CHAPTER 6

Managing MPLS Transport Profile Services

This chapter describes the tasks required to get started using Cisco Prime Fulfillment 6.2, Multiprotocol Label Switching (MPLS) Transport Profile (TP) services.

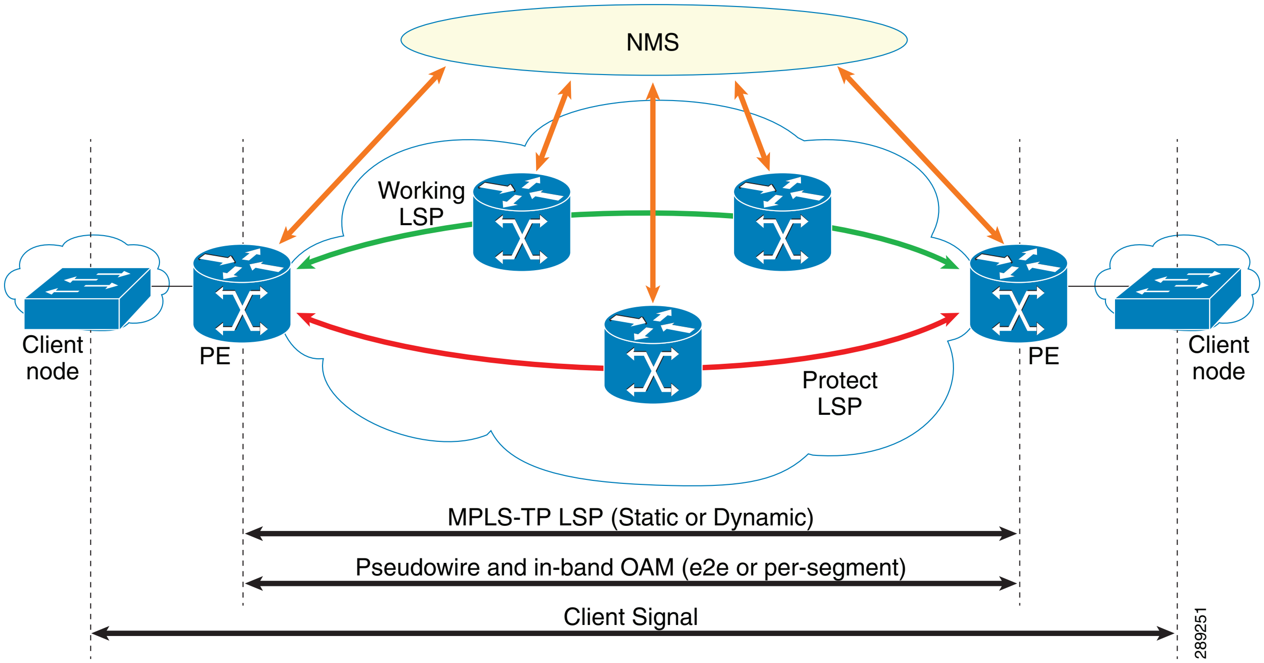
This section covers the following topics:

Introduction

MPLS-TP is a transport service (managed by Prime Fulfillment) for a dynamic MPLS core (not managed by Prime Fulfillment).

In the current implementation of MPLS-TP, an MPLS-TP tunnel can be provisioned between two arbitrary nodes in an MPLS-TP enabled network. The provisioned tunnel can have one or two paths, a working and an optional protect label-switched path (LSP). The normal use case is for Prime Fulfillment to automatically calculate the working and protect paths using a path selection algorithm that chooses MPLS-TP enabled links based on shortest path, and to provision the tunnel on the endpoints and all nodes traversed by the tunnel.

Figure 6-1 An MPLS-TP Enabled Network


NMS
Working LSP
Client node
PE
Protect LSP
PE
Client node
MPLS-TP LSP (Static or Dynamic)
Pseudowire and in-band OAM (e2e or per-segment)
Client Signal
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Prerequisites and Limitations

The current release of Prime Fulfillment involves certain prerequisites and limitations, which are described in the *Cisco Prime Fulfillment Installation Guide 6.2*, including general system recommendations.

Note that Internet Explorer 8 (IE8) will not show the calculated path graphically (as described in Creating an MPLS-TP Service Request, page 6-8) as IE8 offers no support for SVG display. Until IE9 is supported, a textual summary of the path can be used to review the path in IE8.

