MPLS TP Command Reference

This chapter describes commands to configure Multiprotocol Label Switching Transport Profile (MPLS TP).

bfd-template

To create a Bidirectional Forwarding Detection (BFD) template and to enter BFD configuration mode, use the **bfd-template** command in global configuration mode. To disable a BFD template, use the **no** form of this command.

bfd-template single-hop *template-name*

no bfd-template single-hop *template-name*

Syntax Description

single-hop	Specifies a single-hop BFD template.
template-name	Name of the template.

Command Default

The BFD template does not exist.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The **bfd-template** command enables you to create a BFD template and enter BFD configuration mode. The template can be used to specify a set of BFD interval values. The BFD interval values specified as part of the BFD template are not specific to a single interface.

Examples

The following example shows how to create a BFD template and specify BFD interval values.

```
Router(config)# bfd-template single-hop node1
Router(config-bfd)# interval min-tx 120 min-rx 100 multiplier 3
```

Related Commands

Command	Description
interval (MPLS–TP)	Configures the transmit and receive intervals between BFD packets.

debug mpls tp

To display Multiprotocol Label Switching (MPLS) Transport Profile (TP) error messages, use the **debug mpls tp** command in privileged EXEC mode. To disable the display of the messages, use the **no** form of this command.

debug mpls tp [**all** | **cli** | **error** | **event** | **fault-oam** | **ha** | **init** | **link-num** | **lsp-db** | **lsp-ep** | **lsp-mp** | **mem** | **tun-db** | **tunnel**]

no debug mpls tp

Syntax Description

all	Displays all debug messages.
cli	Displays MPLS-TP CLI debug messages.
error	Displays MPLS-TP error debug messages.
event	Displays MPLS-TP event debug messages.
fault-oam	Displays MPLS-TP fault OAM debug messages.
ha	Displays MPLS-TP high availability (HA) debug messages.
init	Displays MPLS-TP initialization debug messages.
link-num	Displays MPLS-TP link management debug messages.
lsp-db	Displays MPLS-TP midpoint label switched path (LSP) database debug messages.
lsp-ep	Displays MPLS-TP endpoint (EP) LSP configuration and operation debug messages.
lsp-mp	Displays MPLS-TP midpoint (MP) LSP configuration and operation debug messages.
mem	Displays MPLS-TP memory allocation and usage debug messages.
tun-db	Displays MPLS-TP tunnel database debug messages.
tunnel	Displays MPLS-TP tunnel configuration and operation debug messages.

Command Default

Debug messages are not enabled.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Examples

The following example displays the MPLS–TP endpoint LSP configuration and operation debug messages.

```
Router# debug mpls tp lsp-ep
```

Related Commands

Command	Description
show mpls tp	Displays information about the MPLS TP tunnels.

interface tunnel-tp

To create a Multiprotocol Label Switching (MPLS) transport profile (TP) tunnel and configure its parameters, use the **interface tunnel-tp** command in global configuration mode.

interface tunnel-tp *number*

Syntax Description

number	Number of the MPLS-TP tunnel.

Command Default

MPLS-TP tunnel parameters are not configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command on the endpoint routers to specify the parameters of the MPLS-TP tunnel.

This command also enters interface configuration mode (config-if). From this mode, configure the following MPLS-TP parameters:

Command	Description
bfd *bfd-template*	Specifies the Bidirectional Forwarding Detection (BFD) template for the tunnel. • If the BFD template for an MPLS-TP tunnel is updated after the tunnel is brought up, a BFD session is brought up on both the working and, if configured, the protect LSPs. • If the BFD template for a tunnel is changed, the BFD sessions for the working and protect LSPs is brought down and then brought back up with the new BFD template. • If a BFD template is not configured on an MPLS-TP tunnel, the initial LSP state will be DOWN.

Command	Description
protect-lsp	Enters protect LSP interface configuration mode (config-if-protect). From this mode, configure the following parameters: • Incoming link number and label (**in-label** *num*). • Lock (**lockout**). • Number of the protect LSP (**lsp-number**). By default, the protect LSP number is 1. • Outgoing label and link numbers (**out-label** *num* **out-link** *num*). A protect LSP is a backup for a working LSP. If the working LSP fails, traffic is switched to the protect LSP until the working LSP is restored, at which time forwarding reverts to the working LSP. Traffic can be locked out on either the working LSP or the protect LSP but not both. When traffic is locked out of the working or protect LSP, no traffic is forwarded on that LSP. The lockout of the LSP is signaled from one endpoint to the other. When one end has locked out one LSP, the other end may only lockout the same LSP. It is strongly advised to lockout the LSP from both ends, so that both sides know (locally) that the LSP is locked out in the absence of further signaling, which may be the case if connectivity of the LSP is broken due to maintenance for an extended time. In the absence of connectivity, a single-ended lockout expires at the remote end in under 15 minutes (256 * 3.5 seconds).

