>
<p><b>Working Path LSP Attribute List, Protection Path LSP Attribute List, and Restore Path LSP Attribute List</b></p> <p>Based on the value you choose in the <b>Path Type</b> field, the respective field group is available.</p> <p>The LSP attributes that you define here are associated with the path option you selected in the <b>Path Type</b> field and these attributes are applicable for source and destination devices.</p> <p><b>Note</b> The values that are defined for a specific path option will override the values specified at the interface tunnel level. For example, if you have defined the LSP attributes for the working path, these values will override the values that you defined in the <b>Tunnel Settings</b> section at the interface tunnel level, which is common for all the path options.</p> <p>For bidirectional tunnel, Working Path LSP attribute list can be configured only when <b>Enable Lock Down</b> check box is unselected.</p>	
New LSP Attribute List	Check this check box to create a new LSP attribute list for the selected path type.
Existing LSP Attribute List	<p>Choose an existing LSP attribute list for the selected path type.</p> <p><b>Note</b> This field is available only when you uncheck the <b>New LSP Attribute List</b> check box.</p>
LSP Attribute List Name	<p>Enter a name for the LSP attribute list that you are creating.</p> <p><b>Note</b> All the below fields including this field are displayed as read-only when the <b>New LSP Attribute List</b> check box is unchecked.</p>
LSP Affinity Bits	Enter the LSP affinity bit that determines the link attribute that the bidirectional TE tunnel will use when configuring the backup paths (working, protected, or restore).
LSP Affinity Mask	Enter the LSP affinity mask that determines which link attribute the router must check when configuring the backup paths.

Attribute	Description
LSP Setup Priority	<p>Enter the setup priority assigned to an LSP for the chosen path type. Based on this priority, the LSP can determine which existing tunnels or LSPs with low priority can be blocked.</p> <p>Valid values are from 0 to 7. A lower number indicates a higher priority. For example, an LSP with a setup priority of 0 can block any LSP with a setup priority between 1 and 7.</p> <p><b>Note</b> LSP setup priority cannot be higher than the LSP hold priority.</p> <p><b>Note</b> For Cisco IOS-XR devices, the <b>LSP Setup Priority</b> and <b>LSP Hold Priority</b> fields are not applicable.</p>
LSP Hold Priority	<p>Enter the hold priority assigned to an LSP for the chosen path type. Based on this priority, the LSP can determine whether it must be blocked by another signaling LSP with a high setup priority.</p> <p>Valid values are from 0 to 7. A lower number indicates a higher priority. For example, an LSP with a hold priority of 0 cannot be blocked by another LSP.</p> <p><b>Note</b> For Cisco IOS devices, if you do not specify an LSP hold priority, Cisco EPN Manager takes the value specified in the <b>LSP Setup Priority</b> field.</p> <p><b>Note</b> For Cisco IOS-XR devices, the <b>LSP Setup Priority</b> and <b>LSP Hold Priority</b> fields are not applicable.</p>
LSP Record Route	Check the check box to record the route used by the LSP.

## Provision Serial Services

- [Prerequisites for Serial Circuits/VCS Provisioning](#), on page 102
- [Create and Provision a New Serial Circuit/VC \(RS232, RS422, and RS485\)](#), on page 103
- [Create and Provision a New Serial Circuit/VC \(Raw Socket\)](#), on page 106

## Prerequisites for Serial Circuits/VCS Provisioning

Following are the prerequisites to provision a serial circuit/VC:

- Communication between devices must be set up before you can provision a serial circuit/VC.
- Inventory collection status for the devices on which the Serial circuits/VCS will be provisioned must be "Completed". To check this, go to **Inventory > Device Management > Network Devices**, and look at the status in the Last Inventory Collection Status column.
- Optionally, customers must be created in the system so that you can associate a circuit/VC to a customer during the circuit/VC creation and provisioning process. From the left sidebar, choose **Inventory > Other > Customers** to create and manage customers.

## Create and Provision a New Serial Circuit/VC (RS232, RS422, and RS485)

To create a new serial circuit/VC:

### Before you begin

For information about the prerequisites that must be met before you can provision a serial circuit/VC, see [Prerequisites for Serial Circuits/VCS Provisioning, on page 102](#).