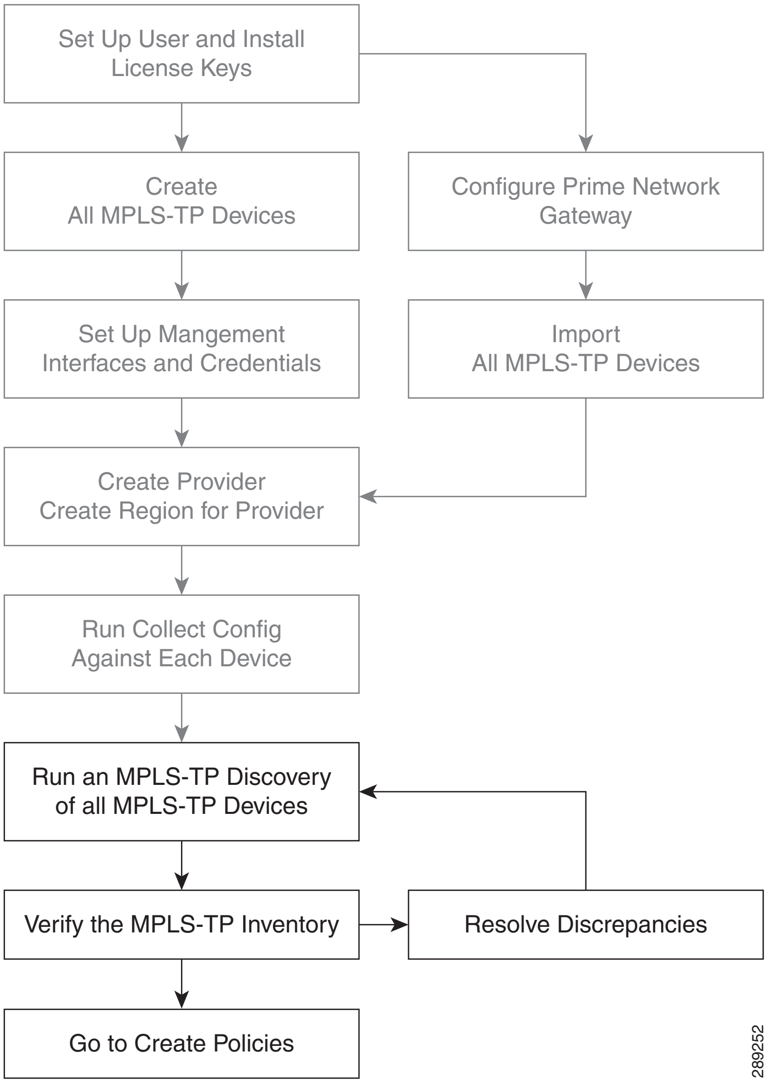
For supported device and OS information , refer to *Cisco Prime Fulfillment Supported Devices 6.2*.

Preconfiguration Process

The preconfiguration process sets up key parameters that enable the system to collect MPLS-TP network information and subsequently deploy MPLS-TP configurations on the chosen network.

The different steps in the preconfiguration process are provided in Figure 6-2.

Figure 6-2 Preconfiguration Process


Set Up User and Install License Keys
Create All MPLS-TP Devices
Configure Prime Network Gateway
Set Up Mangement Interfaces and Credentials
Import All MPLS-TP Devices
Create Provider Create Region for Provider
Run Collect Config Against Each Device
Run an MPLS-TP Discovery of all MPLS-TP Devices
Verify the MPLS-TP Inventory
Resolve Discrepancies
Go to Create Policies
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Before commencing the preconfiguration process, MPLS-TP needs to be enabled on the network devices by making sure that the IP addresses used as devices' MPLS-TP IDs are accessible from the management station (this step is not supported by MPLS-TP). This is described in Other MPLS-TP Preconfiguration Requirements, page 6-4.

Setting up new user and installing license keys is described in Chapter 14, "Administration Tasks" and the other steps are covered in Setting Up Devices and Device Groups, page 2-1 and the Inventory - Discovery appendix (Collect Config step).

See below for a description of specific MPLS-TP user roles.

The MPLS-TP-specific steps are as follows:

1. **Run an MPLS-TP Discovery Task**—Use Task Manager to discover the MPLS-TP network for a particular MPLS-TP provider to populate the repository with a view to creating primary and backup tunnels. (See Running MPLS-TP Discovery, page 6-5.)

