



Configuring MPLS–Transport Profile

This chapter describes the MPLS–Transport Profile and procedures to configure MPLS–Transport Profile.

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Understanding Multiprotocol Label Switching Transport Profile

Multiprotocol Label Switching Transport Profile (MPLS–TP) is a carrier–grade packet transport technology that enables service providers to move from Synchronous Optical Networking (SONET) and Synchronous

Digital Hierarchy (SDH) time–division multiplexing (TDM) to packet switching. MPLS–TP enables MPLS to be deployed in a transport network to support packet transport services with a similar degree of predictability to that found in existing transport networks.

The goal of MPLS–TP is to provide connection–oriented transport for packet and TDM services over optical networks leveraging the widely deployed MPLS technology. Operations, Administration, and Maintenance (OAM) and resiliency features are defined and implemented in MPLS–TP to ensure the capabilities needed for carrier–grade packet transport networks—scalable operations, high availability, performance monitoring and multidomain support.

MPLS–TP defines a profile of MPLS targeted at transport applications and networks. This profile specifies the MPLS characteristics and extensions required to meet the transport requirements.

**Note**

MPLS–TP supports only point–to–point Layer 2 VPN service in this release. The point–to–point Layer 2 VPN service is called Virtual Private Wire Service (VPWS). MPLS–TP supports only static pseudowires in this release.

Key Features

The key features of MPLS–TP are as follows:

- Connection–oriented.
- Carries Layer 3 and Layer 2 services.
- Runs over IEEE Ethernet PHYs, OTN, WDM and so on.
- Static and bidirectional label-switched path (LSP) provisioning.
- OAM functions similar to those available in traditional optical transport networks such as SONET or SDH are provided. These OAM functions belong to the MPLS–TP data plane and are independent from the control plane.
- Fault propagation through Bidirectional Fault Detection (BFD), Link Down Indication (LDI), and Lockout Request (LKR) messages.
- 1:1 revertive path protection.
- IP–less provisioning of tunnels.
- Network provisioning through CTC.
- Traffic switchover time from working LSP to protect LSP and vice versa is up to 50 milliseconds.

Planes in MPLS–TP

The three planes in MPLS–TP perform the following functions:

Plane	Functions
Control plane through CTC	<ul style="list-style-type: none"> • Constraint-based path computation • Primary and backup LSPs definition • Auto-discovery of existing tunnels • Fault management
Data plane	Forwards data packets
Management plane	Configuration

The control plane is decoupled from the data plane such that the failures in the control plane do not affect the data plane and vice versa.

Restrictions

The following restrictions apply to MPLS–TP:

- Penultimate hop popping is not supported. Only ultimate hop popping is supported, because the label mappings are configured at the MPLS–TP end points.
- MPLS–TP link numbers are not configured on the interfaces for which Multiprotocol Label Switching Traffic Engineering (MPLS-TE) is enabled and vice versa.
- IPv6 addressing is not supported.

Understanding MPLS–TP Operations, Administration, and Maintenance

Several Operations, Administration, and Maintenance (OAM) protocols and messages support the provisioning and maintenance of MPLS–TP tunnels and bidirectional LSPs. The OAM messages are used for fault management, connection verification, continuity check, and other functions. The timers can be configured for each OAM message.

The following OAM messages are forwarded along the specified LSP:

- OAM fault management—Link Down Indication (LDI) and Lockout Request (LKR) messages
- OAM connection verification—ping and traceroute messages
- OAM continuity check—Bidirectional Fault Detection (BFD) messages. min_tx and min_rx are 4 milliseconds.

The following messages are forwarded along the specified pseudowire:

- Static pseudowire OAM messages
- Pseudowire ping and traceroute messages
- Pseudowire BFD messages. min_tx and min_rx are 50 milliseconds.

LDI and LKR Messages

The LDI messages are generated at midpoint nodes when a link failure is detected. The LKR messages are sent from a midpoint node to the reachable endpoint when an interface is administratively shut. When a **lockout** command is configured on either the working or the protect LSP, an LDI message is sent from the local endpoint to the remote endpoint.

LSP Ping and Trace Messages

For MPLS–TP connectivity verification, **ping mpls tp** and **trace mpls tp** commands can be used to specify that the echo requests must be sent along the working LSP or the protect LSP, or the locked out working or protect LSP.

BFD Messages

BFD sessions running on MPLS–TP LSPs can be configured. These sessions run on both the working LSP and the protect LSP. BFD provides continuity check for MPLS–TP LSPs to detect forwarding failures between two adjacent routers. When BFD is enabled on an MPLS–TP tunnel interface, the MPLS–TP client creates separate BFD sessions for working and protect LSPs. A single set of BFD timers is configured on the tunnel that applies to both the working and protect LSPs.

Multiprotocol Label Switching Transport Profile Configuration Procedures

The following procedures can be performed using Cisco IOS commands to configure MPLS–TP:

- [DLP-J95 Configure Global Settings for Multiprotocol Label Switching Transport Profile Using Cisco IOS Commands, on page 5](#)
- [DLP-J103 Specify Static Label Range Using Cisco IOS Commands, on page 9](#)
- [DLP-J97 Create and Configure BFD Templates Using Cisco IOS Commands, on page 11](#)
- [DLP-J99 Configure an MPLS–TP Link Using Cisco IOS Commands, on page 16](#)
- [DLP-J226 Configure an MPLS–TP Link Without IP Addresses Using Cisco IOS Commands, on page 17](#)
- [DLP-J101 Create a Static OAM Class Using Cisco IOS Commands, on page 21](#)
- [DLP-J105 Configure Tunnel Midpoints Using Cisco IOS Commands, on page 27](#)
- [DLP-J106 Configure Tunnel Endpoints Using Cisco IOS Commands, on page 30](#)

The following procedures can be performed using CTC to configure MPLS–TP:

- [DLP-J96 Configure Global Settings for Multiprotocol Label Switching Transport Profile Using CTC, on page 7](#)
- [DLP-J104 Specify Static Label Range Using CTC, on page 10](#)
- [DLP-J98 Create and Configure BFD Templates Using CTC, on page 13](#)
- [DLP-J100 Configure an MPLS–TP Link Number Using CTC, on page 19](#)
- [DLP-J102 Create a Static OAM Class Using CTC, on page 22](#)

- [DLP-J107 Create an MPLS–TP Tunnel Using CTC, on page 34](#)
- [DLP-J208 Edit MPLS–TP Tunnel Attributes Using CTC, on page 37](#)

NTP-J36 Configure Global Settings for Multiprotocol Label Switching Transport Profile

Purpose	This procedure configures the global settings for MPLS–TP.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

Perform any of the following procedures as needed:

- [DLP-J95 Configure Global Settings for Multiprotocol Label Switching Transport Profile Using Cisco IOS Commands, on page 5](#)
- [DLP-J96 Configure Global Settings for Multiprotocol Label Switching Transport Profile Using CTC, on page 7](#)

Stop. You have completed this procedure.

DLP-J95 Configure Global Settings for Multiprotocol Label Switching Transport Profile Using Cisco IOS Commands

Purpose	This procedure configures the global settings for MPLS–TP using Cisco IOS commands.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	mpls tp Example: Router(config)# mpls tp	Enters MPLS–TP configuration mode, from where you can configure MPLS–TP parameters for the router.
Step 4	router-id <i>ip-address</i> Example: Router(config-mpls-tp)# router-id 209.165.200.225	Specifies the default MPLS–TP router ID. This address is used as the source node ID for all the MPLS–TP tunnels configured on the router.
Step 5	global-id <i>number</i> Example: Router(config-mpls-tp)# global-id 1	Specifies the default global ID used for all the endpoints and midpoints. The valid range is from 0 to 2147483647. The default value is 0.
Step 6	fault-oam refresh-timer <i>seconds</i> Example: Router(config-mpls-tp)# fault-oam refresh-timer 10	Specifies the maximum time between successive fault OAM messages specified in seconds. The valid range is from 1 to 255. The default value is 20.
Step 7	wtr-timer <i>seconds</i> Example: Router(config-mpls-tp)# wtr-timer 25	Specifies the wait-to-restore (WTR) timer. This timer controls the length of time to wait before reverting to the original working path following the repair of a fault on the original working path. The valid range is from 0 to 2147483647.
Step 8	exit Example: Router(config-mpls-tp)# exit	Returns the router to global configuration mode.
Step 9	Return to your originating procedure (NTP). Example:	

	Command or Action	Purpose
	—	

Example: Configure Global Settings for MPLS–TP

The following example shows how to configure the global settings for MPLS–TP using Cisco IOS commands:

```
Router> enable
Router# configure terminal
Router(config)# mpls tp
Router(config-mpls-tp)# router-id 209.165.200.225
Router(config-mpls-tp)# global-id 1
Router(config-mpls-tp)# fault-oam refresh-timer 10
Router(config-mpls-tp)# wtr-timer 25
Router(config-mpls-tp)# exit
```

DLP-J96 Configure Global Settings for Multiprotocol Label Switching Transport Profile Using CTC

Purpose	This procedure configures the global settings for MPLS–TP using CTC.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

-
- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node on the network where you want to configure the global settings for MPLS–TP.
- Step 2** From the View menu, choose **Go to Home View**.
- Step 3** Right-click the fabric or line card and choose **Open Packet Transport System View**. The Packet Transport System View dialog box appears.
- Step 4** Click the **Provisioning** tab.
- Step 5** From the left pane, click **MPLS TP**.
- Step 6** Click the **Global Settings** tab.
- Step 7** Enter the router IP address in the Node ID field. This IP address need not be the loopback IP address.
- Step 8** In the TP Fault OAM area, enter the number of seconds in the Refresh Timer field to specify how often the static OAM packets must be sent out.
- Step 9** Click **Apply** to save the configuration.
- Step 10** Return to your originating procedure (NTP).
-

NTP-J40 Specify Static Label Range

Purpose	This procedure specifies the static label range.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

Perform any of the following procedures as needed:

- [DLP-J103 Specify Static Label Range Using Cisco IOS Commands](#), on page 9
- [DLP-J104 Specify Static Label Range Using CTC](#), on page 10

Stop. You have completed this procedure.