- 
- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.  
The network topology window opens.
- Step 2** From the toolbar, click **Device Groups** and then select the group of devices you want to show on the map.
- Step 3** Click the **Circuits/VCS** tab.
- Step 4** From the **Circuits/VCS** pane toolbar, click the + (**Create**) icon.  
The Provisioning Wizard opens in a new pane to the right of the map.
- Step 5** Select **Serial** in the Technology drop-down list.
- Step 6** In the Service Type list, select the type of serial service you want to create. For information about the serial service types that Cisco EPN Manager supports, see [Supported Serial Services](#).
- Step 7** If you have defined profiles to set the attributes of the different services, select the required profile from the Select Profile drop-down list. See [Create Circuit/VC Profiles , on page 109](#).
- Step 8** Click **Next** to go to the Customer Service Details page.
- Step 9** Select the customer for whom the circuit/VC is being created. If there are no customers in the list, go to **Inventory > Other > Customers** to create the customer in the system, and then restart the Provisioning Wizard.
- Step 10** Check the **Activate** check box to specify whether the service must be in active state. The Active state enables traffic to pass through the circuit and automatically sets the service state of all the associated endpoints to True.
- Step 11** Enter the service name and description.
- Step 12** In the Deployment Action field, specify what you want to do when the circuit/VC creation process is completed. You can either request a preview of the configurations that will be deployed to the relevant devices before the actual deployment or you can deploy the configurations immediately upon completion.
- Step 13** Click Next to go to the page in which you configure the endpoints. See [Serial Service Details Reference, on page 104](#).
- Step 14** If one of the endpoints is an interface on a device that is not managed by Cisco EPN Manager, provide information for the unmanaged device. See [Provision a Circuit/VC with an Unmanaged Endpoint, on page 111](#) .
- Step 15** Click Next to go to the Line Settings and Pseudowire Settings page. See [Serial Service Details Reference, on page 104](#).
- Step 16** Optional. If you want to append a template with additional CLI commands that will be configured on the devices participating in the circuit/VC, do so in the Template Details page. See [Extend a Circuit/VC Using Templates, on page 111](#) for more information.
- Step 17** When you have provided all the required information for the circuit/VC, click Submit. If you chose to see a preview of the CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the attributes. Otherwise, the configurations will be deployed to the devices immediately.

---

The circuit/VC should be added to the list in the Circuits/VCS pane in the Network Topology window.

## Serial Service Details Reference

The following table lists and describes the attributes that define the serial service type.

**Table 21: Circuit Section Reference—Serial Service Type**

Attribute	Description
<b>A Endpoint and Z Endpoint Configurations</b>	
Media Type	The media type selected for the serial interface service.
Device Name	Name of the source and destination devices in the serial service.
Port Name and Description	Name and description of the interface on the source and destination devices in the serial service.
<b>Unmanaged Device Details</b>	
<b>Note</b> The below fields are available only for Z Endpoint Configurations.	
Unmanaged Device	Check this check box to include a device that is not managed by Cisco EPN Manager and create partial service.
New Device	Check this check box to create a new unmanaged device.
Media Type	Choose either RS232 or RS422 as media type for an existing RS232 or RS422 service to create point-to-point RS232 to RS422 service. For example, at the A-end if there is an existing media type RS232, you can choose either RS232 or RS422 as media type at the Z-end for the point-to-point service configuration. <b>Note</b> You cannot modify a media type after it is created.
Device Name	Enter a unique name for the new unmanaged device that you want to create. <b>Note</b> This field is available as a drop-down list if you have unchecked the <b>New Device</b> check box. You can choose an unmanaged device as your Z endpoint.
Device IP	Enter the IP address of the new unmanaged device that you want to create. <b>Note</b> This field is available only when the <b>New Device</b> check box is checked. If the <b>New Device</b> check box is unchecked, the IP address of the unmanaged device that you chose in the <b>Device</b> drop-down list is populated in this field.
LDP IP	Enter a valid LDP IP for the unmanaged device.
VC ID	Enter a unique Virtual Circuit (VC) ID for the unmanaged device.
<b>Line Settings</b>	
Speed	The speed of the serial link in kilo bits per second.
Data Bits	The measurement of actual data per packet that is transmitted through the serial circuit/VC. The values are 5, 6, 7, and 8.



Attribute	Description
Stop Bits	<p>Indicates the end of communication for a single packet. The values are 1, 1.5, and 2 bits.</p> <p>Since the data is clocked across the lines and each device has its own clock, it is possible for the two devices to become slightly out of sync. Therefore, the stop bits not only indicate the end of transmission but also provides the network with some lenience to synchronize the different clocks. The more bits that are used for stop bits, the greater the lenience in synchronizing the different clocks, but slower the data transmission rate.</p>
Parity	<p>Used to check errors in serial communication. The values are:</p> <ul style="list-style-type: none"> <li>• None—No parity defined for the circuit/VC.</li> <li>• Even— The serial port will set the parity bit (the last bit after the data bits) to a value to ensure that the transmission has an even number of logic high bits. For example, if the data was 011, then for even parity, the parity bit would be 0 to keep the number of logic high bits even.</li> <li>• Odd— The serial port will set the parity bit (the last bit after the data bits) to a value to ensure that the transmission has an odd number of logic high bits. For example, if the data was 011, then for odd parity, the parity bit would be 1, resulting in 3 logic high bits.</li> <li>• Mark— Sets the parity bit high. This allows the receiving device to know the state of a bit which enables the device to determine if noise is corrupting the data or if the transmitting and receiving devices' clocks are out of sync.</li> <li>• Space—Sets the parity bit low. This allows the receiving device to know the state of a bit which enables the device to determine if noise is corrupting the data or if the transmitting and receiving devices' clocks are out of sync.</li> </ul>
Duplex Mode	<p>Choose the required duplex mode for the serial service from the following options:</p> <ul style="list-style-type: none"> <li>• HalfDuplex—Supports communication in both directions between the endpoints, but not simultaneously. The transmission of data happens at one direction at a time.</li> <li>• FullDuplex—Supports simultaneous communication in both directions between the endpoints assuming that both endpoints support full duplex. If one side does not support full duplex, the port will be brought down.</li> </ul> <p><b>Note</b> This field is available only for RS485 and RS422 service types. You can edit RS485 and RS422 service type details. This is because you can select Duplex mode between Half and Full for RS485 and RS422. However, you cannot edit RS232 service type details because for RS232 you can select only FULL Duplex mode.</p>
<b>Pseudowire Settings</b>	
Preferred Path Type	Choose the Preferred Path Type as Bidirectional or Unidirectional.