2. **Verify the MPLS-TP Inventory**—Verify that the MPLS-TP Discovery task was successfully completed. This can be done in a couple of ways. (See Verifying the MPLS-TP Discovery Results, page 6-6.)

MPLS-TP Setup and Installation

Before setting up Prime Fulfillment, the Prime Fulfillment software must be installed. To do so, see the *Cisco Prime Fulfillment Installation Guide 6.2*.

To set up a new Prime Fulfillment user, one or more users with a MPLS-TP role must be created. MPLS-TP roles are decribed in MPLS-TP User Roles, page 6-4 and step by step instructions for creating user roles are documented in Users, page 14-9.

Licensing information, including the Prime Fulfillment licensing options and the procedure needed to install licenses is described in Licensing, page 14-6.

MPLS-TP User Roles

Prime Fulfillment currently supports two MPLS-TP roles, the MPLS-TPRole and MPLS-TPServiceOpRole. These 2 user roles behave similarly to the other roles in Prime Fulfillment, for example the MPLSRole and the MPLSServiceOpRole found in MPLS.

They have the following permissions:

- MPLS-TPRole—full permission to manage the inventory (create, read, update, delete, and deploy MPLS-TP policies and service requests)
- MPLS-TPServiceOpRole—permission to deploy MPLS-TP service requests

For an explanation of how to work with roles, see User Roles, page 14-16.

Other MPLS-TP Preconfiguration Requirements

Prior to performing MPLS-TP provisioning, perform the following additional configuration steps:

Step 1 Enable MPLS-TP on the device:

- Choose a global ID common to all devices (AS number, for example)
- Allocate a device ID to each device.
- Configure MPLS-TP-related timers.

Step 2 Configure a range of statically defined MPLS labels to be used by MPLS-TP tunnels and static pseudowires.

Step 3 Enable MPLS-TP links to select which interfaces will form the links in the MPLS-TP topology:

- Give each interface an ID.
- Optionally configure a bandwidth pool on each interface.
- Enable CDP on the MPLS-TP enabled links. This is not needed for MPLS-TP but is required for MPLS-TP discovery to work in Prime Fulfillment.

Step 4 Create a BFD class to be used to monitor your MPLS-TP tunnels.

Running MPLS-TP Discovery

As a prerequisite for running MPLS-TP discovery, all devices must be present and a Collect Config task must be run (see the Inventory - Discovery appendix, Collect Config step).

The MPLS-TP network is discovered using the **MPLS-TP Discovery** task. This populates the repository with the network topology in an automated way. The necessary steps are described in this section.

Note MPLS-TP discovery will update only the functional MPLS-TP links in the MPLS-TP routing diagram (Service Request Editor, Review Routing accordion).

The MPLS-TP discovery process discovers the following from the live network:

- TP enabled links
- MPLS Static label pools
- MPLS Static label pool usage
- BFD templates
- TP Router ID
- TP Global ID

Where possible, the discovery process will try to keep the repository consistent with the network, for example delete links which have been removed. In cases where this is not possible, for example if a link is in use, a log message will be recorded.

This section includes the following:

- Creating an MPLS-TP Discovery Task, page 6-5
- Creating an MPLS-TP Discovery Task, page 6-5
- Verifying the MPLS-TP Discovery Results, page 6-6

Creating an MPLS-TP Discovery Task

To create a MPLS-TP Discovery task on the MPLS-TP network, use the following steps:

Step 1 Choose **Operate** > **Task Manager**.

The Task Manager window appears.

Step 2 Create a new task by selecting **Create > MPLS-TP Discovery**.

The Create Task window appears.

Step 3 Make any desired changes to the auto-generated name and description text and click Next.

The **MPLS-TP Discovery** window appears.

Step 4 Select the devices through which the MPLS-TP network should be discovered.

Step 5 Click Submit.

The discovery process begins.

Step 6 Once the MPLS-TP discovery task is complete, the outcome will be documented in a log under Operate > Task Logs.

Links and resource pools should now be visible in the MPLS-TP Details window, which is accessible from the Inventory > Devices > MPLS-TP Details page.

Verifying the MPLS-TP Discovery Results

After running MPLS-TP Discovery, you can see the result in various ways.

Viewing Logs

Once the **MPLS-TP Discovery** task is completed, you can view the log that is generated. This summary log will list any changes that have occured in the MPLS-TP network.