DLP-J103 Specify Static Label Range Using Cisco IOS Commands

Purpose	This procedure specifies the static label range using Cisco IOS commands.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

You must specify the static label range before provisioning the MPLS–TP tunnel.

Procedure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	mpls label range <i>dyn-min-value</i> <i>dyn-max-value</i> static <i>static-min-value</i> <i>static-max-value</i> Example: Router(config)# mpls label range 1000 8000 static 16 999	Specifies the static label range that applies to both the pseudowire and MPLS–TP tunnel. The valid range of static and dynamic labels is from 16 to 8000. The dynamic label range is automatically calculated based on the values specified in the static label range.
Step 4	Return to your originating procedure (NTP). Example: —	

Example: Specify Static Label Range

The following example shows how to specify the static label range using Cisco IOS commands:

```
Router> enable
Router# configure terminal
Router(config)# mpls label range 1000 8000 static 16 999
```

DLP-J104 Specify Static Label Range Using CTC

Purpose	This procedure specifies the static label range using CTC.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

You must specify the static label range before provisioning the MPLS–TE or MPLS–TP tunnel.

Procedure

-
- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node on the network where you want to specify the static label range.
- Step 2** From the View menu, choose **Go to Home View**.
- Step 3** Right-click the fabric or line card and choose **Open Packet Transport System View**. The Packet Transport System View dialog box appears.
- Step 4** Click the **Provisioning** tab.
- Step 5** From the left pane, click **Label Range**.
- Step 6** In the MPLS Static Label Range area, enter the minimum label value in the Min Label field.
- Step 7** Enter the maximum label value in the Max Label field.
The static label range specified in the static label applies to both the pseudowire and MPLS–TP tunnel. The valid range of static and dynamic labels is from 16 to 8000. You do not need to specify the values for dynamic labels. The dynamic label range is automatically calculated by CTC based on the values specified in the static label range. For example, if you choose 100 to 1000 for static labels, the dynamic label range is set to 1001 to 8000.
- Step 8** Click **Apply** to specify the static label range.
- Step 9** Return to your originating procedure (NTP).
-

Understanding Bidirectional Forwarding Detection

Bidirectional Forwarding Detection (BFD) provides a low-overhead, short-duration method of detecting failures in the forwarding path between two adjacent routers, including interfaces, data links, and forwarding planes.

BFD is a fault detection protocol that is enabled at the interface level. The BFD asynchronous mode, which depends on sending of BFD control packets between two systems to activate and maintain BFD neighbor sessions between routers, is supported. Therefore, to create a BFD session, BFD must be configured on both systems (or BFD peers). When BFD is enabled on the interfaces, a BFD session is created, BFD timers are negotiated, and the BFD peers begin to send BFD control packets to each other at the negotiated interval.

BFD provides continuity check for MPLS–TP LSPs to detect forwarding failures between two adjacent routers. When BFD is enabled on the MPLS–TP tunnel interface, MPLS–TP client creates separate BFD sessions for working and protect LSPs. A single set of BFD timers is configured on the tunnel that applies to both the working and protect LSPs.

NTP-J37 Configure BFD Templates

Purpose	This procedure creates and configures BFD templates.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

Perform any of the following procedures as needed:

- [DLP-J97 Create and Configure BFD Templates Using Cisco IOS Commands](#), on page 11
- [DLP-J98 Create and Configure BFD Templates Using CTC](#), on page 13

Stop. You have completed this procedure.

DLP-J97 Create and Configure BFD Templates Using Cisco IOS Commands

Purpose	This procedure creates and configures a BFD template using Cisco IOS commands.
Tools/Equipment	None

Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	bfd-template single-hop <i>template-name</i> Example: Router(config)# bfd-template single-hop bfdtemplate1	Creates a BFD template and enters BFD configuration mode. The bfd-template command allows you to create a BFD template and enters BFD configuration mode. The template can be used to specify a set of BFD interval values. You can then invoke the BFD template when you set up the MPLS-TP tunnel.
Step 4	interval microseconds {both <i>microseconds</i> min-tx <i>microseconds</i> min-rx <i>microseconds</i>} [multiplier <i>multiplier-value</i>] Example: Router(config-bfd)# interval microseconds both 3300 multiplier 3	Configures the transmit and receive intervals in microseconds between BFD packets, and specifies the number of consecutive BFD control packets that must be missed from a BFD peer before BFD declares that a peer is unavailable.
Step 5	interval {both <i>milliseconds</i> min-tx <i>milliseconds</i> min-rx <i>milliseconds</i>} [multiplier <i>multiplier-value</i>] Example: Router(config-bfd)# interval both 120 multiplier 3	Configures the transmit and receive intervals in milliseconds between BFD packets, and specifies the number of consecutive BFD control packets that must be missed from a BFD peer before BFD declares that a peer is unavailable.
Step 6	exit Example: Router(config-bfd)# exit	Exits BFD configuration mode and returns the router to global configuration mode.

	Command or Action	Purpose
Step 7	Return to your originating procedure (NTP). Example: —	

Example: Create and Configure BFD Templates

The following example shows how to create and configure a BFD template using Cisco IOS commands:

```
Router> enable
Router# configure terminal
Router(config)# bfd-template single-hop bfdtemplate1
Router(config-bfd)# interval microseconds both 3300 multiplier 3
Router(config-bfd)# exit
```

DLP-J98 Create and Configure BFD Templates Using CTC

Purpose	This procedure creates and configures a BFD template using CTC. You need to enable BFD on both the source and destination nodes of the MPLS–TP tunnel.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

-
- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node on the network where you want to create and configure a BFD template.
- Step 2** From the View menu, choose **Go to Home View**.
- Step 3** Right-click the fabric or line card and choose **Open Packet Transport System View**. The Packet Transport System View dialog box appears.
- Step 4** Click the **Provisioning** tab.
- Step 5** From the left pane, click **MPLS TP**.
- Step 6** Click the **BFD Template** tab.
- Step 7** Click **Create**. The **Create BFD Template** dialog box appears.
- Step 8** Enter the name of the BFD template in the Name field.
The **Single Hop** check box is checked and cannot be changed.
- Step 9** Specify the time unit in milliseconds or microseconds.
- Step 10** To specify the same interval for transmit and receive between BFD packets:
- Check the **Use Single Value** check box.
 - Enter the interval between BFD packets in the Interval Value field. The range is from 4 to 999 milliseconds.
- Step 11** To specify different intervals for transmit and receive between BFD packets:
- Enter the transmit interval between BFD packets in the Min_Tx Interval field. The range is from 4 to 999 milliseconds.
 - Enter the receive interval between BFD packets in the Min_Rx Interval field. The range is from 4 to 999 milliseconds.
- Step 12** Enter the number of consecutive BFD control packets that must be missed before BFD declares that a peer is unavailable in the Multiplier field.
- Step 13** Click **OK** to create and configure a BFD template.
- Step 14** Return to your originating procedure (NTP).
-

Understanding Multiprotocol Label Switching Transport Profile Link Numbers

The MPLS–TP link numbers are configured only on the physical interfaces. Only one MPLS–TP link number can be configured for each interface. The user-assigned link numbers must be unique within the router. The **show mpls tp link-number** command shows all the configured links on the router.

The MPLS–TP link numbers are not assigned to bundled interfaces and virtual interfaces.

The MPLS–TP link numbers can be configured either using the next hop IP address or the MAC address. The valid range of MPLS–TP link number is from 1 to 10000.

When you configure a MPLS–TP link using an IP address for the next hop, you use the following commands, where 209.165.200.226 is the IP address of the next hop router:

```
interface TenGigabitEthernet4/1
```

```
ip address 209.165.200.225 255.255.255.0
mpls tp link 1 ipv4 209.165.200.226
```

MPLS-TP over Ethernet Without IP Addressing

Transport networks usually do not use IP addresses. You can configure MPLS–TP with links that do not require IP addresses. Instead, Ethernet MAC addresses are used to establish MPLS adjacency between the nodes on Ethernet links. MPLS–TP uses IP only to determine the MAC address of the next hop device through Address Resolution Protocol (ARP).

When you configure a MPLS–TP link without an IP address, you use the following commands:

```
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# medium p2p
Router(config-if)# mpls tp link 1
```

You can use these commands whether the interface has an IP address or not. However, the commands are primarily used when the router and its neighbor router do not have IP addresses.

The **medium p2p** command changes an interface that allows multiple connections to a point-to-point interface. This command allows the router to send and receive all the MPLS-TP packets using a common multicast MAC address knowing that it is communicating with only one other device.

An interface that is natively point-to-point, such as serial, does not require the **medium p2p** command.