Attribute	Description
Preferred Path	Select the MPLS bidirectional TE tunnel through which you want the serial service to pass through.  <b>Note</b> This field is available only if you selected <b>Bidirectional</b> as the Preferred Path Type.
Preferred Path (A-Z)	Select the required unidirectional tunnel through which you want the serial service to travel from the A endpoint to the Z endpoint.  <b>Note</b> This field is available only if you selected <b>Unidirectional</b> as the Preferred Path Type.
Preferred Path (Z-A)	Select the required unidirectional tunnel through which you want the serial service to travel from the Z endpoint to the A endpoint.  <b>Note</b> This field is available only if you selected <b>Unidirectional</b> as the Preferred Path Type.
Send Control Word	Check this check box if you want a control word to be used to identify the pseudowire payload on both sides of the connection.

## Create and Provision a New Serial Circuit/VC (Raw Socket)

To create a new serial circuit/VC with Raw Socket type:

### Before you begin

For information about the prerequisites that must be met before you can provision a Raw Socket circuit/VC, see [Prerequisites for Serial Circuits/VCs Provisioning, on page 102](#).

- 
- Step 1** From the left sidebar, choose **Maps > Topology Maps > Network Topology**.  
The network topology window opens.
- Step 2** From the toolbar, click **Device Groups** and then select the group of devices you want to show on the map.
- Step 3** Click the **Circuits/VCs** tab.
- Step 4** From the **Circuits/VCs** pane toolbar, click the + (**Create**) icon.  
The Provisioning Wizard opens in a new pane to the right of the map.
- Step 5** Select **Serial** in the Technology drop-down list.
- Step 6** In the Service Type list, select **Raw Socket**. For information about the Raw Socket circuits/VCs, see [Supported Serial Services](#).
- Step 7** If you have defined profiles to set the attributes of the different services, select the required profile from the Select Profile drop-down list. See [Create Circuit/VC Profiles, on page 109](#).
- Step 8** Click **Next** to go to the Customer Service Details page.
- Step 9** Select the customer for whom the circuit/VC is being created. If there are no customers in the list, go to **Inventory > Other > Customer** to create the customer in the system, and then restart the Provisioning Wizard.

- Step 10** Enter the service name and description.
- Step 11** In the Deployment Action field, specify what you want to do when the circuit/VC creation process is completed. You can either request a preview of the configurations that will be deployed to the relevant devices before the actual deployment or you can deploy the configurations immediately upon completion.
- Step 12** Click **Next** to go to the Server Side Configuration page. See [Raw Socket Service Details Reference, on page 107](#) for descriptions of the fields and attributes.
- Step 13** Click **Next** to go to the Client Side Configuration page. Click the '+' icon in the Raw Socket Client table to add a new row for client side configuration. See [Raw Socket Service Details Reference, on page 107](#) for descriptions of the fields and attributes.
- Step 14** Optional. If you want to append a template with additional CLI commands that will be configured on the devices participating in the circuit/VC, do so in the Template Details page. See [Extend a Circuit/VC Using Templates, on page 111](#) for more information.
- Step 15** When you have provided all the required information for the circuit/VC, click **Submit**. If you chose to see a preview of the CLI that will be deployed to the devices, it will be displayed now and you can click **Edit Attributes** to change the attributes. Otherwise, the configurations will be deployed to the devices immediately.

The circuit/VC should be added to the list in the Circuits/VCS pane in the Network Topology window. From the Services tab, you can click the *i* icon that is present next to the newly created serial interface service and view the recently created endpoints on the server with both end points (that is server and its associated clients) in the **Circuit/VCS 360\*** dialog box. Also, click the *i* icon next to the **Provisioning State** and view the configurations that are being pushed on to each end point.

## Raw Socket Service Details Reference

The following table lists and describes the attributes that define the Raw Socket service type.

**Table 22: Raw Socket Service Type—Server Side and Client Side Configurations**

Attribute	Description
<b>Server Settings and Client Settings</b>	
Media Type	<p>From the Media Type drop-down list, choose one of the following to configure a multipoint RS422 or RS4232 service, as part of cross circuit services.</p> <ul style="list-style-type: none"> <li>RS232—If you choose RS232 option as media type, the SyncRS232 check box is available for Sync operation along with other configuration settings for serial interfaces.</li> </ul> <p><b>Note</b> When you create a service (for example, Serial Raw Socket) with RS232, at the time of configuring the supported services both the end should have either RS232 or RS422, so that the corresponding server and its associated clients can be configured with only one media type at a time. You can configure these configuration settings on the Device and from the EPNM as well.</p> <ul style="list-style-type: none"> <li>RS422—Allows you to configure client, server, and Packetization settings for RS 422 multipoint service.</li> </ul>
Sync RS232	Check this check box to enable the synchronous mode of RS232 for the service.