Command	Description
protection trigger [**ais** | **ldi** | **lkr**]	(Optional) Specifies protection triggers for Alarm Indication Signal (AIS), Link Down Indication (LDI), Lock Report (LKR) messages. These should be used in rare cases. They help in specifying which of these fault notifications can trigger a protection switch. The default is to inherit the setting of the similar commands from the global settings of protection trigger. This command enables a tunnel to override the global settings. The default for the global settings is that protection is triggered on receipt of LDI and LKR, but not AIS. (AIS is a non-fatal indication of potential issues, which turns into LDI when it is known to be fatal.) This command is useful when other devices send AIS or LDI in unexpected ways. For example, a device from another vendor sends AIS when there are link failures and never sends AIS with the LDI flag . In this case, configure the **protection trigger ais** command. If a device sends LDI when there is no actual failure, but there is a possible failure, and the BFD must detect the actual failure and cause protection switching, configure the **no protection trigger ldi** command. To undo these configuration settings and resume inheriting the global settings, use the **default protection trigger** [**ais** | **ldi** | **lkr**] command.
tp bandwidth *num*	(Optional) Specifies the transmit bandwidth, in kilobytes. The valid range is from 1 to 10000000. The default is 0. With MPLS-TP, the **bandwidth** command cannot be used in interface configuration mode. Use the **tp bandwidth** command.
tp destination *node-id* [**tunnel-tp** *num*] [**global-id** *num*]	Specifies the destination MPLS-TP node ID. **tunnel-tp** *num*—(Optional) Indicates 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. **global-id** *num*—(Optional) Indicates the global ID used for the remote end of this MPLS-TP tunnel. The valid range is from 0 to 2147483647. The default is the global ID that is configured with the **mpls tp** command.

Command	Description
tp source *node-id* [**global-id** *num*]	(Optional) Specifies the source MPLS-TP tunnel node ID. This is the ID of the endpoint router being configured. The source ID can be specified to override the router ID configured in the global MPLS-TP configuration. The **tp source** command is optional and not typically used, because the global router ID and global ID can be used to identify the tunnel source at the endpoint. All tunnels on the router generally use the same (globally specified) source information. **global-id** *num*—(Optional) Indicates the global ID of the local endpoint for this tunnel. The valid range is from 0 to 2147483647. The default is the global global ID that is configured with the **mpls tp** command.
tp tunnel-name *name*	(Optional) Specifies the name of the MPLS-TP tunnel. The TP tunnel name is displayed in the **show mpls tp tunnel** command output. This command is useful for consistently identifying the tunnel at all endpoints and midpoints.

Command	Description
working-lsp	Enters working LSP interface configuration mode (config-if-working). From this mode, configure the following parameters: • Incoming link number and label (**in-label** *num*). • Lock (**lockout**) • Number of the working LSP (**lsp-number**). By default, the working LSP number is 0. • Outgoing label and link numbers (**out-label** *num* **out-link** *num*) A working LSP is the primary LSP. If the working LSP fails, traffic is switched to the protect LSP until the working LSP is restored, at which time forwarding reverts to the working LSP. The lockout of the LSP is signaled from one endpoint to the other. When one end has locked out one LSP, the other end may only lockout the same LSP. It is strongly advised to lockout the LSP from both ends, so that both sides know (locally) that the LSP is locked out in the absence of further signaling, which may be the case if connectivity of the LSP is broken due to maintenance for an extended time. In the absence of connectivity, a single-ended lockout expires at the remote end in under 15 minutes (256 * 3.5 seconds).

Examples

The following example shows how to specify the parameters for an MPLS-TP tunnel.

```
Router(config)# interface Tunnel-tp1
Router(config-if)# description "MPLS-TP tunnel # 1"
Router(config-if)# no ip address
Router(config-if)# no keepalive
Router(config-if)# tp bandwidth 10000
Router(config-if)# tp destination 10.1.1.1
Router(config-if)# bfd mpls-tp-bfd-2
Router(config-if)# working-lsp
Router(config-if-working)# in-label 211 out-label 112 out-link 1
Router(config-if-working)# exit
Router(config-if)# protect-lsp
Router(config-if-protect)# in-label 511 out-label 115 out-link 2
Router(config-if-protect)# exit
```

Related Commands

Command	Description
mpls tp	Specifies global values used across the MPLS TP implementation and applies to all the tunnels and midpoint LSPs.