Alternatively, you can configure the unicast MAC address of the next-hop device as follows:

```
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# medium p2p
Router(config-if)# mpls tp link 1 tx-mac 0000.0c00.1234
```

You can also configure to transmit and receive on some other multicast address as follows:

```
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# medium p2p
Router(config-if)# mpls tp link 1 tx-mac 0100.0c99.8877 rx-mac 0100.0c99.8877
```



Note

When a MPLS–TP link is configured without an IP address on an Ethernet interface, Cisco uses an IEEE Bridge Group MAC address (0180.c200.0000) for communication by default.

NTP-J38 Configure an MPLS–TP Link

Purpose	This procedure configures an MPLS-TP link number on a physical interface.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

Perform any of the following procedures as needed:

- [DLP-J99 Configure an MPLS–TP Link Using Cisco IOS Commands](#), on page 16
- [DLP-J226 Configure an MPLS–TP Link Without IP Addresses Using Cisco IOS Commands](#), on page 17
- [DLP-J100 Configure an MPLS–TP Link Number Using CTC](#), on page 19

Stop. You have completed this procedure.

DLP-J99 Configure an MPLS–TP Link Using Cisco IOS Commands

Purpose	This procedure configures an MPLS-TP link number on a physical interface using Cisco IOS commands.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface <i>type number</i> Example: Router(config)# interface TenGigabitEthernet4/1	Specifies the interface to configure and enters interface configuration mode.

	Command or Action	Purpose
Step 4	ip address <i>ip-address mask-value</i> Example: Router(config-if)# ip address 209.165.200.225 255.255.255.0	Assigns an IP network address and network mask to the interface.
Step 5	ip rsvp bandwidth <i>value</i> Example: Router(config-if)# ip rsvp bandwidth 100	<p>Enables Resource Reservation Protocol (RSVP) for IP on this interface.</p> <p>If you configure non-zero bandwidth for the MPLS–TP tunnel or at a midpoint LSP, ensure that the interface to which the output link is attached has enough available bandwidth. For example, if three tunnel LSPs run over link 1 and each LSP was assigned 1000 with the tp bandwidth command, the interface associated with link 1 needs bandwidth of 3000 with the ip rsvp bandwidth command.</p>
Step 6	mpls tp link <i>link-num</i> { ipv4 <i>nexthop-ip-address</i> tx-mac <i>mac-address</i> } Example: Router(config-if)# mpls tp link 1 ipv4 209.165.200.226	<p>Configures the MPLS–TP link either with the IPv4 address of the next hop router or using a per-interface transmit multicast MAC address.</p> <p>The <i>link-num</i> is a number assigned to the link. It must be unique to the device. Only one link number can be assigned per interface. The valid range is from 1 to 10000.</p> <p>Note</p>
Step 7	exit Example: Router(config-if)# exit	Exits interface configuration mode and returns to global configuration mode.
Step 8	Return to your originating procedure (NTP). Example: —	

DLP-J226 Configure an MPLS–TP Link Without IP Addresses Using Cisco IOS Commands

Purpose	This procedure configures an MPLS-TP link without IP addresses using Cisco IOS commands.
Tools/Equipment	None

Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface <i>type number</i> Example: Router(config)# interface TenGigabitEthernet4/1	Specifies the interface to configure and enters interface configuration mode.
Step 4	medium p2p Example: Router(config-if)# medium p2p	Changes an interface that allows multiple connections to a point-to-point interface. This command allows the router to send and receive all the MPLS–TP packets using a common multicast MAC address knowing that it is communicating with only one other device.
Step 5	mpls tp link <i>link-num</i> { ipv4 <i>ip-address</i> tx-mac <i>mac-address</i> rx-mac <i>mac-address</i> } Example: Router(config-if)# mpls tp link 1 tx-mac 0000.0c00.1234	Configures an MPLS–TP link without the IP address. The tx-mac keyword is available on Ethernet interfaces, but the interface must be point-to-point to configure the value of tx-mac as a multicast MAC address. The rx-mac keyword is available only when the tx-mac keyword is used and only when the interface is point-to-point.
Step 6	exit Example: Router(config-if)# exit	Exits interface configuration mode and returns to global configuration mode.
Step 7	Return to your originating procedure (NTP). Example: —	

Example: Configure MPLS–TP Link Numbers Without IP Addresses

The following example shows how to create an MPLS–TP link without an IP address using Cisco IOS commands:

```
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# medium p2p
Router(config-if)# mpls tp link 1
```

The following example shows how to configure the unicast MAC address of the next-hop device using Cisco IOS commands:

```
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# medium p2p
Router(config-if)# mpls tp link 1 tx-mac 0000.0c00.1234
```

The following example shows how to configure the transmit and receive parameters for a different multicast address using Cisco IOS commands:

```
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# medium p2p
Router(config-if)# mpls tp link 1 tx-mac 0100.0c99.8877 rx-mac 0100.0c99.8877
```

DLP-J100 Configure an MPLS–TP Link Number Using CTC

Purpose	This procedure configures an MPLS–TP link number on a physical interface, using CTC.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

-
- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node on the network where you want to configure an MPLS-TP link number.
- Step 2** From the View menu, choose **Go to Home View**.
- Step 3** Right-click the fabric or line card and choose **Open Packet Transport System View**. The Packet Transport System View dialog box appears.
- Step 4** Click the **Provisioning** tab.
- Step 5** From the left pane, click **MPLS TP**.
- Step 6** Click the **Link Config** tab.
- Step 7** Click **Create**. The **Create Link** dialog box appears.
- Step 8** From the Slot drop-down list, choose a slot to configure the MPLS–TP link.
- Step 9** From the Port drop-list, choose a port.
- Step 10** Enter a link number in the Link Number field.
- Step 11** To configure the link with the IP address:
- Check the **Arp** check box.
 - Enter the next hop IP address in the Next Hop IP field.
- Step 12** To configure the MPLS-TP link number with the MAC address, complete one of the following options:
- Check the **P2P Link** check box.
In the Tx–Mac area, enter the unicast or multicast transmit MAC address in the Mac Address field.
In the Rx–Mac area, enter the unicast or multicast receive MAC address in the Mac Address field.
 - Check the **P2P Link** check box.
In the Rx–Mac area, enter the unicast or multicast receive MAC address in the Mac Address field.
 - Check the **P2P Link** check box.
In the Tx–Mac area, enter the unicast or multicast transmit MAC address in the Mac Address field.
- Step 13** Click **OK** to create the MPLS–TP link.
- Step 14** Return to your originating procedure (NTP).
-

NTP-J39 Create a Static OAM Class

Purpose	This procedure creates a static OAM class.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

Perform any of the following procedures as needed:

- [DLP-J101 Create a Static OAM Class Using Cisco IOS Commands](#), on page 21
- [DLP-J102 Create a Static OAM Class Using CTC](#), on page 22

Stop. You have completed this procedure.

DLP-J101 Create a Static OAM Class Using Cisco IOS Commands

Purpose	This procedure creates a static OAM class using Cisco IOS commands. You must create a static OAM class for static pseudowire OAM that specifies the OAM timeout refresh intervals.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	pseudowire-static-oam class <i>class-name</i> Example: Router(config)# pseudowire-static-oam class oam-class1	Specifies the name of the static OAM class.

	Command or Action	Purpose
Step 4	timeout refresh send <i>seconds</i> Example: Router(config-st-pw-oam-class)# timeout refresh send 20	Specifies how often the static OAM packets must be sent out. The valid range is from 1 to 4095 seconds. The default value is 30 seconds.
Step 5	exit Example: Router(config-st-pw-oam-class)# exit	Returns the router to global configuration mode.
Step 6	Return to your originating procedure (NTP). Example: —	

Example: Create a Static OAM Class

The following example shows how to create a static OAM class using Cisco IOS commands:

```
Router> enable
Router# configure terminal
Router(config)# pseudowire-static-oam class oam-class1
Router(config-st-pw-oam-class)# timeout refresh send 20
Router(config-st-pw-oam-class)# exit
```

DLP-J102 Create a Static OAM Class Using CTC

Purpose	This procedure creates a static OAM class using CTC. You must create a static OAM class for static pseudowire OAM that specifies the OAM timeout refresh intervals.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

-
- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node on the network where you want to create a static OAM class.
- Step 2** From the View menu, choose **Go to Home View**.
- Step 3** Right-click the fabric or line card and choose **Open Packet Transport System View**. The Packet Transport System View dialog box appears.
- Step 4** Click the **Provisioning** tab.
- Step 5** From the left pane, click **MPLS TP**.
- Step 6** Click the **Static OAM Class** tab.
- Step 7** Click **Create**. The **Create Static OAM Class** dialog box appears.
- Step 8** Enter the name of static OAM class in the Name field.
- Step 9** Enter the number of seconds in the Refresh Send field to specify how often the static OAM packets must be sent out.
- Step 10** Click **OK** to create a static OAM class.
- Step 11** Return to your originating procedure (NTP).
-

NTP-J67 Create a Provisionable Patchcord Using CTC

Purpose	This procedure creates a Provisionable Patchcord (PPC), also called a virtual link, using CTC.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher



Note

PPCs can be created only between ports of the same size (1GE-1GE or 10GE-10GE) for Client/Trunk to Client/Trunk (layer 2) PPCs.