Attribute	Description
Device Name	Name of the devices that act as a server and client in the Raw Socket service.
Port Name	Name of the interface on the server and client devices in the Raw Socket service.
Server Address and Server Port	The IP address and the port number of the server.
Allowed Sessions	To preconfigure a limit on the number of TCP raw-socket sessions per interface. Its default value is 32.
Client Address and Client Port	The IP address and the port number of the client.
Connection Idle Timeout	TCP session timeout setting for the Raw Socket service. If no data is transferred between the client and server over this interval, then the TCP session closes. The client then automatically attempts to reestablish the TCP session with the server.
VRF	Virtual Routing and Forwarding (VRF) interface through which the server and client are connected to transport the data.  <b>Note</b> Ensure that the VRF definition is common for both server and client.
Speed	The speed of the serial link in kilo bits per second. This line setting is optional for Sync service settings.
Data Bits	The measurement of actual data per packet that is transmitted through the serial circuit/VC. The values are 5, 6, 7, and 8. This line setting is optional for Sync service settings.
Stop Bits	Indicates the end of communication for a single packet. The values are 1, 1.5, and 2 bits. This line setting is optional for Sync service settings.
Parity	Checks errors in serial communication. This line setting is optional for Sync service settings.
Duplex Mode	The duplex mode for the selected serial service. This line setting is optional for Sync service settings.
DTR	Choose one of the following options: <ul style="list-style-type: none"> <li>• Used—Allows you to configure Data Terminal Ready (DTR) equipment from the customer end if there are no connected cables.</li> <li>• Not Used—Allows you not to configure Data Terminal Ready (DTR) equipment from the customer end if there are no connected cables.</li> </ul> <b>Note</b> This option is available only if the SyncRS232 check box is selected.
Clock Rate	Choose the desired clock rate in bits per second (bps) for the service. The valid values are 48000 and 64000.
NRZI Encoding	Check this check box to enable the nonreturn-to-zero inverted (NRZI) encoding mechanism for the service.

Attribute	Description
Control Signal Transport	Check this check box to specify if the hardware control signals need to be sent to the remote PE.
Frequency	Enter the required frequency. The valid value is between 50 and 200.  <b>Note</b> This field is available only when you check the Control Signal Transport check box.
Frame Pattern	Choose one of the required frame formats from the following options that will be used for internal signal transport: <ul style="list-style-type: none"> <li>• BCN—Beacon</li> <li>• CFGR—Configure for test</li> <li>• NR0—Nonreserved 0</li> <li>• NR1—Nonreserved 1</li> <li>• NR2—Nonreserved 2</li> <li>• NR3—Nonreserved 3</li> </ul>
Connection Topology	The connection topology, either point-to-point or point-to-multipoint, for the service is displayed.
<b>Packetization Settings</b>	
Packet Length	The packet length that triggers the routing device (either a server or a client) to transmit the serial data to the peer. When the device collects the specified bytes of data in its buffer, it packetizes the accumulated data and forwards it to the Raw Socket peer.
Fragment Off	Check this check box to disable the frame relay fragmentation for this service.
Packet Timer	Specifies the amount of time in milliseconds, the device (either server or client) waits to receive the next character in a stream. If a character is not received by the time the packet timer expires, the data the device has accumulated in its buffer is packetized and forwarded to the Raw Socket peer.
Special Char	A character that triggers the device (either server or client) to packetize the data accumulated in its buffer and send it to the Raw Socket peer. When the specified special character is received, the device packetizes the accumulated data and sends it to the Raw Socket peer.

## Create Circuit/VC Profiles

Profiles contain sets of attributes specific to different types of circuits/VCS. Once a profile is created, you can select it during circuit/VC creation. When a profile is selected, the Provisioning Wizard is populated with profile attributes. You must define the endpoints of the service and make changes before provisioning the circuit/VC, if necessary.

The types of profiles you can create mirror the types of circuits/VCS that can be provisioned.

Each profile is given a unique name, so you can create multiple profiles per circuit/VC type, depending on your needs.

To create a profile:

---

**Step 1** Choose **Inventory > Other > Profiles** in the left navigation pane. The **Profiles** window opens, showing a table of existing profiles (if any). You can select a profile in the table to edit or delete it.

The Profiles window displays the attribute information of existing profiles, which includes name, description, profile ID, technology, Qualifier (noneditable, read-only parameter that helps differentiate between the OCH-Trail circuits types, mostly applicable for L0 circuits), and so on.

**Step 2** Click **Create**.

**Step 3** In the Create Profile wizard, provide a unique name for the profile and enter a description.

**Step 4** Select the required technology type from the **Technology** list, for example, **Carrier Ethernet**. The relevant service types for the selected technology are displayed.