To view the log, select the relevant task in Task Manager and click **Logs**.

Verifying Links, Pools, and MPLS-TP Global and Router IDs

To verify the status of links and pools, go to the MPLS-TP Details page at Inventory > Devices > MPLS-TP Details.

The MPLS-TP global and router IDs for a particular device can be verified by going to Inventory > Devices > Edit.

Creating an MPLS-TP Policy

An MPLS-TP policy is needed to successfully create and deploy a service request. It serves as a template for the settings that are needed on the device.

To create an MPLS-TP policy, use the following steps:

Step 1 Choose one of the following:

a. **Service Design** > **Policy Manager**.

In the Policy Manager window, click **Create**.

b. **Service Design** > **Create Policy**.

In either case, a Policy Type drop-down appears.

Step 2 Click the down-arrow to open the **Policy Types** drop-down list and select **MPLS-TP Tunnel**.

The Policy Information accordion opens.

Step 3 Complete accordion 1 – Policy Information.

Enter **Policy Name** and optionally a **Description**. Policy Name is the only field that is mandatory in the Policy Editor.

Step 4 Click **Next.**

The Policy Information accordion closes and the next accordion opens.

Step 5 Complete accordion 2 – Tunnel Characteristics.

Set how each of the attributes will be displayed within the Service Request Editor window using the drop-down next to each field:

- **Editable** will display the attribute and permit modification.
- **Visible** will display the attribute but prevent editing.
- **Hidden** will not display the attribute.

Make sure to select **Editable** for any fields that you want to be able to edit in the Service Request Editor.

Use the **State** field to indicate whether the tunnel should be provisioned with the **shutdown** command or not.

For path protection, keep the **Protection** box selected to have Prime Fulfillment autogenerate an alternate protective path for the new tunnel.

For the **Diversity Options** drop-down menu, choose one of the following options:

- Node Diversity Required—Path calculation will fail if protection with unique nodes cannot be found.
- Node Diversity Desired—Allow a path with common nodes to be returned.
- Link Diversity Only—Do not allow working and protection path to pass through the same links.

Step 6 Complete accordion 3 – Tunnel End-points.

As in the previous accordion, remember to specify which fields should be Editable, Visible, and Hidden in the Service Request Editor.

Complete the fields as needed, using the drop-downs to select source and destination nodes and BFD templates.

Select the required BFD templates from a list of available BFD templates on the source and destination devices respectively. A valid BFD template name is max. 31 characters long.

For an explanation of global ID and router ID, see Global ID and Router ID, page 6-7.

Step 7 Click **Finish** to create the policy.

The new policy appears in the list of tunnels in the Policy Manager.

Global ID and Router ID

Global ID and router ID are used to identify devices within the MPLS-TP network so they can be discovered and managed.

If you as a user decide to specify the router ID and global ID, those values will be used for tunnel creation. If they are not specified, the router ID and global ID configured on the device itself are used.

Every MPLS-TP tunnel and LSP has a unique ID formed by the concatenation of the Global ID, Router ID, Tunnel ID, and LSP ID of both ends of the tunnel. This ID is configured at every endpoint and midpoint of the tunnel. The Global ID and router ID are normally configured globally on a router but it is possible to override these values for specific tunnels. Prime Fulfillment is aware of the globally configured IDs and uses them when configuring tunnels but also allows you to override these values as needed.

Global ID

Every MPLS-TP enabled node can have an MPLS-TP global ID configured within the global configuration. If the Global ID is set at the MPLE-TP global configuration level, it will be used as the default global ID for all endpoint and midpoint configuration. If not configured, a global ID of 0 is used for configured tunnels unless a different value is explicitly specified within the tunnel configuration itself.

The MPLS-TP global ID is retrieved from a device via MPLS-TP discovery.

Router ID

To be MPLS-TP emabled, a device must have a router ID.

If neither the MPLS-TP router ID nor the MPLS-TP global ID can be retrieved from the device, this is logged in the corresponding **MPLS-TP Discovery** task log file and all remaining MPLS-TP Discovery steps are halted for this device. The device in question is flagged as being MPLS-TP Disabled.

Creating an MPLS-TP Service Request

An MPLS-TP service request needs to be created to deploy a service request. It is assumed that at least one MPLS-TP policy is available. If not, see Creating an MPLS-TP Policy, page 6-6.