Procedure

-
- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node on the network where you want to create a provisionable patchcord.
- Step 2** In the node view (single-shelf mode), click the **Provisioning > Comm Channels > PPC** tabs. Alternatively, in network view, click the **Provisioning > Provisionable Patchcord (PPC)** tabs.
PPCs can be created in either node or network view. However, if you create the PPC in node view, the PPC origination ports will be restricted to the cards installed on the node. Therefore, choose node view only if you know that the PPC origination port resides on a card installed in the node.
- Step 3** Click **Create**. The PPC Attributes screen of the PPC Creation wizard appears.
- Step 4** Choose the Client/Trunk to Client/Trunk (L2) link type.
This link type creates a PPC between two NNI client or trunk ports.
- Step 5** Click **Next**.
- Step 6** In the PPC Origination screen of the wizard, specify the following:
- From the Node drop-down list, choose the node where the PPC will originate.
 - From the Slot drop-down list, choose the slot where the PPC will originate.
 - From the Port drop-down list, choose the port where the PPC will originate.
- The ID field displays the ID automatically assigned to the PPC.
- Step 7** Click **Next**.
- Step 8** In the PPC Termination screen of the wizard, specify the following:
- From the Node drop-down list, choose the node where the PPC will terminate.
 - From the Slot drop-down list, choose the slot where the PPC will terminate.
 - From the Port drop-down list, choose the port where the PPC will terminate.
- The ID field displays the ID automatically assigned to the PPC.
- Step 9** Click **Next**.
- Step 10** In the PPCs ID page, review the PPC information. If the PPC information is correct, click **Finish**. If you need to make corrections, click **Back** and return to the wizard page where you want to change the information.
Stop. You have completed this procedure.
-

Understanding Multiprotocol Label Switching Transport Profile Tunnels

An MPLS–TP tunnel consists of a pair of unidirectional tunnels providing a bidirectional LSP. Each unidirectional tunnel can be protected with a protect LSP that activates automatically upon failure. MPLS–TP tunnels are provisioned manually at their endpoints across the network.

Tunnel Identifiers

MPLS–TP tunnel identifiers uniquely identify an MPLS–TP tunnel within the network. The tunnel identifier consists of a global identifier, a node identifier, and a tunnel number for each endpoint of the MPLS–TP LSP.

The node identifier is an IP address for an interface on the endpoint router. The tunnel number is the tunnel–tp number assigned when the tunnel–tp virtual interface is created on the endpoint router.

Tunnel Source

The tunnel source is the MPLS–TP node identifier of the endpoint router that is configured. This tunnel source can be specified to override the router-id configured in the global MPLS–TP configuration.

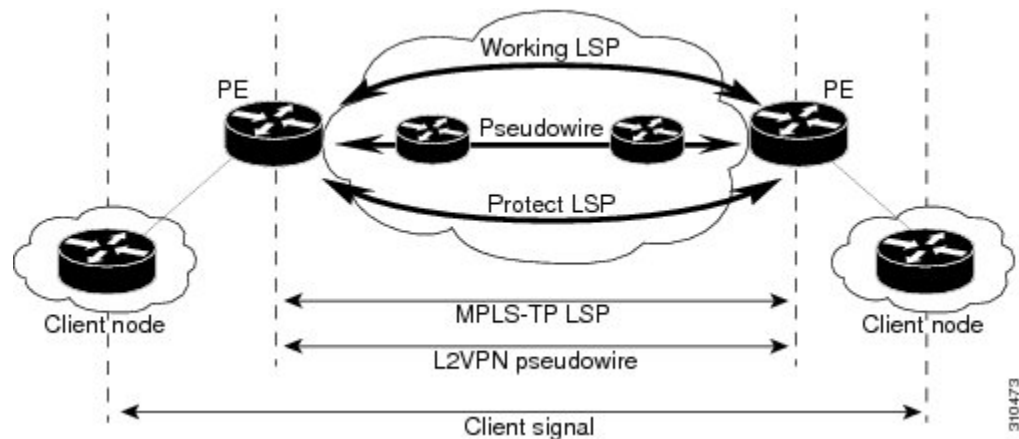
Tunnel Destination

The tunnel destination is the MPLS–TP node identifier of the remote endpoint router. The destination tunnel number is the virtual interface number assigned to the remote tunnel interface when it is provisioned. This destination tunnel number can be optionally configured. If the destination tunnel number is not configured, it defaults to the local tunnel number.

Understanding MPLS–TP LSPs

MPLS–TP LSPs are bidirectional and corouted and are comprised of two unidirectional LSPs that are supported by the MPLS forwarding infrastructure. The static and bidirectional MPLS–TP LSPs can be configured either through CTC or Cisco IOS commands. The LSPs are configured and managed without a control plane. The MPLS–TP LSPs have a fixed path. The statically defined LSP does not require an Interior Gateway Protocol (IGP).

Figure 1: MPLS–TP LSP



MPLS–TP LSPs are not supported over a Link Aggregation Group (LAG). The static pseudowire is the only traffic carried over MPLS–TP LSPs in this release.

LSP Path Protection

MPLS–TP LSPs support 1:1 revertive path protection. The working and protect LSPs can be configured as part of configuring MPLS–TP tunnels. The working LSP is the primary LSP used to route the traffic. The

protect LSP is a backup for the working LSP. When the working LSP fails, the traffic is switched to the protect LSP until the working LSP is restored, at which time the forwarding reverts to the working LSP.

LSP Number

The LSP number is assigned when the MPLS–TP LSP is configured. The default value of the LSP number is 0 for the working LSP and 1 for the protect LSP. You can edit LSP numbers.

LSP Ping and Trace

The LSP **ping** and **trace** commands are supported on MPLS–TP bidirectional LSPs and pseudowires.

LSP Lockout

The working LSP or protect LSP can be locked out. Only one LSP must be locked out at a time. When the LSP is currently locked out, the **lockout** command is not available in the other LSP configuration submode. The lockout of a working or protect LSP is cleared using the **no lockout** command.

When the LSP is locked out, the user traffic is not forwarded over the locked out LSP. However, the OAM traffic and BFD traffic is forwarded over the locked out LSP.

Because an MPLS-TP tunnel is statically configured, the possibility exists that the working LSP could be locked out at one MPLS-TP tunnel endpoint and the protect LSP could be locked out at the other MPLS-TP tunnel endpoint. If this occurs, the MPLS-TP tunnel is deadlocked and non-functional until the lockout configuration is changed at one of the endpoints.

LSP Shutdown

When the LSP is shut down, the LDI messages, user traffic, and OAM traffic are not sent.

Tunnel Midpoints and Endpoints

Tunnel LSPs, whether endpoint or midpoint, use the same identifying information. However, it is entered differently.

- At the midpoint, all the information for the LSP is specified with the **mpls tp lsp** command, which enters the submode for configuring forward and reverse information for forwarding.
- At the midpoint, determining which end is source and which end is destination is arbitrary. That is, if you are configuring a tunnel between your router and a coworker's router, your router is the source. However, your coworker considers his or her router to be the source. At the midpoint, either router could be considered the source. At the midpoint, the forward direction is from source to destination, and the reverse direction is from destination to source.
- At the endpoint, the source information comes either from the global router ID or from locally configured information using the **tp source** command after you enter the command **interface tunnel-tp number** command, where *number* is the source tunnel number.
- At the endpoint, the remote information (destination) is configured using the **tp destination** command after you enter the command **interface tunnel-tp number**. The **tp destination** command includes the destination node ID, optionally the global ID, and optionally the destination tunnel number. If you do not specify the destination tunnel number, the source tunnel number is used.
- At the endpoint, the LSP number is configured in working-lsp or protect-lsp submode. The default value is 0 for the working LSP and 1 for the protect LSP.

NTP-J41 Configure an MPLS-TP Tunnel

Purpose	This procedure configures an MPLS–TP tunnel.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

Perform any of the following procedures as needed:

- [DLP-J105 Configure Tunnel Midpoints Using Cisco IOS Commands](#), on page 27
- [DLP-J106 Configure Tunnel Endpoints Using Cisco IOS Commands](#), on page 30
- [DLP-J107 Create an MPLS–TP Tunnel Using CTC](#), on page 34
- [DLP-J208 Edit MPLS–TP Tunnel Attributes Using CTC](#), on page 37

Stop. You have completed this procedure.

DLP-J105 Configure Tunnel Midpoints Using Cisco IOS Commands

Purpose	This procedure configures the midpoints for the MPLS–TP tunnel.
Tools/Equipment	None
Prerequisite Procedures	<ul style="list-style-type: none"> • DLP-J95 Configure Global Settings for Multiprotocol Label Switching Transport Profile Using Cisco IOS Commands, on page 5 • DLP-J99 Configure an MPLS–TP Link Using Cisco IOS Commands, on page 16 • DLP-J103 Specify Static Label Range Using Cisco IOS Commands, on page 9
Required/As Needed	As needed
Onsite/Remote	Onsite or remote

Security Level	Provisioning or higher
----------------	------------------------

Procedure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	mpls tp lsp source <i>ip-address</i> [global-id <i>number</i>] tunnel-tp <i>tunnelnumber</i> lsp <i>{lspnumber working protect}</i> destination <i>ip-address</i> [global-id <i>number</i>] tunnel-tp <i>tunnelnumber</i> Example: Router(config)# mpls tp lsp source 209.165.200.225 tunnel-tp 15 lsp 0 destination 209.165.200.226 tunnel-tp 20	Configures the source and destination parameters of the MPLS–TP tunnel. The source and destination parameters may be specified in a different order at different midpoints of an MPLS–TP tunnel. The default value of source and destination global-id is 0. The LSP number defined for one of the endpoints can uniquely identify an MPLS–TP LSP.
Step 4	forward-lsp Example: Router(config-mpls-tp-lsp)# forward-lsp	Enters the configuration mode of the forward LSP.
Step 5	bandwidth <i>number</i> Example: Router(config-mpls-tp-lsp-forw)# bandwidth 100	Configures the bandwidth for the forward LSP. The forward LSP refers to the unidirectional LSP going from the source to the destination.
Step 6	in-label <i>locallabelnumber</i> out-label <i>outlabelnumber</i> out-link <i>outlinknumber</i> Example: Router(config-mpls-tp-lsp-forw)# in-label 200 out-label 300 out-link 2	Assigns an incoming label (local label), outgoing label, and outgoing link to the forward LSP. The values for the incoming label must be within the static label range that is defined. The outgoing label must be a valid and unreserved MPLS label.
Step 7	exit Example: Router(config-mpls-tp-lsp-forw)# exit	Exits the configuration mode of the forward LSP.