**Step 5** Select the required service type.

For example, for L3VPN services, choose **Unicast** to create a profile that helps prepopulate values for most L3VPN service creation fields or choose **IPSLA Operations** to create a profile with IP SLA-specific options for the L3VPN service.

**Step 6** Click **Next** to go to the attribute definition page and define the attributes for the selected service type. The attributes in the profile are the same as the attributes in the Provisioning Wizard, and they are described in the following reference sections:

Information on Ethernet VCs attributes is provided in these topics:

- For attributes relating to the service itself, see [Service Details Reference, on page 17](#).
- For attributes specific to the UNI, see [New UNI Details Reference, on page 18](#).
- For attributes relating to the UNI as it operates within the service, see [UNI Service Details Reference, on page 19](#).
- For UNI attributes, see [Configure a Device and Interface To Be a UNI, on page 22](#).
- For ENNI attributes, see [Configure a Device and Interface To Be an ENNI, on page 23](#).

Information on OCH and OTN attributes is provided in [Circuit Section Reference for OCH Circuit Types, on page 33](#) and [Circuit Section Reference for OTN Circuit Types, on page 47](#).

Information on L3VPN attributes is provided in [Create and Provision a New L3VPN Service, on page 58](#) and [View L3VPN Service Details, on page 70](#).

**Step 7** Click **Save** when you have defined the attributes. The profile will be added to the table in the Profiles window.

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## Create Customers

Customers must be created in the system so that they are available for selection during the circuit/VC provisioning process.

To create a customer:

- 
- Step 1** From the left sidebar, choose **Inventory > Other > Customers**.
- Step 2** Click **Create Customer**.
- Step 3** Enter the name of the customer and a description (optional).
- Step 4** Click **OK**. The customer is now added to the table of customers. You can select a customer to edit or delete it.
- 

## Provision a Circuit/VC with an Unmanaged Endpoint

You can create and provision a circuit/VC even if one or more of the endpoints is a device that is not managed by Cisco EPN Manager. The Provisioning Wizard allows you to identify an endpoint device as "unmanaged" and to provide information about that device so that the system can create the circuit/VC. Once you identify the unmanaged device, it will be available in the system in the Unmanaged Devices group and can be used for other services.

- 
- Step 1** Start the circuit/VC creation process for the required technology, as described in [Provision Circuits/VCS, on page 1](#).
- Step 2** For a point-to-point EVC and a CEM service:
- When defining the Z endpoint, select the **Unmanaged Device** check box. The Unmanaged Device Details panel opens.
  - If the unmanaged device has already been identified in the system, deselect the **New Device** check box and select the required device from the list. If you are identifying a new unmanaged device, provide the device name, IP address, and LDP IP. The LDP IP is used as the neighbor address of the pseudowire on the managed device.
- Step 3** For a point-to-multipoint or multipoint -to-multipoint EVC: In the Unmanaged UNI page, click the Plus icon in the table to add a row and then define the Unmanaged Device Details and Service Endpoint details for the selected row.
- Step 4** Complete the circuit/VC creation and provisioning process for the required technology, as described in [Provision Circuits/VCS, on page 1](#).
- 

## Extend a Circuit/VC Using Templates

When you create and provision a circuit/VC, Cisco EPN Manager configures a set of CLI commands on the participating devices. If you need to configure additional commands on the same devices, you can create a template containing these commands and you can include it during the circuit/VC creation process. This effectively extends the circuit/VC beyond what is configured by Cisco EPN Manager. This functionality is available in the provisioning wizard but it is dependent on the template being created prior to creating or modifying the circuit/VC.

Extending a circuit/VC using CLI templates involves the following steps:

- Create the CLI template using blank templates or existing templates. See [Create a New CLI Configuration Template Using a Blank Template](#) and [Create a New CLI Configuration Template Using An Existing Template](#).
- Create/modify a circuit/VC and append the CLI template. See [Provision Circuits/VCS, on page 1](#).