To create an MPLS-TP service request, use the following steps:

Step 1 This operation can be done in two ways:

a. From the Policy Manager, select the desired policy and click **Create Service Request**.

b. Choose **Operate** > **Create Service Request**.

The Service Request Editor window appears.

Next to the **Policy** field, click the down-arrow to open the **Policies** drop-down list.

Step 2 Select the desired MPLS-TP policy.

The Service Request Editor opens. In this editor,

Step 3 In the Service Request accordion, add a description in the **Service Description** field.

Step 4 In the Tunnel Characteristics accordion, use the pre-populated field values or make the desired modifications.

To set the **Diversity Options**, see Creating an MPLS-TP Policy, page 6-6 for an explanation.

Step 5 In the Tunnel End-Points accordion, complete the **Source Node** and **Destination Node** fields and optionally any other fields.

In this accordion, both source device, destination device, and BFD information is mandatory.

Step 6 In the Review Routing accordion, specify which links should be required or excluded.

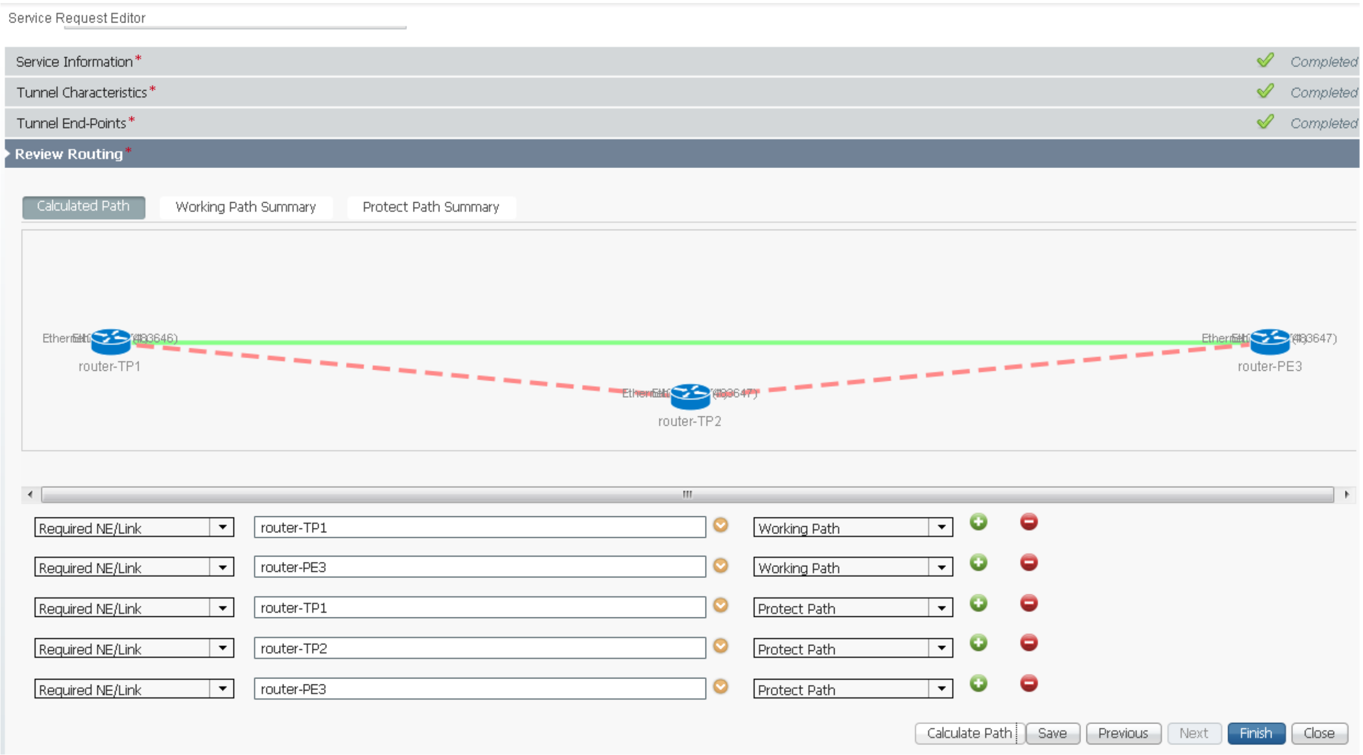
Click **Calculate Path** to view the path diagram:

Working path—Green solid line

Protect Link—Red dotted line

For an example of an MPLS-TP routing diagram generated with **Calculate Path**, see Figure 6-3 .

