

MPLS Command Reference for Cisco NCS 5500 Series, Cisco NCS 540 Series, and Cisco NCS 560 Series Routers

First Published: 2017-07-14

Last Modified: 2026-09-11

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Preface

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- Communications, Services, and Additional Information, on page xvi

Changes to This Document

This table lists the technical changes made to this document since it was first published.

Date	Change Summary
December 2015	Initial release of this document.
November 2016	Republished with release 6.1.2 command reference updates.
March 2017	Republished with release 6.2.1 command reference updates.
July 2017	Republished for Release 6.2.2
September 2017	Republished for Release 6.3.1
March 2018	Republished for Release 6.4.1
August 2018	Republished for Release 6.5.1
January 2019	Republished for Release 6.5.2
March 2019	Republished for Release 6.5.3
May 2019	Republished for Release 6.6.25
August 2019	Published for the Release 7.0.1
January 2020	Published for the Release 7.1.1
September 2022	Republished for the Release 7.5.3
December 2024	Republished for the Release 24.4.1

Date	Change Summary
March 2025	Republished for the Release 25.1.1
June 2025	Republished for the Release 25.2.1
September 2025	Republished for the Release 25.3.1
December 2025	Republished for the Release 25.4.1
February 2026	Republished for the Release 26.1.1
June 2026	Republished for the Release 26.2.1

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MPLS ACL Commands

This module describes the commands used to configure the access control list (ACL) for MPLS.

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mpls access-list

To define an MPLS access list, use the **mpls access-list** command in XR Config mode. To remove all entries in an MPLS access list, use the **no** form of this command.

mpls access-list *acl_name*

Syntax Description

acl_name	Name of the access list. Names cannot contain a space or quotation marks.

Command Default

None

Command Modes

XR Config mode

Command History

Release	Modification
Release 24.4.1	This command was introduced.

Usage Guidelines

The **mpls access-list** configuration places the router in the access list configuration mode.

To enable the router to permit the access conditions, use the **permit** command. Use the **deny** command so that the router disallows the access conditions.

The MPLS access list need not be applied to an interface as the **mpls access-list** configuration is used only for monitoring the ingress MPLS packets.

The maximum number of supported port ranges for MPLS must not exceed 23. Port range exceeding 23 results in invalid configuration and reports an OOR (out-of-resource) error condition.

Task ID

Task ID	Operations
acl	read, write
mpls-ldp	read, write
mpls-static	read, write
mpls-te	read, write

Examples

This example shows how to define an MPLS access list.

```
Router(config)# mpls access-list mp
Router(config-mpls-acl)# 10 permit label1 2000  label1 3000  label3 4000  exp1 5 exp2 5
exp3 7
Router(config-mpls-acl)# exit
Router(config)# commit
```



MPLS Label Distribution Protocol Commands

Note All commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router that is introduced from Cisco IOS XR Release 6.3.2. References to earlier releases in Command History tables apply to only the Cisco NCS 5500 Series Router.

Note

- Starting with Cisco IOS XR Release 6.6.25, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 560 Series Routers.
- Starting with Cisco IOS XR Release 6.3.2, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router.
- References to releases before Cisco IOS XR Release 6.3.2 apply to only the Cisco NCS 5500 Series Router.
- Cisco IOS XR Software Release 7.0.1 specific updates are not applicable for the following variants of Cisco NCS 540 Series Routers:
  - N540-28Z4C-SYS-A
  - N540-28Z4C-SYS-D
  - N540X-16Z4G8Q2C-A
  - N540X-16Z4G8Q2C-D
  - N540X-16Z8Q2C-D
  - N540-12Z20G-SYS-A
  - N540-12Z20G-SYS-D
  - N540X-12Z16G-SYS-A
  - N540X-12Z16G-SYS-D

This module describes the commands used to configure Label Distribution Protocol (LDP) in a Multiprotocol Label Switching (MPLS) network on the .

LDP provides a standard methodology for hop-by-hop (or dynamic label) distribution in an MPLS network by assigning labels to routes that have been chosen by the underlying Interior Gateway Protocol (IGP) routing protocols. The resulting labeled paths, called *label switch paths* (LSPs), forward labeled traffic across an MPLS backbone.

LDP also provides the means for label switching routers (LSRs) to request, distribute, and release label prefix binding information to peer routers in a network. LDP enables LSRs to discover potential peers and establish LDP sessions with those peers to exchange label binding information.