- Step 1** Create the CLI template:
- In the left sidebar, choose **Configuration > Templates > Features & Technologies**.
  - In the Templates panel, choose **CLI Templates > CLI**.
  - Provide identifying information for the new circuit and define the content of the template using CLI, global variables, and/or template variables. See [Create a New CLI Configuration Template Using a Blank Template](#) and [Use Global Variables in a Template](#).
  - Click **Save as New Template**.
  - The new CLI template is saved under **My Templates > CLI Templates (User Defined)**.
- Step 2** Create/modify a service that includes the template you created (or a different template if relevant):
- From the left sidebar, choose **Maps > Topology Maps > Network Topology**.  
The network topology window opens.
  - Click the **Circuits/VCS** tab.
  - From the **Circuits/VCS** pane toolbar, either click the + (**Create**) icon or select a circuit and then click the pencil (**Modify**) icon.  
The Provisioning Wizard opens in a new pane to the right of the map.
  - Start creating or modifying the required circuit or VC. See [Provision Circuits/VCS, on page 1](#) and [Modify a Circuit/VC](#).
  - In the **Service Template** page, use the **Pre-Configuration** section if you want the template to be a prefix to the service configuration or use the **Post-Configuration** section if you want the template to be a suffix to the service configuration.
  - In the **Template** drop-down menu, select the required CLI template.  
The same CLI template cannot be selected for both pre-configuration and post-configuration options.
  - In the **Template Usage** drop-down menu, select an option to indicate under what circumstances the CLI template should be configured on the devices. For example, if you select **Service Create Only**, the template CLI will only be configured on the devices when the service is created. It will not be configured when the service is modified.
  - Enter values for the template parameters. The parameters shown here depend on the variables that were defined for the template.
  - Click **Submit**.
- Note** By default, the selected CLI templates are associated with all devices that take part in the service. You cannot specifically choose the devices to be associated with the CLI templates.
- Step 3** You can configure rollback templates for the configured templates. See [Example Configuration: Rollback Template, on page 117](#).
- Step 4** You can also configure interactive templates. See [Example Configuration: Interactive Template, on page 118](#).

## Example Configuration: Extend a Circuit/VC Using CLI Templates

**Example Configuration 1:** Extending an L3VPN service on a Cisco ASR 903 router device using a CLI template with Global and Template (Local) variables:

```
vrf definition Testdoc1
exit
```



```

vrf Testdoc1
  vpn id 36B:3
  address-family ipv4 unicast
    import route-target
      65:1
    export route-target
      65:1
  address-family ipv6 unicast
    import route-target
      65:1
    export route-target
      65:1
interface GigabitEthernet0/0/0/11.2
  vrf Testdoc1
  ipv4 address 4.5.7.8 255.255.255.0
  mtu 1522
router bgp 140
  vrf Testdoc1
  rd auto
  address-family ipv6 unicast
  address-family ipv4 unicast
    redistribute static metric 54
  neighbor 3.4.6.8
    remote-as 21
    address-family ipv4 unicast
      exit
    exit
  exit
exit
interface GigabitEthernet0/0/6
  desc postconfig
  delay 5988
  mtu 436
  exit

```

**Example Configuration 2:** Extending a CEM service using a CLI template with a global variable and a template (local) variable:

```

#set($interfaceNameList = $gv.service-cem-cemInterfaceNameList.split(","))
#set($cemGroupNumberList = $gv.service-cem-cemGroupNumberList.split(","))
#set($count = 0)
#foreach($interfaceName in $interfaceNameList)
  interface $interfaceName
    service-policy input MainInterfacePolicy
    #if($count == 0)
      cem $cemGroupNumberList[0]
    #else
      cem $cemGroupNumberList[1]
    #end
    service-policy input servicePolicy
    #set($count = $count+1)
  #end
#end

```

**Example Configuration 3:** Extending a CEM service to configure QoS over CEM:

```

#set($count = 0)
#foreach($interfaceName in $gv.service-cem-cemInterfaceNameList)
  interface $interfaceName
  service-policy input MainInterfacePolicy
  #if($count == 0)
  cem $gv.service-cem-cemGroupNumberList[0]
  #else
  cem $gv.service-cem-cemGroupNumberList[1]
  #end
#end

```

```

service-policy input servicePolicy
#set($count = $count+1)
#end
exit

```

**Example Configuration 4:** Extending a Layer 3 Link service using a CLI template with a global variable and a template (local) variable:

```

##CREATE AND MODIFY CASE
#if($gv.service-serviceOperationType == "CREATE" || $gv.service-serviceOperationType ==
"MODIFY")
##XE DEVICE
#if($variant=="IOS-XE")
#if($gv.service-l3Link-routingProtocolName=="BGP")
  router bgp $gv.service-l3Link-routerProcessId
  address-family ipv4
    neighbor $gv.service-l3Link-bgpNeighborName next-hop-self all
  ##assume A End as remote building
  #if($gv.service-l3Link-isRouteReflectorClient=="TRUE" && $prefixListName!=" " &&
$gv.service-l3Link-endPointDesignation=="AEND")
    neighbor $gv.service-l3Link-bgpNeighborName capability orf prefix-list send
    neighbor $gv.service-l3Link-bgpNeighborName prefix-list $prefixListName
in
    #elseif($gv.service-l3Link-isRouteReflectorClient=="TRUE" &&
$prefixListName!=" " && $gv.service-l3Link-endPointDesignation=="ZEND")
    neighbor $gv.service-l3Link-bgpNeighborName capability orf prefix-list receive
  #end
  exit
  exit
#end

#if($xeMTU!=" " || $xeClnsMTU!=" ")
  interface $gv.service-l3Link-interfaceName
  #if($xeMTU!=" ")
    mtu $xeMTU
  #end
  #if($xeClnsMTU!=" ")
    clns mtu $xeClnsMTU
  #end
  exit
#end

#if($gv.service-l3Link-routingProtocolName=="BGP")
#if($addressFamily !=" " && $addressFamily=="vpngv4")
  router bgp $gv.service-l3Link-routerProcessId
  address-family $addressFamily
    neighbor $gv.service-l3Link-bgpNeighborName activate
  neighbor $gv.service-l3Link-bgpNeighborName send-community both
#if($gv.service-l3Link-isRouteReflectorClient=="TRUE")
  neighbor $gv.service-l3Link-bgpNeighborName route-reflector-client
#end
  bgp additional-paths install
  neighbor $gv.service-l3Link-bgpNeighborName next-hop-self all
  exit
  exit
#end
#end
##XR DEVICE
#else

#if($xrMTU!=" ")
#if($gv.service-l3Link-subInterfaceName!=" ")
  interface $gv.service-l3Link-subInterfaceName
  mtu $xrMTU