Figure 6-3 MPLS-TP Routing Diagram



Service Request Editor

Service Information * ✓ Completed

Tunnel Characteristics * ✓ Completed

Tunnel End-Points * ✓ Completed

Review Routing *

Required NE/Link	router-TP1	Working Path
Required NE/Link	router-PE3	Working Path
Required NE/Link	router-TP1	Protect Path
Required NE/Link	router-TP2	Protect Path
Required NE/Link	router-PE3	Protect Path

- **Working Path Summary**—Click this button to view hop and link information for the working path.
- **Protect Path Summary**—Click this button to view hop and link information for the protect path.
- Add (or remove) path constraints by clicking the plus (or minus) icons to the right:
  - **Required NE/Link**—Specify network elements or links that traffic must pass through for either the working or the protect path.
  - **Excluded NE/Link**—Specify network elements or links that traffic must **not** pass through for either the working or the protect path.

For more information about path constraints, see Working with Path Constraints, page 6-10.

Step 7 Go back over the various accordions to check and edit as necessary.

Step 8 Click **Finish** on the last accordion to complete the create service request operation.

The Service Request Manager window opens.

For information about the Service Request Manager elements and operations, see Chapter 8, “Managing Service Requests.”

Guidelines for working with path constraints are provided in Working with Path Constraints, page 6-10.

An MPLS-TP service request that is in the **DRAFT** state can be modified. If a **DRAFT** MPLS-TP service request is modified, the new values will replace the previously saved values.

If the **DRAFT** service request is determined to be valid and complete so that all mandatory fields have been populated with valid values and the **Save** button is pressed, then the existing MPLS-TP service request will be moved to the **REQUESTED** state. The wizard is completed when you press the **Finish** button. Values to be auto-allocated from resource pools are allocated at that point.

If the **DRAFT** service request is determined to be incomplete so that not all mandatory fields have been populated or there are validation errors and the **Save** button is pressed, then the existing MPLS-TP service request will remain in the **DRAFT** state. The wizard is completed when you press the **Finish** button. Values to be auto-allocated from resource pools are NOT allocated at that point.

A service request in **DRAFT** state is marked by a white/orange work cone in the Service Request Manager.

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Working with Path Constraints

Path constraints can be added to control the tunnel path when a service request is created or modified as shown in the procedure in Step 6 in the create procedure.

There are two ways to add path constraints:

- Clicking a node or link on the routing diagram and clicking the plus sign. This adds a new path constraint to the working path by default. Change to **Protect Path** using the drop down if needed. Similarly, clicking the minus sign will remove the constraint.
- If the node/link you want to exclude/include is not present in the diagram, you can use the selector next to **Required NE/Link**.

Note If you change anything after the first path calculation, for example adding/removing constraints, switching protection on/off, etc., you will need to re-run path calculation by clicking **Calculate Path**.

Running Config Audit

A config audit task can be run against an MPLS-TP service requests to check that the configuration rolled onto a device by a particular service request is still present as expected.

To create a MPLS-TP Config Audit task, use the following steps:

Step 1 Choose **Operate** > **Task Manager**.

Step 2 Click **Audit > Config Audit** to open the Create Task window.

Step 3 Modify the **Name** or **Description** fields as desired and click **Next**.

The service request selection window appears.

Step 4 Click **Select SRs** to add a service request and select schedule.

Step 5 Click **Submit**.

If successful, this adds the task to the list of created tasks in the Tasks window.

To view the task logs for the created tasks, in Task Manager select the created task and click **Logs**.

Running MPLS-TP Functional Audit

In an MPLS-TP Functional Audit, information is retrieved from source and destination endpoints to provide tunnel audit information.

This task only performs functional audit on service requests, which are not in one of the following states:

- **Draft**
- **Closed**
- **Requested**
- **Invalid**
- **Failed Deploy**

For more information on working with service requests, see Chapter 8, "Managing Service Requests."

To create a MPLS-TP Functional Audit task, use the following steps:

Step 1 Choose **Operate** > **Task Manager**.

Step 2 Click **Audit > MPLS-TP Tunnel Functional Audit** to open the Create Task window.

Step 3 Modify the **Name** or **Description** fields as desired and click **Next**.

The service request selection window appears.