	Command or Action	Purpose
Step 8	reverse-lsp Example: Router(config-mpls-tp-lsp)# reverse-lsp	Enters the configuration mode of the reverse LSP.
Step 9	bandwidth <i>number</i> Example: Router(config-mpls-tp-lsp-rev)# bandwidth 100	Configures the bandwidth for the reverse LSP. The reverse LSP refers to the unidirectional LSP going from the destination to the source.
Step 10	in-label <i>locallabelnumber</i> out-label <i>outlabelnumber</i> out-link <i>out-tp-link</i> Example: Router(config-mpls-tp-lsp-rev)# in-label 201 out-label 301 out-link 4	Assigns an incoming label (local label), outgoing label, and outgoing link to the reverse LSP. The values for the incoming label must be within the static label range that is defined. The outgoing label must be a valid and unreserved MPLS label.
Step 11	exit Example: Router(config-mpls-tp-lsp-rev)# exit	Exits the configuration mode of the reverse LSP.
Step 12	exit Example: Router(config-mpls-tp-lsp)# exit	Exits the LSP configuration mode.
Step 13	Return to your originating procedure (NTP). Example: —	

Example: Configuring Tunnel Midpoints

The following example shows how to configure the midpoints of the MPLS–TP tunnel using Cisco IOS commands:

```
Router> enable
Router# configure terminal
Router(config)# mpls label range 1000 8000 static 16 999
Router(config)# bfd bfd-tp-template

Router(config)# mpls tp
Router(config-mpls-tp)# router-id 2.2.2.2
Router(config-mpls-tp)# exit

Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# mpls tp link 1 ipv4 11.10.10.15
Router(config-if)# exit
Router(config)# interface TenGigabitEthernet4/2
Router(config-if)# mpls tp link 1 ipv4 11.10.10.16
```

```
Router(config-if) # exit
```

```
Router(config) # mpls tp lsp source 1.1.1.1 tunnel-tp 10 lsp working destination 3.3.3.3
tunnel-tp 30
```

```
Router(config-mpls-tp-lsp) # forward-lsp
```

```
Router(config-mpls-tp-lsp-forw) # bandwidth 1000
```

```
Router(config-mpls-tp-lsp-forw) # in-label 200 out-label 300 out-link 2
```

```
Router(config-mpls-tp-lsp-forw) # exit
```

```
Router(config-mpls-tp-lsp) # reverse-lsp
```

```
Router(config-mpls-tp-lsp-rev) # in-label 250 out-label 100 out-link 1
```

```
Router(config-mpls-tp-lsp-rev) # exit
```

```
Router(config-mpls-tp-lsp) # exit
```

```
Router(config-mpls-tp) # exit
```

```
Router(config) # mpls tp lsp source 1.1.1.1 tunnel-tp 10 lsp protect destination 3.3.3.3
tunnel-tp 30
```

```
Router(config-mpls-tp-lsp) # forward-lsp
```

```
Router(config-mpls-tp-lsp-forw) # bandwidth 1000
```

```
Router(config-mpls-tp-lsp-forw) # in-label 201 out-label 301 out-link 4
```

```
Router(config-mpls-tp-lsp-forw) # exit
```

```
Router(config-mpls-tp-lsp) # reverse-lsp
```

```
Router(config-mpls-tp-lsp-rev) # in-label 251 out-label 101 out-link 3
```

```
Router(config-mpls-tp-lsp-rev) # exit
```

```
Router(config-mpls-tp-lsp) # exit
```

```
Router(config-mpls-tp) # exit
```

DLP—J106 Configure Tunnel Endpoints Using Cisco IOS Commands

Purpose	This procedure configures the endpoints for MPLS—TP tunnels. The MPLS—TP tunnel is provisioned as a virtual interface.
Tools/Equipment	None
Prerequisite Procedures	<ul style="list-style-type: none"> • DLP-J95 Configure Global Settings for Multiprotocol Label Switching Transport Profile Using Cisco IOS Commands, on page 5 • DLP-J97 Create and Configure BFD Templates Using Cisco IOS Commands, on page 11 • DLP-J99 Configure an MPLS—TP Link Using Cisco IOS Commands, on page 16 • DLP-J103 Specify Static Label Range Using Cisco IOS Commands, on page 9
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface tunnel-tp <i>tunnelnumber</i> Example: Router(config)# interface tp-tunnel 30	Enters the interface configuration mode and configures the parameters of the tunnel.
Step 4	description <i>tunnel-description</i> Example: Router(config-if)# description firsttunnel	Provides a description for the tunnel. The description is used only when displaying information about the MPLS–TP tunnel.
Step 5	bandwidth tx <i>number</i> [rx <i>number</i>] Example: Router(config-if)# bandwidth tx 1000	Configures the bandwidth for the MPLS–TP tunnel. The transmit and receive bandwidth provisioned for the working LSP are the same as that of the protect LSP.
Step 6	tp source <i>ip-address</i> [global-id <i>number</i>] Example: Router(config-if)# tp source 209.165.200.225	Configures the MPLS–TP tunnel source IP address. The source IP address is the ID of the endpoint router that is configured. The global-id is the default global ID used for all midpoints and endpoints. The default value of the global-id is 0. The valid range is from 0 to 2147483647.
Step 7	tp destination <i>ip-address</i> [tunnel-tp <i>number</i>] [global-id <i>number</i>] Example: Router(config-if)# tp destination 209.165.200.226	Configures the MPLS–TP tunnel destination IP address. The tunnel-tp is the tunnel–TP number of the MPLS–TP tunnel destination. If the tunnel–TP number is not specified, the number assigned to the local tunnel is used. The global-id is the default global ID used for the endpoint. The default value of the global-id is 0. The valid range is from 0 to 2147483647.
Step 8	bfd <i>bfdtemplatename</i> Example: Router(config-if)# bfd bfd1	Configures a BFD template for the MPLS–TP tunnel. The BFD configuration template used for the working LSP is the same as that of the protect LSP.

	Command or Action	Purpose
Step 9	working-lsp Example: Router(config-if)# working-lsp	Enters the configuration mode of the working LSP.
Step 10	out-label <i>outlabelnumber</i> out-link <i>out-tp-link</i> Example: Router(config-if-working)# out-label 250 out-link 1	Assigns an outgoing label and outgoing link to the working LSP. The outgoing label must be a valid and unreserved MPLS label. The working LSP is the primary LSP that is used to route traffic.
Step 11	in-label <i>locallabelnumber</i> Example: Router(config-if-working)# in-label 10	Assigns an incoming label (local label) to the working LSP. The values for the incoming label must be within the static label range (16 to 8000).
Step 12	lsp-num <i>number</i> Example: Router(config-if-working)# lsp-num 0	Configures the LSP number for the working LSP. The default LSP number for the working LSP is 0. The range is 0 and above. The local and remote LSP numbers must match.
Step 13	lockout Example: Router(config-if-working)# lockout	Locks out the working LSP.
Step 14	protect-lsp Example: Router(config-if)# protect-lsp	Enters the configuration mode of the protect LSP.
Step 15	out-label <i>outlabelnumber</i> out-link <i>out-tp-link</i> Example: Router(config-if-protect)# out-label 251 out-link 2	Assigns an outgoing label and outgoing link to the protect LSP. The outgoing label must be a valid and unreserved MPLS label. A protect LSP is a backup for a working LSP. If the working LSP fails, the traffic is switched to the protect LSP until the working LSP is restored, when forwarding reverts to the working LSP.
Step 16	in-label <i>locallabelnumber</i> Example: Router(config-if-protect)# in-label 20	Assigns an incoming label (local label) to the protect LSP. The values for the incoming label must be within the static label range that is defined.
Step 17	lsp-num <i>number</i> Example: Router(config-if-protect)# lsp-num 1	Configures the LSP number for the protect LSP. The default LSP number for the protect LSP is 1. The range is 1 and above. The local and remote LSP numbers must match.

	Command or Action	Purpose
Step 18	lockout Example: Router(config-if-protect)# lockout	Locks out the protect LSP.
Step 19	shutdown Example: Router(config-if)# shutdown	Performs an administrative shut down of the MPLS–TP tunnel.
Step 20	Return to your originating procedure (NTP).	