```

```

        exit
    #else
        interface $gv.service-l3Link-interfaceName
            mtu $xrMTU
        exit
    #end
#end

#if($gv.service-l3Link-routingProtocolName=="BGP")
#if($addressFamily != "" && $addressFamily=="vpn4")
    router bgp $gv.service-l3Link-routerProcessId
        address-family $addressFamily unicast
additional-paths receive
        exit
    neighbor $gv.service-l3Link-bgpNeighborName
        address-family $addressFamily unicast
            #if($gv.service-l3Link-isRouteReflectorClient=="TRUE")
                route-reflector-client
            #end
    aigp
        #if( $routePolicyName!="")
            route-policy $routePolicyName in
        #end
        exit
    exit
#end
#end

#end

##DELETE USE CASE
#elseif($gv.service-serviceOperationType == "DELETE")
##XE DEVICE
#if($variant=="IOS-XE")

    #if($xeMTU!=" " || $xeClnsMTU!="")
        interface $gv.service-l3Link-interfaceName
            #if($xeMTU!="")
                no mtu $xeMTU
            #end
            #if($xeClnsMTU!="")
                no clns mtu $xeClnsMTU
            #end
        exit
    #end

    #if($gv.service-l3Link-routingProtocolName=="BGP")
    #if($addressFamily != "" && $addressFamily=="vpn4")
        router bgp $gv.service-l3Link-routerProcessId
            no address-family $addressFamily
        exit
    #end
    #end

##XR DEVICE
#else
    #if($xrMTU!="")
        #if($gv.service-l3Link-subInterfaceName=="")
            interface $gv.service-l3Link-interfaceName
                no mtu $xrMTU
            exit
        #end
    #end

```

```

        #end
    #end

    #if($gv.service-l3Link-routingProtocolName=="BGP")
    #if($addressFamily !="" && $addressFamily=="vpnv4")
        router bgp $gv.service-l3Link-routerProcessId
        address-family $addressFamily unicast
        no additional-paths receive
    exit
    neighbor $gv.service-l3Link-bgpNeighborName
        no address-family $addressFamily unicast
    exit
        exit
    #end
    #end

#end

#end

```

**Example Configuration 5:** Extending a Bidirectional TE tunnel using a CLI template with a global variable and a template (local) variable:

```

##CREATE AND MODIFY CASE
#if($gv.service-serviceOperationType == "CREATE" || $gv.service-serviceOperationType ==
"MODIFY")
    #if($variant && $variant=="IOS-XE")
        #if($gv.service-teTunnel-tunnelId && $gv.service-teTunnel-tunnelId!="")
            #if($xeBandWidth && $xeBandWidth!="")
                interface Tunnel$gv.service-teTunnel-tunnelId
                    bandwidth $xeMaxBandWidth
                    tunnel mpls traffic-eng auto-bw frequency $xeBandWidth max-bw
$xeMaxBandWidth min-bw $xeMinBandWidth
                exit
            #end
        #end
    #else
    #if($gv.service-teTunnel-tunnelId && $gv.service-teTunnel-tunnelId!="")
    #if($xrBandWidth && $xrBandWidth!="")
        interface tunnel-te$gv.service-teTunnel-tunnelId
            bandwidth $xrMaxBandWidth
            auto-bw
            bw-limit min $xrMinBandWidth max $xrMaxBandWidth
            application $xrBandWidth
        exit
    exit
        #end
    #end
#elseif($gv.service-serviceOperationType == "DELETE")
#if($variant && $variant=="IOS-XE")
    #if($gv.service-teTunnel-tunnelId && $gv.service-teTunnel-tunnelId!="")
    #if($xeBandWidth && $xeBandWidth!="")
        interface Tunnel$gv.service-teTunnel-tunnelId
            no bandwidth
            no tunnel mpls traffic-eng auto-bw
        exit
    #end
    #end
#else
    #if($gv.service-teTunnel-tunnelId && $gv.service-teTunnel-tunnelId!="")
    #if($xrBandWidth && $xrBandWidth!="")
        interface tunnel-te$gv.service-teTunnel-tunnelId
            no bandwidth

```

```

        no auto-bw
    exit
#end
#end

#end

```

## Example Configuration: Rollback Template

You can create a rollback template and use it if the deployment fails. Navigate to Configuration > Templates > Features and Technologies, then choose CLI Templates to configure a custom rollback template. While configuring the template you must use #ROLLBACK\_CONFIG\_START and #ROLLBACK\_CONFIG\_END as flags for rollback. You must specify what the CLI needs to rollback to in between these flags. It can be used for both pre and post service configuration.