Step 4 Click **Select SRs** to add a service request and select schedule.

Step 5 Click **Submit**.

If successful, this adds the task to the list of created tasks in the Tasks window.

To view the task logs for the created tasks, in Task Manager select the created task and click **Logs**.

Deploying an MPLS-TP Tunnel

The final step required to provision an MPLS-TP service request is the deploy the service request. This pushes the service request and the associated configuration updates to the network.

Note A service request in **DRAFT** state cannot be deployed.

The deploy functionality is the same as for other Prime Fulfillment services. For instructions on how to deploy an MPLS-TP service request, see Deploying Service Requests, page 8-10.

Decommissioning

MPLS-TP service request configurations can be removed from the network using the decommissioning functionality within the Service Request Manager. Decommissioning will cause the previously deployed configurations to be removed from all tunnel endpoint and mid-point devices within the MPLS-TP tunnel path.

To decommission one or more service requests, see Chapter 8, "Managing Service Requests."

Sample Configlets

The configlets included in this section show the CLIs generated by Prime Fulfillment for particular services and features. Each configlet example provides the following information:

- Service
- Feature
- Devices configuration (network role, hardware platform, relationship of the devices and other relevant information)
- Sample configlets for each device in the configuration
- Comments.

All examples in this section assume the presence of an MPLS-TP core.

Note The configlets generated by Prime Fulfillment are only the delta between what needs to be provisioned and what currently exists on the device. This means that if a relevant CLI is already on the device, it does not show up in the associated configlet.

This section provides sample configlets for MPLS-TP service provisioning in Cisco Prime Fulfillment.

It includes the following section:

- MPLS-TP Working Tunnel Configlet (IOS), page 6-13

MPLS-TP Working Tunnel Configlet (IOS)

Configuration

- Service: MPLS-TP Working Tunnel
- Feature: MPLS-TP configlet (IOS) for configuring MPLS-TP enabled nodes

Configlets

IOS Device Configuration	Comments

Endpoint Config
interface Tunnel-tp200
  description PrimeF:JobID:2(testTunnel)
  tp tunnel-name test
  tp bandwidth 100
  tp source 3.3.3.3 global-id 2
  tp destination 1.1.1.1 tunnel-tp 200 global-id 3
  bfd BFDTemplate-SingleHopMicrosec-1
  working-lsp
    lsp-number 0
    in-label 8018
    out-label 5003 out-link 8
  protect-lsp
    lsp-number 1
    in-label 8019
    out-label 50012 out-link 12
Midpoint Config
mpls tp lsp source 3.3.3.3 global-id 2 tunnel-tp 200 lsp working destination 1.1.1.1 global-id 3 tunnel-tp 200
  forward-lsp
    tp bandwidth 100
    in-label 5003 out-label 50011 out-link 10
  reverse-lsp
    tp bandwidth 100
    in-label 5004 out-label 8018 out-link 8
EndPoint Config
interface Tunnel-tp200
  description PrimeF:JobID:2(testTunnel)
  tp tunnel-name test
  tp bandwidth 100
  tp source 1.1.1.1 global-id 3
  tp destination 3.3.3.3 tunnel-tp 200 global-id 2
  bfd BFDTemplate-SingleHopMicrosec-1
  working-lsp
    lsp-number 0
    in-label 50011
    out-label 5004 out-link 10
  protect-lsp
    lsp-number 1
    in-label 50012
    out-label 8019 out-link 12
	Create an MPLS-TP working tunnel with endpoint and midpoint nodes. This involves configuring the settings on each node in the tunnel.
	Create an MPLS-TP working tunnel with the following attributes:
	Endpoint 1:
	- tp tunnel name: test
	- Source: 3.3.3.3
	- Destination 1.1.1.1
	- Bandwidth 100 kbps
	- bfd BFDTemplate-SingleHopMicrosec-1
	- Working LSP configuration
	- Protect LSP configuration
	Midpoint:
	- Source: 3.3.3.3
	- Destination 1.1.1.1
	- Bandwidth 100 kbps
	- Forward LSP configuration
	- Reverse LSP configuration
	Endpoint 2:
	- tp tunnel name: test
	- Source: 1.1.1.1
	- Destination 3.3.3.3
	- Bandwidth 100 kbps
	- bfd BFDTemplate-SingleHopMicrosec-1
	- Working LSP configuration
	- Protect LSP configuration