interval (mpls–tp)

To configure the transmit and receive intervals between BFD packets and to specify the number of consecutive BFD control packets to miss before BFD declares that a peer is unavailable, use the **interval** command in BFD configuration mode. To disable interval values, use the **no** form of this command.

interval [**microseconds**] {**both** *time* | **min-tx** *time* **min-rx** *time*} [**multiplier** *multiplier-value*]

no interval

Syntax Description

microseconds	(Optional) Specifies, in microseconds, the rate at which BFD control packets are sent to and received from BFD peers. If the **microseconds** keyword is not specified, the interval defaults to milliseconds.
both *time*	Specifies the rate at which BFD control packets are sent to BFD peers and the rate at which BFD control packets are received from BFD peers.
min-tx *time*	Specifies the rate at which BFD control packets are sent to BFD peers.
min-rx *time*	Specifies, the rate at which BFD control packets are received from BFD peers.
multiplier *multiplier-value*	(Optional) Specifies the number of consecutive BFD control packets that must be missed from a BFD peer before BFD declares that the peer is unavailable and the Layer 3 BFD peer is informed of the failure. The range is from 3 to 50. The default value is 3.

Command Default

The transmit and receive intervals between BFD packets are not set.

Command Modes

BFD configuration (config-bfd)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The **interval** command enables you to configure the session parameters for a BFD template.

Examples

The following example shows how to configure interval settings for the node1 BFD template.

```
Router(config)# bfd-template single-hop node1
Router(config-bfd)# interval min-tx 120 min-rx 100 multiplier 3
```

Related Commands

Command	Description
bfd-template	Creates a BFD template and enters BFD configuration mode.

local interface

To specify the pseudowire type when configuring static to dynamic pseudowires in an Mutliprotocol Label Switching Transport Protocol (MPLS-TP) network, use the **local interface** command in VFI neighbor configuration mode. To disable the pseudowire type, use the **no** form of this command.

local interface *pseudowire-type*

no local interface *pseudowire-type*

Syntax Description

pseudowire-type	Specifies the pseudowire type by its number in hex format: 01 Frame Relay DLCI (Martini mode) 02 ATM AAL5 SDU VCC transport 03 ATM transparent cell transport 04 Ethernet Tagged mode 05 Ethernet 06 HDLC 07 PPP 08 SONET/SDH Circuit Emulation Service Over MPLS 09 ATM n-to-one VCC cell transport 0A ATM n-to-one VPC cell transport 0B IP Layer 2 transport 0C ATM one-to-one VCC Cell mode 0D ATM one-to-one VPC Cell mode 0E ATM AAL5 PDU VCC transport 0F Frame-Relay Port mode 10 SONET/SDH Circuit Emulation over Packet 11 Structure-agnostic E1 over Packet 12 Structure-agnostic T1 (DS1) over Packet 13 Structure-agnostic E3 over Packet 14 Structure-agnostic T3 (DS3) over Packet 15 CESoPSN basic mode 16 TDMoIP AAL1 Mode 17 CESoPSN TDM with CAS

Command Default

The pseudowire type is not defined in the MPLS-TP network.

Command Modes VFI neighbor configuration

Command History

Release	Modification
9.3.0	This command was introduced.

Examples The following example shows how to set the local interface virtual circuit (VC) type to Ethernet.

```
Router(config-vfi-neighbor)# local interface 5
```

medium p2p

To configure the interface as point-to-point, use the **medium p2p** command in interface configuration mode. To return the interface to its normal mode, use the **no** form of this command.

medium p2p

no medium p2p

Syntax Description

This command has no arguments or keywords.

Command Default

Interfaces are configured to connect to multiple devices.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command enables the router to send and receive all MPLS-TP packets using a common multicast MAC address knowing that it is communicating with only one other device.

Examples

The following example shows how to configure the interface as point-to-point:

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

Related Commands

Command	Description
mpls tp link	Configures MPLS–TP link parameters.

mpls tp

To configure Multiprotocol Label Switching (MPLS) transport profile (TP) parameters and enter MPLS-TP configuration mode, use the **mpls tp** command in global configuration mode. To remove all MPLS-TP parameters, use the **no** form of this command.

mpls tp
no mpls tp

Syntax Description

This command has no arguments or keywords.

Command Default

MPLS-TP parameters are not configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command to enter MPLS-TP configuration mode. From this mode, configure the following parameters:

Command	Description
fault-oam refresh-timer *secs*	(Optional) Specifies the maximum time between successive fault Operations, Administration, and Maintenance (OAM) messages specified in seconds. The range is from 1 to20. The default value is 20.
global-id *num*	(Optional) Specifies the default global ID used for all endpoints and midpoints. The range is from 0 to 2147483647. The default value is 0. This command makes the router-id globally unique in a multiprovider tunnel. Otherwise, the router-id is only locally meaningful. The **global-id** is an autonomous system number, which is a controlled number space by which providers can identify each other.