Example: Configuring Tunnel Endpoints

The following example shows how to configure one of the endpoints of the MPLS–TP tunnel using Cisco IOS commands:

```

Router> enable
Router# configure terminal
Router(config)# mpls label range 1000 8000 static 16 999
Router(config)# bfd bfd-tp-template

Router(config)# mpls tp
Router(config-mpls-tp)# router-id 1.1.1.1
Router(config-mpls-tp)# exit

Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# mpls tp link 1 ipv4 11.10.10.15
Router(config-if)# exit
Router(config)# interface TenGigabitEthernet4/2
Router(config-if)# mpls tp link 1 ipv4 11.10.10.16
Router(config-if)# exit

Router(config)# interface tunnel-tp 10
Router(config-if)# description MPLS-TP tunnel connecting ABC customer A PE routers
Router(config-if)# bandwidth tx 1000

Router(config-if)# no ip address
Router(config-if)# no keepalive
Router(config-if)# tp destination 3.3.3.3 tunnel-tp 30
Router(config-if)# bfd bfd-tp-template

Router(config-if)# working-lsp
Router(config-if-working)# out-label 200 out-link 1
Router(config-if-working)# in-label 100
Router(config-if-working)# lsp-number 0
Router(config-if-working)# exit

Router(config-if)# protect-lsp
Router(config-if-protect)# out-label 201 out-link 2
Router(config-if-protect)# in-label 101
Router(config-if-protect)# lsp-number 1
Router(config-if-protect)# exit
Router(config-if)# exit

```

The following example shows how to configure another endpoint of the MPLS—TP tunnel using Cisco IOS commands:

```
Router> enable
Router# configure terminal
Router(config)# mpls label range 1000 8000 static 16 999
Router(config)# bfd bfd-tp-template

Router(config)# mpls tp
Router(config-mpls-tp)# router-id 2.2.2.2
Router(config-mpls-tp)# exit

Router(config)# interface TenGigabitEthernet4/3
Router(config-if)# mpls tp link 1 ipv4 11.10.11.17
Router(config-if)# exit
Router(config)# interface TenGigabitEthernet4/4
Router(config-if)# mpls tp link 1 ipv4 11.10.11.18
Router(config-if)# exit

Router(config)# interface tunnel-tp 30
Router(config-if)# description MPLS-TP tunnel connecting ABC customer A PE routers
Router(config-if)# bandwidth tx 1500

Router(config-if)# no ip address
Router(config-if)# no keepalive
Router(config-if)# tp destination 1.1.1.1 tunnel-tp 10
Router(config-if)# bfd bfd-tp-template

Router(config-if)# working-lsp
Router(config-if-working)# out-label 250 out-link 1 in-label 300
Router(config-if-working)# lsp-number 2
Router(config-if-working)# exit

Router(config-if)# protect-lsp
Router(config-if-protect)# out-label 251 out-link 2 in-label 301
Router(config-if-protect)# lsp-number 3
Router(config-if-protect)# exit
Router(config-if)# exit
```

DLP-J107 Create an MPLS—TP Tunnel Using CTC

Purpose	This procedure creates an MPLS—TP tunnel using CTC.
Tools/Equipment	None

Prerequisite Procedures	<ul style="list-style-type: none"> • DLP-J96 Configure Global Settings for Multiprotocol Label Switching Transport Profile Using CTC, on page 7 • DLP-J98 Create and Configure BFD Templates Using CTC, on page 13 • DLP-J100 Configure an MPLS–TP Link Number Using CTC, on page 19 • DLP-J104 Specify Static Label Range Using CTC, on page 10 • NTP-J67 Create a Provisionable Patchcord Using CTC, on page 23
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

**Note**

You cannot create an MPLS–TE tunnel and an MPLS–TP tunnel on the same interface.

**Note**

The layer 2 services on CPT can be created on top of layer 2 PPCs or OCHTrails.

CPT supports Client/Trunk to Client/Trunk (layer 2) PPC for topology discovery and layer 2 service routing. If CPT is used in the GNE-ENE mode of configuration, then generic communications channels (GCC) can be used for topology discovery and layer 2 PPCs for layer 2 service routing. Both layer 2 PPC and GCC can be created between the same set of ports. However, this is not mandatory.

CPT also supports OCH Trunk to OCH Filter PPCs to connect CPT to MSTP nodes. If you want to route the traffic from a non co-located CPT node to a DWDM network, use OCH Trunk to OCH Filter PPCs to connect CPT and MSTP nodes. The OCHTrail can be created on top of this and the layer 2 services can be created on top of OCHTrails.

Procedure

-
- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node on the network where you want to create an MPLS—TP tunnel.
- Step 2** From the View menu, choose **Go to Network View**.
- Step 3** Click the **Layer2+** tab.
- Step 4** In the left pane, click **Circuits**.
- Step 5** Click the **MPLS TP Tunnels** tab.
- Step 6** Click **Create**. The Circuit Creation wizard appears.
- Step 7** In the Circuit Attributes screen of the wizard:
- Enter the name of the tunnel that you want to create, in the Name field.
 - Enter the description of the tunnel in the Description field.
The type of the tunnel is MPLS_TP and cannot be changed. The tunnel is always created as a bidirectional tunnel.
 - Check the **Protection** check box to create a protected tunnel.
 - From the Admin State drop-down list, choose **UP** or **DOWN**. The default value is UP.
 - Enter the bandwidth of the MPLS—TP tunnel in Kbps (default), Mbps, or Gbps and click **Next**.
- Step 8** In the Source screen of the wizard, specify the parameters for one endpoint:
- From the drop-down list, choose a .
 - From the Attach BFD drop-down list, choose a BFD template to attach to this endpoint.
Note It is recommended that the same BFD template be attached for the endpoints.
 - Enter the unique tunnel number for this endpoint in the Tunnel Number field.
 - Enter the LSP number for the working LSP in the Working LSP Number field. The default value is 0.
 - Enter the LSP number for the protect LSP in the Protect LSP Number field. The default value is 1. Click **Next**.
- Step 9** In the Destination screen of the wizard, specify the parameters for another endpoint. Repeat the previous step to do this.
- Step 10** In the TP Tunnel Circuit Routing Preferences screen of the wizard, specify the routing preferences for the tunnel:
- For constraint-based routing, check the **Using Required Nodes/Spans** check box. The **Route Automatically** check box is set by default and cannot be changed.
 - Specify the diversity constraints by choosing **Nodal Diversity Required**, **Nodal Diversity Desired**, or **Link Diversity Only**.
 - Nodal Diversity Required**—Ensures that the primary and alternate paths within path protection portions of the complete circuit path are nodally diverse.
 - Nodal Diversity Desired**—Specifies that node diversity is preferred, but if node diversity is not possible, CTC creates fiber-diverse paths for the path protection portion of the complete circuit path.
Node diversity is not applicable if the source and destination are directly connected with fiber diverse path.
 - Link Diversity Only**—Specifies that only fiber-diverse primary and alternate paths for path protection portions of the complete circuit path are needed. The paths might be node-diverse, but CTC does not check for node diversity.

c) Click **Next**.

Step 11 In the TP Tunnel Circuit Routing Constraints screen of the wizard, the route of the MPLS–TP tunnel is displayed.

- a) In the route, choose the nodes appropriately to include or exclude in the MPLS–TP tunnel.
- b) Click **Next**.

Step 12 In the TP Tunnel Circuit Label Preview screen of the wizard:

- a) Change the local label and outgoing label for working LSP and protect LSP as appropriate.
- b) Click **Apply**.
- c) Click **Finish** to create an MPLS–TP tunnel.

It is not recommended to delete the MPLS–TP tunnel in Partial state. For example, the tunnel is in Partial state due to missing intermediate LSP information. If you delete this Partial tunnel, you cannot delete the LSP information on the intermediate node and reuse the tunnel bandwidth.

When you change the PPC paths of a tunnel in Discovered state, you cannot delete the LSP information on the intermediate node. For example, consider a tunnel that spans three nodes A, B, and C. The PPC links from A to B and B to C are deleted and a direct PPC link is created from A to C. In this case, the LSP information on the intermediate node B cannot be deleted.

Step 13 Return to your originating procedure (NTP).

DLP-J208 Edit MPLS–TP Tunnel Attributes Using CTC

Purpose	This procedure edits MPLS–TP tunnel attributes using CTC.
Tools/Equipment	None
Prerequisite Procedures	DLP-J107 Create an MPLS–TP Tunnel Using CTC, on page 34
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

-
- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node on the network where you want to edit an MPLS–TP tunnel.
- Step 2** From the View menu, choose **Go to Network View**.
- Step 3** Click the **Layer2+** tab.
- Step 4** From the left pane, click **Circuits**.
- Step 5** Click the **MPLS TP Tunnels** tab.
- Step 6** Choose a tunnel to edit and click **Edit**. The Edit Circuit screen appears.
- Step 7** In the General tab, modify the name, description of the MPLS–TP tunnel as required.
- Step 8** In the LSPs tab, edit, add, or remove the LSPs:
- To edit an LSP:
 - Choose an LSP to edit.
 - From the Node drop-down list, choose a node.
 - Click **Edit LSP**.
 - Modify the values in the Local Label and Out Label fields as appropriate.
 - Click **Apply**.
 - To add an LSP:
 - Click **Add LSP**. The Add LSP Members wizard appears.
 - In the Circuit Attributes screen of the wizard, enter the LSP number in the LSP Number field and click **Next**.
 - In the Routing and Member Preferences screen of the wizard, check the **Using Required Nodes/Spans** check box for constraint–based routing. The **Route Automatically** check box is set by default and cannot be changed.
 - Specify the diversity constraints by choosing **Nodal Diversity Required**, **Nodal Diversity Desired**, or **Link Diversity Only** and click **Next**.
 - In the Constraints for Automatic Routing screen of the wizard, choose the nodes appropriately to include or exclude and click **Next**.
 - In the Circuit Label Preview screen of the wizard, enter the local label and outgoing label for the working LSP and protect LSP as appropriate.
 - Click **Apply**.
 - Click **Finish** to add an LSP.
 - To delete an LSP:
 - Choose an LSP to delete.
 - Click **Delete LSP**. The Delete LSP dialog box appears.
 - Click **OK** in the Delete LSP dialog box.