For detailed information about MPLS concepts, configuration tasks, and examples, see *MPLS Configuration Guide for Cisco NCS 5500 Series RoutersMPLS Configuration Guide for Cisco NCS 540 Series RoutersMPLS Configuration GuideMPLS Configuration Guide for Cisco NCS 540 Series Routers*.

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backoff

To configure the parameters for the Label Distribution Protocol (LDP) backoff mechanism, use the **backoff** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

backoff *initial maximum*
no backoff

Syntax Description

initial	Initial backoff delay, in seconds. Range is 5 to 2147483 50331.
maximum	Maximum backoff delay, in seconds. Range is 5 to 2147483 50331.

Command Default

initial : 15

maximum : 120

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The LDP backoff mechanism prevents two incompatibly configured label switch routers from engaging in an unthrottled sequence of session setup failures. If a session setup attempt fails (due to incompatibility), each Label Switching Router (LSR) delays the next attempt, increasing the delay exponentially with each successive failure until the maximum backoff delay is reached.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure the initial backoff delay to 30 seconds and the maximum backoff delay to 240 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)# backoff 30 240
```

clear mpls ldp forwarding

To clear (or reset) the MPLS Label Distribution Protocol (LDP) forwarding rewrites, use the **clear mpls ldp forwarding** command in XR EXEC mode.

clear mpls ldp [**vrf** *vrf-name*] [**ipv4** | **ipv6**] **forwarding** [*prefix/length*]

Syntax Description

vrf *vrf-name*	(Optional) Clears the VRF information for the specified VRF.
ipv4	(Optional) Specifies IP version 4 address family.
ipv6	(Optional) Specifies IP version 6 address family.
prefix	(Optional) Destination prefix, written in A.B.C.D format.
length	(Optional) Network mask length, in bits. Range is 0 to 32.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

This command resets LDP installed forwarding state for all prefixes or a given prefix. It is useful when installed LDP forwarding state needs to be reprogrammed in LSD and MPLS forwarding.

Task ID

Task ID	Operations
mpls-ldp	read, write

Example

This example shows how to clear (or reset) the MPLS LDP forwarding rewrites using the **clear mpls ldp forwarding** command:

```
RP/0/RP0/CPU0:router# clear mpls ldp forwarding
```

clear mpls ldp msg-counters neighbor

To clear the Label Distribution Protocol (LDP) message counters, use the **clear mpls ldp msg-counters neighbor** command in XR EXEC mode.

clear mpls ldp [**vrf** *vrf-name*] **msg-counters neighbor** [*lsr-id ldp-id*]

Syntax Description

vrf *vrf-name*	(Optional) Clears the VRF information for the specified VRF.
lsr-id	LSR ID of neighbor in A.B.C.D format.
ldp-id	LDP ID of neighbor in A.B.C.D: format.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **clear mpls ldp msg-counters neighbor** command to clear the statistics on message counters for a specific neighbor (IP address) or for all neighbors. These message counters count the number of LDP protocol messages sent to and received from LDP neighbors.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to clear message counters for neighbor 10.20.20.20:

```
RP/0/RP0/CPU0:router# clear mpls ldp msg-counters neighbor 10.20.20.20
```

clear mpls ldp neighbor

To force Label Distribution Protocol (LDP) session restart, use the **clear mpls ldp neighbor** command in XR EXEC mode.

clear mpls ldp [**vrf all**] [**vrf** *vrf-name*] **neighbor** [*ip-address ldp-id*]

Syntax Description

vrf all	(Optional) Clears all LDP configured VRF neighbors.
vrf *vrf-name*	(Optional) Clears the VRF information for the specified VRF.
ip-address	(Optional) Neighbor IP address.
ldp-id	(Optional) Neighbor LDP ID in A.B.C.D: format.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **clear mpls ldp neighbor** command to restart a single LDP session or all LDP sessions (without restarting the LDP process itself).

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to force an unconditional LDP session restart:

```
RP/0/RP0/CPU0:router# clear mpls ldp neighbor 10.20.20.20
```

clear mpls ldp nsr statistics neighbor

To clear the nonstop routing (NSR) statistics, use the **clear mpls ldp nsr statistics neighbor** command in XR EXEC mode.

clear mpls ldp [**vrf** *vrf-name*] **nsr statistics neighbor** [*lsr-id ldp-id*]

Syntax Description

vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
lsr-id	(Optional) LSR ID of neighbor in A.B.C.D format.
ldp-id	(Optional) LDP ID of neighbor in A.B.C.D: format.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following example shows how to clear NSR statistics for neighbor 10.20.20.20:

```
RP/0/RP0/CPU0:router#clear mpls ldp nsr statistics neighbor 10.20.20.20
```

debug mpls ldp rsi

To enable the display of MPLS LDP router space infrastructure (RSI) debugging events, use the **debug mpls ldp rsi** command in XR EXEC mode. To disable the display of MPLS LDP RSI debugging information, use the **no** form of this command.

debug mpls ldp rsi [**location** *node-id*]
no debug mpls ldp rsi [**location** *node-id*]

Syntax Description

location *node-id*	(Optional) Displays location information for the specified node ID.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following example shows how to enable MPLS LDP RSI debugging events:

```
RP/0/RP0/CPU0:router# debug mpls ldp rsi
```

debug mpls ldp vrf

To enable the display of MPLS LDP virtual routing and forwarding (VRF) debugging events, use the **debug mpls ldp vrf** command in XR EXEC mode. To disable the display of MPLS LDP VRF debugging information, use the **no** form of this command.

debug mpls ldp vrf [**location** *node-id*]
no debug mpls ldp vrf [**location** *node-id*]

Syntax Description

location *node-id*	(Optional) Displays location information for the specified node ID.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following example shows how to enable MPLS LDP VRF debugging events:

```
RP/0/RP0/CPU0:router# debug mpls ldp vrf
```

default-route

To enable Multiprotocol Label Switching (MPLS) switching for IP default route by allocating and advertising non-null label, use the **default-route** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

default-route
no default-route

Syntax Description

This command has no arguments or keywords.

Command Default

Allocates null (implicit or explicit) local label for IP default route prefix 0.0.0.0/0.

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

When the IP default route 0.0.0.0/0 is configured on an egress router, it is advertised through Interior Gateway Protocol (IGP) to other routers to enable default IP forwarding. When MPLS LDP is configured and establishing label switch paths (LSPs) for other prefixes, you can emulate default forwarding and switching for MPLS in the same way as IP forwarding. To do so, allocate a non-null local label and advertise this label to its peers.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to enable default MPLS switching for default prefix:

```
RP/0/RP0/CPU0:router(config-ldp)# default-route
```

default-vrf implicit-ipv4 disable

To disable the implicitly enabled IPv4 address family for default VRF, use the **default-vrf implicit-ipv4 disable** command in MPLS LDP configuration mode.

default-vrf implicit-ipv4disable

This command has no keywords or arguments.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls ldp	read, write

Example

The following example shows how to disable the implicitly enabled IPv4 address family for default VRF:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#mpls ldp
RP/0/0/CPU0:ios(config-ldp)#router-id 5.5.5.5
RP/0/0/CPU0:ios(config-ldp)#default-vrf implicit-ipv4 disable
```

discovery hello

To configure the interval between transmission of consecutive Label Distribution Protocol (LDP) discovery hello messages and the holdtime for a discovered LDP neighbor, use the **discovery hello** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

discovery hello {**holdtime** *seconds* | **interval** *seconds*}
no discovery hello {**holdtime** | **interval**}

Syntax Description

holdtime	Sets the time, in seconds, a discovered LDP neighbor is remembered without receipt of an LDP hello message from the neighbor. Default is 15.
interval	Sets the time, in seconds, between consecutive hello messages. Default is 5.
seconds	Time value, in seconds. Range is 1 to 65535 (65535 means infinite).

Command Default

holdtime: 15

interval: 5

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure the link hello holdtime to 30 seconds:

```
RP/0/RP0/CPU0:router(config-ldp)# discovery hello holdtime 30
```

The following example shows how to configure the link hello interval to 10 seconds:

```
RP/0/RP0/CPU0:router(config-ldp)# discovery hello interval 10
```

discovery instance-tlv disable

To disable transmit and receive processing for Type-Length-Value (TLV), use the **discovery instance-tlv disable** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