Command	Description
protection trigger [**ais** | **ldi** | **lkr**]	(Optional) Specifies protection triggers for Alarm Indication Signal (AIS), Link Down Indication (LDI), Lock Report (LKR) messages. These should be used in rare cases. They help in changing the default protection-switching behavior for fault notifications on all tunnels. The default for these global settings is to trigger protection on receipt of LDI and LKR, but not AIS. (AIS is a non-fatal indication of potential issues, which turns into LDI when it is known to be fatal.) This command is useful when other devices send AIS or LDI in unexpected ways. For example, configure the **protection trigger ais** command to interoperate with another vendor whose devices send AIS when there are link failures and never send AIS with the LDI flag. Another example is if a device sends LDI when there is no actual failure, but there is a possible failure, and the BFD must detect the actual failure and cause protection switching, configure the **no protection trigger ldi** command. To undo these configuration settings and revert to the default settings, use the **no protection trigger [ais | ldi | lkr]** command.
router-id *router-id*	(Required) Specifies the default MPLS-TP router ID, which is used as the source node ID for all MPLS-TP tunnels configured on the router. This is required for MPLS-TP forwarding. This router-id is used in fault OAM messaging to identify the source of a fault on a midpoint router.
wtr-timer	Specifies the wait-to-restore (WTR) timer. This timer controls the length of time to wait before reversion following the repair of a fault on the original working path.

Examples

The following example shows how to enter MPLS-TP configuration mode.

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

The following example shows how to set the default router ID from MPLS-TP configuration mode.

```
Router(config-mpls-tp)# router-id 10.10.10.10
```

Related Commands

Command	Description
mpls tp lsp	Specifies the parameters for two ends of the MPLS-TP tunnel from the tunnel midpoint.
interface tunnel-tp	Specifies the parameters for the MPLS tunnel.

mpls tp link

To configure Multiprotocol Label Switching (MPLS) transport profile (TP) link parameters, use the **mpls tp link** command in interface configuration mode.

mpls tp link *link-num* {**ipv4** *ip-address* | **tx-mac** *mac-address*} {**rx-mac** *mac-address*}

no mpls tp link *link-num*

Syntax Description

link-num	Number assigned to the link. It must be unique on the device. Only one link number can be assigned per interface. The range is from 1 to 2147483647.
ipv4 *ip-address*	Specifies the next-hop address that the Address Resolution Protocol (ARP) uses to discover the destination MAC address.
tx-mac {*mac-address*}	Specifies a per-interface transmit multicast MAC address. • *mac-address*—User-supplied MAC address. The **tx-mac** keyword is available only on point-to-point Ethernet interfaces. It is not available on serial interfaces.
rx-mac {*mac-address*}	Specifies a per-interface receive multicast MAC address. • *mac-address*—User-supplied MAC address. The **rx-mac** keyword is available only when the **tx-mac** keyword is used. It is not available on serial interfaces.

Command Default

MPLS-TP link parameters are not configured.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The link number must be unique on the device. Only one link number can be assigned per interface.

MPLS-TP link numbers may be assigned to physical interfaces only. Bundled interfaces and virtual interfaces are not supported for MPLS-TP link numbers.

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

Examples

The following example shows how to create an MPLS-TP link without an IP address.

```
interface TenGigabitEthernet4/1
  medium p2p
  mpls tp link 1
```

The following example shows how to configure the unicast MAC address of the next-hop device.

```
interface TenGigabitEthernet4/1
  medium p2p
  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.