- Step 9** In the BFD tab, choose an appropriate BFD template from the BFD Template field and click **Apply**.
- Step 10** In the Lockout tab, choose a node from the Endpoint field.
- Step 11** From the Switch State drop–down list, choose **LOCKOUT** or **CLEAR**
The Lockout option specifies that the locked out LSP do not carry traffic. Only one LSP can be locked out at a time. The Lockout option can be applied only when there are two LSPs. The Clear option clears the lockout condition.
- Step 12** In the State tab, choose UP or DOWN from the Target Circuit Admin State drop-down list and click **Apply**.
- Step 13** Return to your originating procedure (NTP).

DLP-J368 Query an MPLS-TP Circuit Using CTC

Purpose	This procedure allows you to discover the MPLS-TP services using CTC.
Tools/Equipment	None
Prerequisite Procedures	DLP-J107 Create an MPLS–TP Tunnel Using CTC, on page 34
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher



Note

When the discovered nodes are disconnected, the circuits move to Partial state. When the disconnected nodes become online in CTC, re-query the circuits to move the circuits to Discovered state.

Procedure

- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node where you want to query for an MPLS-TP circuit.
- Step 2** From the View menu, choose **Go to Home View**.
- Step 3** Click the **Layer2+** tab.
- Step 4** From the left pane, click **Carrier Ethernet**.
- Step 5** Click **Query**. The L2 Services Query dialog box appears.
- Step 6** From the Existing/New Query drop-down list, choose an existing query or a new query.
- Step 7** In the Equipment Termination area, choose **Port** or **Query Group**.
- Step 8** If you choose Port, specify the following:
- Click **Port**. The Port/Channel Group Selection dialog box appears.
 - Choose the node, card, and port/channel group and click **OK**.

c) Close the Port/Channel Group Selection dialog box.

Step 9 If you choose Query Group, specify the following:

- a) Click **Query Group**. The User Query Group Chooser dialog box appears.
- b) From the Group drop-down list, choose a query group.
- c) Add the nodes that can be grouped for the query from the Available Nodes area to the Grouped Nodes area.
- d) Click **Save** to save the query group and close the User Query Group Chooser dialog box.

Step 10 In the L2 Services Query dialog box, click **Save**. The Store a Set of Query Criteria dialog box appears.

Step 11 Enter the query name in the Name field and click **Save** to save the query.

Step 12 In the L2 Services Query dialog box, click **Run Query**.
The results of the query appear in the Service Query Results area.

Step 13 Click **Discover All** to discover all the MPLS-TP services, click **Discover Selected** to discover the selected MPLS-TP services or click **Delete** to delete the midpoint nodes of the MPLS-TP services.
Close the L2 Services Query dialog box. The discovered MPLS-TP services appear in the Carrier Ethernet Circuits area.

Step 14 Return to your originating procedure (NTP).

NTP-J107 Perform ping and traceroute Operations on Services Using CTC

Purpose	This procedure performs ping and traceroute operations on services using CTC.
Tools/Equipment	None
Prerequisite Procedures	None
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Procedure

- Step 1** Complete the [NTP-J22 Log into CTC](#) procedure at a node on the network where you want to perform ping and traceroute operations.
- Step 2** Right-click the fabric or line card and choose **Open Packet Transport System View**. The Packet Transport System View dialog box appears.
- Step 3** Click the **Maintenance** tab.
- Step 4** In the left pane, click **OAM**.
- Step 5** From the Service drop-down list, choose **TP Tunnel**, **TE Tunnel**, **Pseudowire**.
- Step 6** From the Command drop-down list, choose **Ping** or **Traceroute**.
- Step 7** If you choose TP Tunnel as the service, complete the following:
 - a) Enter the tunnel ID in the Tunnel No field.
 - b) From the LSP drop-down list, choose **Active**, **Working**, or **Protect**.
- Step 8** If you choose TE Tunnel as the service, complete the following:
 - a) Enter the tunnel ID in the Tunnel No field.
- Step 9** If you choose Pseudowire as the service, complete the following:
 - a) Enter the IP address in the IP field.
 - b) Enter the virtual circuit ID in the VC ID field.
- Step 10** Click **Execute** to run the OAM operation for the specified service.
Stop. You have completed this procedure.

MPLS–TP Show Commands

This section describes several show commands that can be used with MPLS–TP tunnels.

Display MPLS–TP Tunnel Summary

This command displays a count of the configured tunnels, midpoint LSPs, and the global configuration parameters.

```
Router# show mpls tp summary
```

```
Endpoints: 4      Midpoints: 3
ICC:
Router Id: 3.3.3.3
Global Id: 0
Path protection mode: 1:1 revertive
Fault OAM timer: 0
```

Display Link Number Information

This command provides information about the MPLS–TP link numbers. It displays the mappings between link numbers and physical interfaces and next hop addresses when appropriate.

```
Router# show mpls tp link-numbers
```

Link Number	Interface	Next Hop
1	Ethernet0/0	1.2.3.4
2	Ethernet1/0	2.3.4.5
3	Ethernet0/3	fcce.clcc.cc01

Display MPLS-TP Tunnel Information

This command displays the tunnel information of MPLS-TP tunnels.

```
Router# show mpls tp tunnel-tp
```

Tunnel Number	Peer node-id::tun	Working/Protect	Local Label	Outgoing Label	Outgoing Interface	Oper State
5	4.4.4.4::5	w	100	110	Et0/0	up
6	6.6.6.6::7	w	200	210	Et0/0	up

Display MPLS-TP Tunnel Information with LSPs

This command displays the tunnel information of MPLS-TP tunnels with LSPs.

```
Router# show mpls tp tunnel-tp lsps
```

Tunnel Number	Peer node-id::tun	Working/Protect	Local Label	Outgoing Label	Outgoing Interface	Oper State
5	4.4.4.4::5	w	100	110	Et0/0	up
	LSP: working		100	110	Et0/0	up active
	LSP: protect		120	130	Et1/0	up standby
6	6.6.6.6::7	w	200	210	Et0/0	up
	LSP: working		200	210	Et0/0	up active
	LSP: protect		220	230	Et1/0	up standby

Display Detailed MPLS-TP Tunnel Information

This command displays detailed tunnel information of MPLS-TP tunnels.

```
Router# show mpls tp tunnel-tp detail
```

```
MPLS-TP Tunnels:
MPLS-TP tunnel 5:
  source global id 0 : node id 3.3.3.3 : tunnel 5
  dest global id 0 : node id 4.4.4.4 : tunnel 5
  description: this is test tunnel 5
  UMC: tunnel5 ICC: ATT
  Admin: up Oper: up
  bandwidth transmit 1400, receive 1500
```

```

BFD template: bfd-template-5
working-lsp: active      lsp num 0
protect-lsp: standby    lsp num 1
MPLS-TP tunnel 6:
source global id 0 : node id 3.3.3.3 : tunnel 6
dest global id 0 : node id 6.6.6.6 : tunnel 7
description: this is test tunnel 6
Admin: up              Oper: up
bandwidth transmit    1600, receive    1700
BFD template:
working-lsp: active      lsp num 0
protect-lsp: standby    lsp num 1
MPLS-TP tunnel 65530:
source global id 0 : node id 123.123.123.123 : tunnel 65530
dest global id 0 : node id 124.124.124.124 : tunnel 65530
description: this is test tunnel 65530
UMC: big_id
Admin: up              Oper: up
bandwidth transmit    1600, receive    1700
BFD template:
working-lsp: active      lsp num 0
protect-lsp: standby    lsp num 1

```

Display Detailed MPLS-TP Tunnel Information with LSPs

This command displays detailed tunnel information of MPLS-TP tunnels with LSPs.

Router# **show mpls tp tunnel-tp lsp detail**

```

MPLS-TP Tunnels:
MPLS-TP tunnel 5:
source global id 0 : node id 3.3.3.3 : tunnel 5
dest global id 0 : node id 4.4.4.4 : tunnel 5
description: this is test tunnel 5
UMC: tunnel5      ICC: ATT
Admin: up          Oper: up
bandwidth transmit 1400, receive    1500
BFD template: bfd-template-5
working-lsp: active      lsp num 0
0::3.3.3.3::5::0::4.4.4.4::5::0
local label 100      local label table 0      outgoing label    110
outgoing tp-link 1   interface Et0/0
UMC: working-5
protect-lsp: standby    lsp num 1
0::3.3.3.3::5::0::4.4.4.4::5::1
local label 120      local label table 0      outgoing label    130
outgoing tp-link 2   interface Et1/0
MPLS-TP tunnel 6:
source global id 0 : node id 3.3.3.3 : tunnel 6
dest global id 0 : node id 6.6.6.6 : tunnel 7
description: this is test tunnel 6
Admin: up          Oper: up
bandwidth transmit 1600, receive    1700
BFD template:
working-lsp: active      lsp num 0
0::3.3.3.3::6::0::6.6.6.6::7::0
local label 200      local label table 0      outgoing label    210

```

```

    outgoing tp-link 1    interface Et0/0
    protect-lsp: standby    lsp num 1
    0::3.3.3.3::6::0::6.6.6.6::7::1
    local label 220    local label table 0    outgoing label    230
    outgoing tp-link 2    interface Et1/0
    UMC: protect-6
MPLS-TP tunnel 65530:
    source global id 0 : node id 123.123.123.123 : tunnel 65530
    dest global id 0 : node id 124.124.124.124 : tunnel 65530
    description: this is test tunnel 65530
    UMC: big_id
    Admin: up          Oper: up
    bandwidth transmit    1600, receive    1700
    BFD template:
    working-lsp: active    lsp num 0
    0::123.123.123.123::65530::0::124.124.124.124::65530::0
    local label 300    local label table 0    outgoing label    310
    outgoing tp-link 1    interface Et0/0
    protect-lsp: standby    lsp num 1
    0::123.123.123.123::65530::0::124.124.124.124::65530::1
    local label 320    local label table 0    outgoing label    330
    outgoing tp-link 2    interface Et1/0

```

Display MPLS-TP Tunnel Information for a Single Tunnel

This command displays the tunnel information for a single MPLS-TP tunnel.