**Note** These rollback templates are not applicable for optical services.

Sample template format:

```

#ROLLBACK_CONFIG_START
interface GigabitEthernet0/0/20
mtu 1555
#ROLLBACK_CONFIG_END

```

**Example Configuration 1:** Rollback of preconfig CLI without parameters:

CLI example:

```

snmp-server enable traps
FAIL here
vrf definition PreConfigTest
  vpn id 12:566
  rd 23.23.23.23:2
  address-family ipv4
    route-target import 32:1
    route-target export 32:1
interface GigabitEthernet0/10
  service instance 3 ethernet
  encapsulation dot1q 521
  rewrite ingress tag pop 1 symmetric
  bridge-domain 8
exit
interface Vlan8
  no shutdown
  mtu 1522
  vrf forwarding PreConfigTest
  ip address 33.44.24.55 255.255.255.0
router bgp 100
  address-family ipv4 vrf PreConfigTest
  exit

```

**Example Configuration 2:** RollBack of postconfig CLI without parameters:

CLI example:

```

snmp-server enable traps
vrf definition PreConfigTest
  vpn id 12:566

```

```

rd 23.23.23.23:3
address-family ipv4
  route-target import 24:1
  route-target export 24:1
interface GigabitEthernet0/10
  service instance 4 ethernet
  encapsulation dot1q 685
  rewrite ingress tag pop 1 symmetric
  bridge-domain 9
  exit
interface Vlan9
  no shutdown
  mtu 1522
  vrf forwarding PostConfigTest
  ip address 23.44.55.56 255.255.255.0
router bgp 100
  address-family ipv4 vrf PostConfigTest
  exit
  exit
snmp-server enable traps
FAIL here

```

**Example Configuration 3:** PreConfig working template, Post config invalid template, Deployment failure and rollback CLI

CLI example:

```

snmp-server enable traps
vrf definition PrePostConfig
  vpn id 34:55
  rd 23.23.23.23:4
  address-family ipv4
    route-target import 234:1
    route-target export 234:1
interface GigabitEthernet0/10
  service instance 5 ethernet
  encapsulation dot1q 664
  rewrite ingress tag pop 1 symmetric
  bridge-domain 11
  exit
interface Vlan11
  no shutdown
  mtu 1522
  vrf forwarding PrePostConfig
  ip address 44.55.22.55 255.255.255.0
router bgp 100
  address-family ipv4 vrf PrePostConfig
  exit
  exit
snmp-server enable traps
FAIL here

```

## Example Configuration: Interactive Template

**Example Configuration 1:** Interactive template for commands that have single prompt:

Template Format:

```

#INTERACTIVE
no username test<IQ>confirm<R>y
#ENDS_INTERACTIVE

```

CLI example (Template set as Pre-service configuration):

```

no username test
bridge-domain 8
ethernet cfm domain EVC level 4
    service b_evplan_4Mar evc b_evplan_4Mar vlan 8
        continuity-check
        continuity-check interval 1s
ethernet evc b_evplan_4Mar
    oam protocol cfm domain EVC
interface GigabitEthernet0/0/1
    ethernet uni id UniName3
    service instance 2 ethernet b_evplan_4Mar
        encapsulation dot1q 22
        bridge-domain 8
        cfm mep domain EVC mpid 1
        ethernet lmi ce-vlan map 22
        snmp trap link-status
    exit
exit

```

**Example Configuration 2:** Interactive template for commands that more than one prompt:

Template Format:

```

#INTERACTIVE
crypto key generate rsa<IQ>% Do you really want to replace them? [yes/no]:<EM><R>yes<IQ>How
many bits in the modulus [512]:<EM><R>512
#ENDS_INTERACTIVE

```

CLI example (Template set as Post-service configuration):

```

bridge-domain 8
ethernet cfm domain EVC level 4
    service b_evplan_4Mar evc b_evplan_4Mar vlan 8
        continuity-check
        continuity-check interval 1s
ethernet evc b_evplan_4Mar
    oam protocol cfm domain EVC
interface GigabitEthernet0/0/0
    ethernet uni id UniName4
    ethernet lmi interface
    service instance 1 ethernet b_evplan_4Mar
        encapsulation dot1q 345
        bridge-domain 8
        cfm mep domain EVC mpid 1
        ethernet lmi ce-vlan map 345
        snmp trap link-status
    exit
exit
crypto key generate rsa

```

## Provisioning failure syslog

When a service provisioning failures occurs, Cisco EPN Manager generates a syslog and sends it to the receivers that are configured in the Cisco EPN Manager. This syslog is generated for create, modify, delete, and promote operations.

The receiver can be configured by CLI by logging into the Cisco EPN Manager server. See [Connect via CLI](#). Execute **logging security <syslog receiver ip> in conf mode**.

The visual representation of the syslog depends on the software used on the receiver machine/server.