```
interface TenGigabitEthernet4/1
  medium p2p
  mpls tp link 1 tx-mac 0100.0c99.8877 rx-mac 0100.0c99.8877
```

Related Commands

Command	Description
medium p2p	Configures the interface as point-to-point.
mpls tp lsp	Specifies the parameters for two ends of the MPLS-TP tunnel from the tunnel midpoint.
interface tunnel-tp	Specifies the parameters for the MPLS tunnel.

mpls tp lsp

To configure Multiprotocol Label Switching (MPLS) transport profile (TP) midpoint connectivity, use the **mpls tp lsp** command in global configuration mode.

mpls tp lsp source *node-id* **[global-id** *num*] **tunnel-tp** *num* **lsp** {*lsp-num* | **protect** | **working**} **destination** *node-id* [**global-id** *num*] **tunnel-tp** *num*

Syntax Description

source *node-id*	Specifies the source node ID of the MPLS-TP tunnel.
global-id *num*	(Optional) Specifies the global ID of the tunnel source.
tunnel-tp *num*	Specifies the tunnel-TP number of MPLS-TP tunnel source.
lsp {*lsp-num* | **protect** | **working** }	Specifies the label switched path (LSP) within the MPLS-TP tunnel. • *lsp-num*—Specifies the number of the LSP • **protect**—Indicates that the LSP is a backup for the primary, or working, LSP. When you specify the **protect** keyword, the LSP number is 1. **working**—Indicates that the LSP is the primary LSP. When you specify the **working** keyword, the LSP number is 0. A protect LSP is a backup for a working LSP. When the working LSP fails, traffic is switched to the protect LSP until the working LSP is restored, at which time forwarding reverts to the working LSP.
destination *node-id*	Specifies the destination node ID of the MPLS-TP tunnel.
global-id *num*	(Optional) Specifies the global ID of the tunnel destination. The range is from 0 to 2147483647. The default value is 0.
tunnel-tp *num*	Specifies the tunnel-TP number of MPLS-TP tunnel destination.

Command Default

No MPLS-TP parameters are not configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command on midpoint routers to specify the source and destination parameters of the MPLS-TP tunnel. You can use the **mpls trace** command to validate that the traffic is traversing the correct tunnel at each midpoint.

This command also enters MPLS-TP LSP configuration mode (config-mpls-tp-lsp). From this mode, configure the following parameters:

Command	Parameter
forward-lsp *num*	Enters MPLS-TP LSP forward LSP configuration mode (config-mpls-tp-lsp-forw). From this mode, you can configure the following parameters: • Bandwidth (**bandwidth**) • Incoming label (**in-label**) and outgoing label and link numbers (**out-label out-link**)
reverse-lsp *name*	Enters MPLS-TP LSP reverse LSP configuration mode (config-mpls-tp-lsp-rev). From this mode, you can configure the following parameters: • Bandwidth (**bandwidth**) • Incoming label (**in-label**) and outgoing label and link numbers (**out-label out-link**)
tunnel-name *name*	Specifies the name of the MPLS-TP tunnel.

Examples

The following example shows how to configure a midpoint LSP carrying the working LSP of an MPLS-TP tunnel between node 209.165.200.225, tunnel-number 1 and 209.165.200.226, tunnel-number 2, using 1000 kbps bandwidth in both the directions:

```
Router(config)# mpls tp lsp source 209.165.200.225 tunnel-tp 1 lsp working destination
209.165.200.226 tunnel-tp 2
Router(config-mpls-tp-lsp)# forward-lsp
Router(config-mpls-tp-lsp-forw)# bandwidth 1000
Router(config-mpls-tp-lsp-forw)# in-label 20 out-label 40 out-link 10
Router(config-mpls-tp-lsp-forw)# exit
Router(config-mpls-tp-lsp)# reverse-lsp
Router(config-mpls-tp-lsp-rev)# bandwidth 1000
Router(config-mpls-tp-lsp-rev)# in-label 21 out-label 50 out-link 11
```

The following example shows how to configure a midpoint LSP on the protect LSP between node 2::209.165.200.225, tunnel 4 and 14::209.165.200.226, tunnel 2. No bandwidth is reserved:

```
Router(config)# mpls tp lsp source 209.165.200.225 global-id tunnel-tp 4 lsp protect
destination 10.11.11.11 global-id 14 tunnel-tp 12
Router(config-mpls-tp-lsp)# forward-lsp
Router(config-mpls-tp-lsp-forw)# in-label 30 out-label 100 out-link 37
Router(config-mpls-tp-lsp-forw)# exit
Router(config-mpls-tp-lsp)# reverse-lsp
Router(config-mpls-tp-lsp-rev)# in-label 31 out-label 633 out-link 30
```

Related Commands

Command	Description
mpls tp	Specifies the parameters of the MPLS-TP and enters MPLS-TP configuration mode.
interface tunnel-tp	Specifies the parameters for the MPLS tunnel.

ping mpls tp

To check Multiprotocol Label Switching (MPLS) transport protocol (TP) label switched path (LSP) connectivity, use the **ping mpls tp** command in privileged EXEC mode.

ping mpls tp tunnel-tp *num* **lsp** {**working** | **protect** | **active**}

[**ddmap** [**hashkey ipv4 bitmap** *bitmap-size* | **none**]

[**dsmap [hashkey ipv4 bitmap** *bitmap-size* | **none**]

[**destination** *ip-addr*]

[**exp** *num*]

[**flags fec**]

[**interval** *num*]

[**pad** *num*]

[**repeat** *num*]

[reply dscp *num* | **mode control channel**]

[**size** *num*]

[**source** *ip-addr*]

[**sweep** *num num num*]

[**timeout** *num*]

[**ttl** *num*]

[**verbose**]

Syntax Description

tunnel-tp *num*	Specifies the MPLS-TP tunnel number.
lsp {**working** | **protect** | **active**}	Specifies the type of MPLS-TP label switched path (LSP) on which to send echo request packets.
ddmap [**hashkey ipv4 bitmap** *bitmap-size*| **none**	Specifies the rate at which BFD control packets are sent to BFD peers. (Optional) Interrogates a transit router for downstream mapping (DDMAP) information. Allows you to control the hash key and multipath settings.Valid values are: **none**—There is no multipath (type 0). **ipv4 bitmap** *bitmap-size*—Size of the IPv4 addresses (type 8) bitmap. If you enter the **none** keyword, multipath LSP traceroute acts like enhanced LSP traceroute; that is, it uses multipath LSP traceroute retry logic and consistency checking.

dsmap [**hashkey ipv4 bitmap** *bitmap-size*| **none**	(Optional) Interrogates a transit router for downstream mapping (DSMAP) information. Allows you to control the hash key and multipath settings. Valid values are: **none**—There is no multipath (type 0). **ipv4 bitmap** *bitmap-size*—Size of the IPv4 addresses (type 8) bitmap. If you enter the **none** keyword, multipath LSP traceroute acts like enhanced LSP traceroute; that is, it uses multipath LSP traceroute retry logic and consistency checking.
destination *ip-addr*	(Optional) Specifies a network 127 address.
exp *num*	(Optional) Specifies the MPLS experimental field value in the MPLS header for an MPLS echo reply. The range is from 0 to 7. The default value is 0.
flags fec	(Optional) Allows Forward Equivalence Class (FEC) checking on the transit router. A downstream map TLV containing the correct received labels must be present in the echo request for target FEC stack checking to be performed. Target FEC stack validation is always done at the egress router. Be sure to use this keyword in conjunction with the ttl keyword.
interval *num*	(Optional) Specifies the time, in milliseconds (ms), between successive MPLS echo requests. This parameter allows you to pace the transmission of packets so that the receiving router does not drop packets. Default is 0.
pad *num*	(Optional) The pad TLV is used to fill the datagram so that the MPLS echo request (User Datagram Protocol [UDP] packet with a label stack) is the specified size. The default is 0xABCD.
repeat *num*	(Optional) Specifies the repeat count. Range: 1-2147483647
reply dscp *num* |**mode control channel**	(Optional) Provides the capability to request a specific quality of service (QoS) in an echo reply by providing a differentiated services code point (DSCP) value. The echo reply is returned with the IP header type of service (ToS) byte set to the value specified in the **reply dscp** command.
size *num*	Specifies the packet size.
source *ip-addr*	(Optional) Specifies the source address or name. The default address is loopback0. This address is used as the destination address in the MPLS echo response.
sweep *num num num*	(Optional) Enables you to send a number of packets of different sizes, ranging from a start size to an end size. This parameter is similar to the Internet Control Message Protocol (ICMP) ping sweep parameter.
timeout *num*	(Optional) Specifies the timeout interval in seconds for an MPLS request packet. The range is from 0 to 3600. The default is 2 seconds.
ttl *num*	(Optional) Specifies a time-to-live (TTL) value. The default is 225 seconds.

verbose	(Optional) Enables verbose output mode.

Command Default

Connectivity is not checked.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use the **ping mpls tp** command to validate, test, or troubleshoot MPLS TP LSPs.

Note The **ping mpls tp** command does not support interactive mode.

You can use ping and trace in an MPLS-TP network without IP addressing. However, no IP addresses are displayed in the output.

The following rules determine the source IP address:

1. Use the IP address of the TP interface
2. Use the global router ID.
3. Use router-id : A.B.C.D local node id in IPv4 address format. This is not an IP address. However, it is better to use a value rather than leave it as 0.0.0.0 and risk the packet being deemed invalid and dropped.

Examples

The following example checks connectivity of a MPLS-TP LSP.