discovery instance-tlv disable
no discovery instance-tlv disable

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to disable transmit and receive processing for TLV:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)# discovery instance-tlv disable
```

discovery targeted-hello

To configure the interval between transmission of consecutive Label Distribution Protocol (LDP) discovery targeted-hello messages, the hold time for a discovered targeted LDP neighbor, and to accept targeted hello from peers, use the **discovery targeted-hello** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

discovery targeted-hello address-family {**ipv4** | **ipv6**} {**accept** | [**from** *acl*] | **holdtime** *seconds* | **interval** *seconds*}
no discovery targeted-hello {**accept** | **holdtime** | **interval**}

Syntax Description

accept	Accepts targeted hellos from any source.
ipv4	Specifies IP version 4 address family.
ipv6	Specifies IP version 6 address family.
from *acl*	(Optional) Accepts targeted hellos from LDP peers as permitted by the access-list.
holdtime	Configures the time a discovered LDP neighbor is remembered without receipt of an LDP hello message from a neighbor.
interval	Displays time between consecutive hello messages.
seconds	Time value, in seconds. Range is 1 to 65535.

Command Default

accept : Targeted hello messages are not accepted from any source (neighbor).

holdtime : 90

interval : 10

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

- LDP supports IPv4 standard access lists only.
- When you configure the **targeted-hello interval** and **holdtime** for MPLS LDP, the interval is determined by this formula:

  Effective targeted-hello interval = min ("targeted-hello interval", "holdtime/9")

  Example: If you set the **targeted-hello interval** to 10 seconds and the **holdtime** to 45 seconds, the effective interval becomes 5 seconds because minimum of (10, 45/9) is equal to 5.

  To maintain a 10 second interval, set the **holdtime** to at least 90 seconds. Adjust these parameters to suit your network requirements.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure the targeted-hello holdtime to 45 seconds:

```
RP/0/RP0/CPU0:router(config-ldp)# discovery targeted-hello holdtime 45
```

The following example shows how to configure the targeted-hello interval to 5 seconds:

```
RP/0/RP0/CPU0:router(config-ldp)# discovery targeted-hello interval 5
```

The following example shows how to configure acceptance of targeted hellos from all peers:

```
RP/0/RP0/CPU0:router(config-ldp)# discovery targeted-hello accept
```

The following example shows how to configure acceptance of targeted hello from peers 10.1.1.1 and 10.2.2.2 only:

```
RP/0/RP0/CPU0:router(config)# ipv4 access-list peer_acl_10
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 10.1.1.1
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 10.2.2.2
RP/0/RP0/CPU0:router(config-ldp)# discovery targeted-hello accept from peer_acl_10
```

discovery transport-address

To provide an alternative address for a TCP connection, use the **discovery transport-address** command in MPLS LDP interface configuration mode. To return to the default behavior, use the **no** form of this command.

[**vrf** *vrf-name*][**interface** *type interface-path-id*] **address-family**
ipv4 | **ipv6**
discovery transport-address {*ip-address* | **interface**}
no [**vrf** *vrf-name*][**interface** *type interface-path-id* **address-family**] {**ipv4** | **ipv6**} **discovery transport-address** {*ip-address* | **interface**}

Syntax Description

vrf *vrf-name*	(Optional) Specifies the VRF name.
interface *type*	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
address-family ipv4	Specifies IP version 4 address family.
ipv6	Specifies IP version 6 address family.
ip-address	IP address to be advertised as the transport address in discovery hello messages.
interface	Advertises the IP address of the interface as the transport address in discovery hello messages.

Command Default

LDP advertises its LDP router ID as the transport address in LDP discovery hello messages.

Command Modes

MPLS LDP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Establishing an LDP session between two routers requires a TCP session connection. To establish the TCP session connection, each router must know the transport address (IP address) of the other router.

The LDP discovery mechanism provides the means for a router to advertise transport addresses. Transport address is implicit or explicit. Implicit addresses do not appear as part of the contents of the discovery hello messages sent to the peer. If explicit, the advertisement appears as part of the contents of discovery hello messages sent to the peer.

The **discovery transport-address** command modifies the default behavior described above. Using the **interface** keyword, LDP advertises the IP address of the interface in LDP discovery hello messages sent from the interface. Using the *ip-address* argument, LDP advertises the IP address in LDP discovery hello messages sent from the interface.



Note When a router has multiple links connecting it to its peer device, the router must advertise the same transport address in the LDP discovery hello messages it sends on all such interfaces.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to specify an exiting address (10.10.3.1) as the transport address on an interface HundredGigE 0/1/0/0:

```
RP/0/RP0/CPU0:router(config-ldp)# interface POS 0/1/0/0interface POS 0/1/0/0
RP/0/RP0/CPU0:router(config-ldp-if)# address-family ipv4
RP/0/RP0/CPU0:router(config-ldp-if-af)#discovery transport-address 10.10.3.1