Router# **show mpls tp tunnel-tp** *tunnelnumber*

Tunnel Number	Peer node-id::tun	Working/Protect	Local Label	Outgoing Label	Outgoing Interface	Oper State
5	4.4.4.4::5	w	100	110	Et0/0	up

Display MPLS-TP Tunnel Information for a Single Tunnel with LSPs

This command displays the tunnel information for a single MPLS-TP tunnel with LSPs.

Router# **show mpls tp tunnel-tp** *tunnelnumber* **lsps**

Tunnel Number	Peer node-id::tun	Working/Protect	Local Label	Outgoing Label	Outgoing Interface	Oper State
5	4.4.4.4::5	w	100	110	Et0/0	up
	LSP: working		100	110	Et0/0	up active
	LSP: protect		120	130	Et1/0	up standby
6	6.6.6.6::7	w	200	210	Et0/0	up
	LSP: working		200	210	Et0/0	up active
	LSP: protect		220	230	Et1/0	up standby

Display Detailed MPLS-TP Tunnel Information for a Single Tunnel

This command displays the detailed tunnel information for a single MPLS-TP tunnel.

Router# **show mpls tp tunnel-tp tunnelnumber detail**

```
MPLS-TP Tunnels:
MPLS-TP tunnel 5:
  source global id 0 : node id 3.3.3.3 : tunnel 5
  dest global id 0 : node id 4.4.4.4 : tunnel 5
  description: this is test tunnel 5
  UMC: tunnel5      ICC: ATT
  Admin: up         Oper: up
  bandwidth transmit 1400, receive 1500
  BFD template: bfd-template-5
  working-lsp: active      lsp num 0
  protect-lsp: standby     lsp num 1
```

Display Detailed MPLS-TP Tunnel Information for a Single Tunnel with LSPs

This command displays the detailed tunnel information for a single MPLS-TP tunnel with LSPs.

Router# **show mpls tp tunnel-tp tunnelnumber lsps detail**

```
MPLS-TP Tunnels:
MPLS-TP tunnel 5:
  source global id 0 : node id 3.3.3.3 : tunnel 5
  dest global id 0 : node id 4.4.4.4 : tunnel 5
  description: this is test tunnel 5
  UMC: tunnel5      ICC: ATT
  Admin: up         Oper: up
  bandwidth transmit 1400, receive 1500
  BFD template: bfd-template-5
  working-lsp: active      lsp num 0
    0::3.3.3.3::5::0::4.4.4.4::5::0
    local label 100      local label table 0      outgoing label 110
    outgoing tp-link 1   interface Et0/0
    UMC: working-5
  protect-lsp: standby     lsp num 1
    0::3.3.3.3::5::0::4.4.4.4::5::1
    local label 120      local label table 0      outgoing label 130
    outgoing tp-link 2   interface Et1/0
```

Display LSP Information

This command displays information for all the MPLS-TP LSPs (midpoint and endpoint LSPs) configured on this router.

Router# **show mpls tp lsps**

```
MPLS-TP Endpoint LSPs:
LSP Identifier                                Local   Outgoing   Outgoing   Oper   Role
Label    Label    Interface  State
0::3.3.3.3::5::0::4.4.4.4::5::0      100     110        Et0/0      up     active
0::3.3.3.3::5::0::4.4.4.4::5::1      120     130        Et1/0      up     standby
```

```

0::3.3.3.3::6::0::6.6.6.6::7::0    200    210      Et0/0    up    active
0::3.3.3.3::6::0::6.6.6.6::7::1    220    230      Et1/0    up    standby

```

MPLS-TP Midpoint LSPs:

LSP Identifier	LSP	Local Label	Outgoing Label	Outgoing Interface
0::1.1.1.1::1::0::6.6.6.6::1::0	forw	150	151	Et0/0
	rev	152	153	Et1/0
0::1.1.1.1::9::0::9.9.9.9::9::0	forw	160	161	Et0/0
	rev	162	163	Et1/0

Display Midpoint LSP Information

This command displays information for the midpoint LSP.

```
Router# show mpls tp lsps midpoints
```

MPLS-TP Midpoint LSPs:

LSP Identifier	LSP	Local Label	Outgoing Label	Outgoing Interface
0::1.1.1.1::1::0::6.6.6.6::1::0	forw	150	151	Et0/0
	rev	152	153	Et1/0
0::1.1.1.1::9::0::9.9.9.9::9::0	forw	160	161	Et0/0
	rev	162	163	Et1/0

Display Endpoint LSP Information

This command displays information for the endpoint LSP.

```
Router# show mpls tp lsps endpoints
```

MPLS-TP Endpoint LSPs:

LSP Identifier	Local Label	Outgoing Label	Outgoing Interface	Oper State	Role
0::3.3.3.3::5::0::4.4.4.4::5::0	100	110	Et0/0	up	active
0::3.3.3.3::5::0::4.4.4.4::5::1	120	130	Et1/0	up	standby
0::3.3.3.3::6::0::6.6.6.6::7::0	200	210	Et0/0	up	active
0::3.3.3.3::6::0::6.6.6.6::7::1	220	230	Et1/0	up	standby

Display Detailed LSP Information

This command displays detailed LSP information.

```
Router# show mpls tp lsps detail
```

MPLS-TP Endpoint LSPs:

```

0::3.3.3.3::5::0::4.4.4.4::5::0
  local label 100    local label table 0    outgoing label    110
  outgoing tp-link 1    interface Et0/0
  UMC: working-5
0::3.3.3.3::5::0::4.4.4.4::5::1
  local label 120    local label table 0    outgoing label    130
  outgoing tp-link 2    interface Et1/0
0::3.3.3.3::6::0::6.6.6.6::7::0
  local label 200    local label table 0    outgoing label    210

```

```

outgoing tp-link 1    interface Et0/0
0::3.3.3.3::6::0::6.6.6.6::7::1
local label 220      local label table 0      outgoing label    230
outgoing tp-link 2    interface Et1/0
UMC: protect-6
0::123.123.123.123::65530::0::124.124.124.124::65530::0
local label 300      local label table 0      outgoing label    310
outgoing tp-link 1    interface Et0/0
0::123.123.123.123::65530::0::124.124.124.124::65530::1
local label 320      local label table 0      outgoing label    330
outgoing tp-link 2    interface Et1/0

```

MPLS-TP Midpoint LSPs:

```

0::1.1.1.1::1::0::6.6.6.6::1::0
  source global id 0 : node id 1.1.1.1 : tunnel 1
  dest global id 0 : node id 6.6.6.6 : tunnel 1
  lsp    working
  UMC: midpoint_1_2    ICC: ATT
  forward-lsp: local label 150    outgoing label    151
                outgoing tp-link 1    interface Et0/0
  bandwidth    1122
  reverse-lsp: local label 152    outgoing label    153
                outgoing tp-link 2    interface Et1/0
                bandwidth    2211
0::1.1.1.1::9::0::9.9.9.9::9::0
  source global id 0 : node id 1.1.1.1 : tunnel 9
  dest global id 0 : node id 9.9.9.9 : tunnel 9
  lsp    working
  forward-lsp: local label 160    outgoing label    161
                outgoing tp-link 1    interface Et0/0
  bandwidth    0
  reverse-lsp: local label 162    outgoing label    163
                outgoing tp-link 2    interface Et1/0
                bandwidth    0
0::2.2.2.2::2::0::9.9.9.9::2::0
  source global id 0 : node id 2.2.2.2 : tunnel 2
  dest global id 0 : node id 9.9.9.9 : tunnel 2
  lsp    working
  forward-lsp: local label 170    outgoing label    171
                outgoing tp-link 1    interface Et0/0
  bandwidth    0
  reverse-lsp: local label 172    outgoing label    173
                outgoing tp-link 2    interface Et1/0
                bandwidth    0

```

Display Matching LSP Information

This command displays information for the MPLS-TP LSPs that match the specified filter value. The filter value can be node-id, global-id, tunnel number, or lsp number. The specified filter value is applied to each source and destination LSP identifier.

Router# **show mpls tp lsps 6.6.6.6**

MPLS-TP Endpoint LSPs:

LSP Identifier	Local Label	Outgoing Label	Outgoing Interface	Oper State	Role
0::3.3.3.3::6::0::6.6.6.6::7::0	200	210	Et0/0	up	active

```
0::3.3.3.3::6::0::6.6.6.6::7::1    220    230        Et1/0    up    standby
```

MPLS-TP Midpoint LSPs:

LSP Identifier	LSP	Local Label	Outgoing Label	Outgoing Interface
0::1.1.1.1::1::0::6.6.6.6::1::0	forw	150	151	Et0/0
	rev	152	153	Et1/0