```
Router# ping mpls tp tunnel-tp 1 repeat 1 ttl 2

Sending 1, 100-byte MPLS Echos to Tunnel-tp1,
   timeout is 2 seconds, send interval is 0 msec:
Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no label entry,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0
Type escape sequence to abort.
!
Success rate is 100 percent (1/1), round-trip min/avg/max = 156/156/156
ms
```

Related Commands

Command	Description
trace mpls tp	Displays the MPLS LSP routes that packets take to their destinations.

pseudowire-static-oam class

To create an Operations, Administration, and Maintenance (OAM) class and specify the timeout intervals, use the **pseudowire-static-oam class** command in global configuration mode. To remove the specified class, use the **no** form of this command.

pseudowire-static-oam class *class-name*
no pseudowire-static-oam class *class-name*

Syntax Description

class-name	OAM class name. It creates an OAM class and enters static pseudowire OAM configuration mode, from which you can enter timeout intervals.

Command Default

OAM classes are not created.

Command Modes

Global configuration mode (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Examples

The following example shows how to create the class oam-class3 and enter static pseudowire OAM configuration mode.

```
Router(config)# pseudowire-static-oam class oam-class3
Router (config-st-pw-oam-class)# timeout refresh send ?
<1-4095> Seconds, default is 30
R1(config-st-pw-oam-class)# timeout refresh send 45 ?
```

Related Commands

Command	Description
status protocol notification static	Invokes the specified class as part of the static pseudowire.

pseudowire-tlv template

To create a template of pseudowire type, length, value (TLV) parameters to use in a MPLS-TP configuration, use the **pseudowire-tlv template** command in privileged EXEC configuration mode. To remove the template, use the **no** form of this command.

pseudowire-tlv template *template-name*
no pseudowire-tlv template *template-name*

Syntax Description

template-name	Name of the TLV template.

Command Default

TLV values are not specified.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Examples

The following example shows how to create a TLV template called tlv3.

```
Router(config)# pseudowire-tlv template tlv3
```

Related Commands

Command	Description
tlv template	Specifies a TLV template to use as part of the local interface configuration.

show mpls tp

To display information about Multiprotocol Label Switching (MPLS) transport profile (TP) tunnels, use the **show mpls tp** command in user EXEC or privileged EXEC mode.

show mpls tp [**link numbers**] [**lsps** [*node-id* [*options*]]] [**detail**] [**summary**] [**tunnel-tp** [*tunnel-num* [*options*]]] [**detail**]

Syntax Description

detail	Displays detailed output.
link-numbers	Displays information about the MPLS TP link number database.
lsps [*node-id*[*options*]]	Displays information about the MPLS TP label switched paths (LSPs), including those on midpoint and endpoint routers. • *node-id*—LSP information for that node ID. • *options*–LSP options: ◦ **endpoints**—Displays LSP information for the endpoint routers. ◦ **global-id** *num*—Displays LSP information for matching the global ID. ◦ **lsp** {*num* | **protect** | **working**}—Displays LSP information for a specific LSP. ◦ **midpoints**—Displays information about LSP midpoints configured on a router. ◦ **tunnel-name** *tunnel-tp-name*—Displays the information for a specific named tunnel. ◦ **tunnel-tp** *num*—Displays LSP information for a specific tunnel.
summary	Displays a summary of all link numbers.
tunnel-tp [*options*]	Displays information for MPLS-TP tunnels. Use a combination of any of the following options: • *tunnel-tp-number*—Displays the information for a specific numbered tunnel. • **lsps**—Displays LSP information for MPLS-TP tunnels. • *tunnel-tp-name*—Displays the information for a specific named tunnel.

Command Modes

User EXEC (>), Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Examples

The following is a sample output from the **show mpls tp** command that displays MPLS–TP link number information.

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

```
MPLS-TP Link Numbers:
Link    Interface                Next Hop        RX Macs
1       TenGigabitEthernet4/1  209.165.200.225
2       TenGigabitEthernet4/2  0180.c200.0000  0180.c200.0000
```

The following is a sample output from the **show mpls tp** command that displays information for MPLS–TP tunnels.

```
Router> show mpls tp tunnel-tp
```

```
MPLS-TP Tunnels:
Tunnel Peer                      Active Local  Out     Out       Oper
Number global-id::node-id::tun   LSP Label    Label  Interface  State
------ ----------------------    ------ ----- -----   ---------  -----
1      1::104.10.1.1::1          work 211      112      Ten4/1     up
2      20::104.10.1.1::2         work 221      122      Ten4/1     up
3      1::104.10.1.1::3          work 231      132      Ten4/1     up
4      0::10.20.20.4::4          work 241      142      Ten4/1     up
```

Related Commands

Command	Description
debug mpls tp	Displays MPLS TP debug messages.

status protocol notification static

To enable the timers set in the specified class name, use the **status protocol notification static** command in pseudowire-class configuration mode. To disable the use of the specified class, use the **no** form of this command.

status protocol notification static *class-name*
no status protocol notification static *class-name*

Syntax Description

class-name	OAM class that was created with the **pseudowire-static-oam-class** command.

Command Default

OAM classes are not specified.

Command Modes

Pseudowire-class (config-pw-class)

Command History

Release	Modification
9.3.0	This command was introduced.

Examples

The following example shows how to enable the timers in class oam-class3.

```
Router(config-pw-class)# status protocol notification static oam-class3
```

Related Commands

Command	Description
pseudowire-static-oam class	Creates a class that defines the OAM parameters for the pseudowire.

tlv template

To use the pseudowire type, length, value (TLV) parameters created with the **pseudowire-tlv template** command, use the **tlv template** command in VFI neighbor interface configuration mode. To remove the TLV template, use the **no** form of this command.

tlv template *template-name*
no tlv template *template-name*

Syntax Description

template-name	Name of the TLV template that was created with the **pseudowire-tlv template** command.

Command Default

No TLV template is used.

Command Modes

VFI neighbor interface configuration mode (config-vfi-neighbor-interface)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Ensure that you create the template with the **pseudowire-tlv template** command before specifying the template as part of the local interface configuration.

Examples

The following example shows how to use a TLV template called net.

```
Router(config-vfi-neighbor-interface)# tlv template net
```

Related Commands

Command	Description
pseudowire-tlv template	Creates a template of TLV parameters to use in an MPLS-TP configuration.

trace mpls tp

To display the Multiprotocol Label Switching (MPLS) transport protocol (TP) label switched path (LSP) routes that packets take to their destinations, use the **trace mpls tp** command in privileged EXEC mode.

trace mpls tp tunnel-tp *num* **lsp** {**working** | **protect** | **active**}

[**destination** *ip-addr*]

[**exp** *num*]

[**flags fec**]

[reply dscp *num* | **mode control channel**]

[**source** *ip-addr*]

[**timeout** *num*]

[**ttl** *num*]

[**verbose**]

Syntax Description

tunnel-tp *num*	Specifies the MPLS-TP tunnel number.
lsp {**working** | **protect** | **active**}	Specifies the type of MPLS-TP label switched path (LSP) on which to send echo request packets.
destination *ip-addr*	(Optional) Specifies a network 127 address.
exp *num*	(Optional) Specifies the MPLS experimental field value in the MPLS header for an MPLS echo reply. Valid values are from 0 to 7. Default is 0.
flags fec	(Optional) Allows Forward Equivalence Class (FEC) checking on the transit router. A downstream map TLV containing the correct received labels must be present in the echo request for target FEC stack checking to be performed. Target FEC stack validation is always done at the egress router. Be sure to use this keyword in conjunction with the ttl keyword.
reply dscp *num* |**mode control channel**	(Optional) Provides the capability to request a specific quality of service (QoS) in an echo reply by providing a differentiated services code point (DSCP) value. The echo reply is returned with the IP header type of service (ToS) byte set to the value specified in the **reply dscp** command.
size *num*	Specifies the packet size.
source *ip-addr*	(Optional) Specifies the source address or name. The default address is loopback0. This address is used as the destination address in the MPLS echo response.
timeout *num*	(Optional) Specifies the timeout interval in seconds for an MPLS request packet. The range is from 0 to 3600. The default is 2 seconds.

ttl *num*	(Optional) Specifies a time-to-live (TTL) value. The default is 225 seconds.
verbose	(Optional) Enables verbose output mode.

Command Default Connectivity is not checked.

Command Modes Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines Use the **trace mpls tp** command to validate, test, or troubleshoot MPLS TP LSPs.

Note The **trace mpls tp** command does not support interactive mode.

You can use ping and trace in an MPLS-TP network without IP addressing. However, no IP addresses are displayed in the output.

The following rules determine the source IP address:

1. Use the IP address of the TP interface
2. Use the global router ID.
3. Use router-id : A.B.C.D local node id in IPv4 address format. This is not an IP address. However, it is better to use a value rather than leave it as 0.0.0.0 and risk the packet being deemed invalid and dropped.

Examples The following example checks connectivity of an MPLS-TP LSP:

```
Router# trace mpls tp tunnel-tp 1 lsp working verbose

Tracing MPLS TP Label Switched Path on Tunnel-tp1, timeout is 2 seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no label entry,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'l' - Label switched with FEC change, 'd' - see DDMAP for return code,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.
  0 1.1.1.5 127.0.0.1 MRU 1500 [Labels: 444 Exp: 0]
```

```
I 1 0.0.0.0 127.0.0.1 MRU 1500 [Labels: 300/13 Exp: 0/0] 1 ms, ret code
6
! 2 0.0.0.0 1 ms, ret code 3
```

Related Commands

Command	Description
ping mpls tp	Checks MPLS-TP LSP connectivity.