RP/0/RP0/CPU0:router# show mpls ldp neighbor

  Peer LDP Identifier: 10.44.44.44:0
    TCP connection: 10.44.44.44:65520 - 10.10.3.1:646
    Graceful Restart: Yes (Reconnect Timeout: 15 sec, Recovery: 180 sec)
    State: Oper; Msgs sent/rcvd: 13/9
    Up time: 00:00:11
    LDP Discovery Sources:
         POS 0/1/0/0
    Addresses bound to this peer:
      10.10.3.2       10.44.44.44
```

downstream-on-demand

To configure MPLS Label Distribution Protocol (LDP) downstream-on-demand mode, use the **downstream-on-demand** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

[**vrf** *vrf-name* **session**]
downstream-on-demand with *access-list*

Syntax Description

vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
session	(Optional) Configures session parameters.
with	Displays access list of LDP peers.
access-list	IPv4 access-list name.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read, write

Examples

This is a sample output from the **downstream-on-demand** command:

```
RP/0/RP0/CPU0:router(config-ldp)# downstream-on-demand with access-list
```

explicit-null

To configure a router to advertise explicit null labels instead of implicit null labels, use the **explicit-null** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

[**vrf** *vrf-name*] **address-family** {**ipv4** | **ipv6**} **label local advertise explicit-null** [**to** *peer-acl* | **for** *prefix-acl* [**to** *peer-acl*]]
no [**vrf** *vrf-name*] **address-family** {**ipv4** | **ipv6**} **label local advertise explicit-null** [**to** *peer-acl* | **for** *prefix-acl* [**to** *peer-acl*]]

Syntax Description

vrf *vrf-name*	(Optional) Specifies the VRF name.
address-family ipv4	Specifies IP version 4 address family.
ipv6	Specifies IP version 6 address family.
label	Configures label control and policies.
local	Configures local label control and policies.
advertise	Configures outbound label advertisement control.
to *peer-acl*	(Optional) Specifies LDP peers for which explicit-null is advertised instead of implicit-null. Range is 1 to 99.
for *prefix-acl*	(Optional) Specifies prefixes for which explicit-null is advertised instead of implicit-null. Range is 1 to 99.

Command Default

Implicit null is advertised as default null label for routes, such as directly connected routes.

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Normally, LDP advertises an implicit null label for directly connected routes. The implicit null label causes the previous hop router to perform next to last router hop popping.

The **explicit-null** command advertises the explicit-null labels in place of implicit null labels for directly connected prefixes.

LDP supports IPv4 standard access lists only.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following command shows how to advertise explicit null for all directly connected routes to all LDP peers:

```
RP/0/RP0/CPU0:router(config-ldp-af-lbl-lcl-advt)# explicit-null
```

The following command sequence shows how to advertise explicit-null for directly connected route 192.168.0.0 to all LDP peers and implicit-null for all other directly connected routes:

```
RP/0/RP0/CPU0:router(config)# ipv4 access-list pfx_acl_192_168
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 192.168.0.0
RP/0/RP0/CPU0:router(config-ldp-af-lbl-lcl-advt)# explicit-null for pfx_acl_192_168
```

The following command sequence shows how to send explicit-null for all directly connected routes to peers 10.1.1.1 and 10.2.2.2 and implicit-null to all other peers:

```
RP/0/RP0/CPU0:router(config)# ipv4 access-list peer_acl_10
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 10.1.1.1
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 10.2.2.2
RP/0/RP0/CPU0:router(config-ldp-af-lbl-lcl-advt)# explicit-null to peer_acl_10
```

The following command shows how to advertise explicit-null for prefix 192.168.0.0 to peers 10.1.1.1 and 10.2.2.2 and advertise implicit-null for all other applicable routes to all other peers:

```
RP/0/RP0/CPU0:router(config-ldp-af-lbl-lcl-advt)# explicit-null for pfx_acl_192_168 to
peer_acl_10
```

graceful-restart (MPLS LDP)

To configure graceful restart, use the **graceful-restart** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

graceful-restart [**reconnect-timeout** *seconds* | **forwarding-state-holdtime** *seconds*]
no graceful-restart [**reconnect-timeout** | **forwarding-state-holdtime**]

Syntax Description

reconnect-timeout *seconds*	(Optional) Configures the time that the local LDP sends to its graceful restartable peer, indicating how long its neighbor should wait for reconnection in the event of a LDP session failure, in seconds. Range is 60 to 1800.
forwarding-state-holdtime *seconds*	(Optional) Configures the time the local forwarding state is preserved (without being reclaimed) after the local LDP control plane restarts, in seconds. Range is 60 to 1800.

Command Default

By default, graceful restart is disabled.

reconnect-timeout: 120

forwarding-state-holdtime: 180

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the LDP graceful restart capability to achieve nonstop forwarding (NSF) during an LDP control plane communication failure or restart. To configure graceful restart (MPLS LDP) between two peers, enable LDP graceful restart on both label switch routers (LSRs).

When an LDP graceful restart session is established and there is control plane failure, the peer LSR starts graceful restart procedures, initially keeps the forwarding state information pertaining to the restarting peer, and marks this state as stale. If the restarting peer does not reconnect within the reconnect timeout, the stale forwarding state is removed. If the restarting peer reconnects within the reconnect time period, it is provided recovery time to resynchronize with its peer. After this time, any unsynchronized state is removed.

The value of the forwarding state hold time keeps the forwarding plane state associated with the LDP control-plane in case of a control-plane restart or failure. If the control plane fails, the forwarding plane retains the LDP forwarding state for twice the forwarding state hold time. The value of the forwarding state hold time is also used to start the local LDP forwarding state hold timer after the LDP control plane restarts. When the LDP graceful restart sessions are renegotiated with its peers, the restarting LSR sends the remaining value

of this timer as the recovery time to its peers. Upon local LDP restart with graceful restart enabled, LDP does not replay forwarding updates to MPLS forwarding until the forwarding state hold timer expires.



Note In the presence of a peer relationship, any change to the LDP graceful restart configuration will restart LDP sessions. If LDP configuration changes from nongraceful restart to graceful restart, all the sessions are restarted. Only graceful restart sessions are restarted upon graceful restart to nongraceful restart configuration changes.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure an existing session for graceful restart:

```
RP/0/RP0/CPU0:router(config-ldp)# graceful-restart

RP/0/RP0/CPU0:router:Apr  3 10:56:05.392 : mpls_ldp[336]: %ROUTING-LDP-5-NBR_CHANGE : Nbr
172.16.0.1:0, DOWN
RP/0/RP0/CPU0:router:Apr  3 10:56:05.392 : mpls_ldp[336]: %ROUTING-LDP-5-NBR_CHANGE : Nbr
192.168.0.1:0, DOWN
RP/0/RP0/CPU0:router:Apr  3 10:56:09.525 : mpls_ldp[336]: %ROUTING-LDP-5-NBR_CHANGE : Nbr
192.168.0.1:0, UP
RP/0/RP0/CPU0:router:Apr  3 10:56:11.114 : mpls_ldp[336]: %ROUTING-LDP-5-NBR_CHANGE : Nbr
172.16.0.1:0, UP

RP/0/RP0/CPU0:router# show mpls ldp neighbor brief

  Peer              GR Up Time         Discovery Address
  ----------------- -- --------------- --------- -------
  192.168.0.1:0       Y  00:01:04               3       8
  172.16.0.1:0        N  00:01:02               2       5

RP/0/RP0/CPU0:router# show mpls ldp graceful-restart

    Forwarding State Hold timer : Not Running
    GR Neighbors                : 1

     Neighbor ID      Up  Connect Count  Liveness Timer      Recovery Timer
     ---------------  --  -------------  ------------------  ------------------
     192.168.0.1          Y        1               -                   -
```

hw-module fib mpls label lsr-optimized

To enable label-based LSR optimization, use the **hw-module fib mpls label lsr-optimized** command in global configuration mode.

hw-module fib mpls label lsr-optimized

Syntax Description

This command has no keywords or arguments.

Command Default

None

Command Modes

XR Configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The router must be reloaded for the **hw-module fib mpls label lsr-optimized** feature to be functional.

When you enable the **hw-module fib mpls label lsr-optimized** profile, QPPB doesn't work for /32 IPv4 prefixes on NCS 5500 line card-based routers.

Task ID

Task ID	Operation
system	read, write

The following example shows how to enable the label-based LSR optimization.

```
Router(config)# hw-module fib mpls label lsr-optimized
Router(config)# commit
```

session holdtime (MPLS LDP)

To change the time for which an Label Distribution Protocol (LDP) session is maintained in the absence of LDP messages from the session peer, use the **session holdtime** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

session holdtime *seconds*
no session holdtime

Syntax Description

seconds	Time, in seconds, that an LDP session is maintained in the absence of LDP messages from the session peer. Range is 15 to 65535.

Command Default

seconds: 180

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to change the hold time of LDP sessions to 30 seconds:

```
RP/0/RP0/CPU0:router(config-ldp)# session holdtime 30
```

igp auto-config disable

To disable Label Distribution Protocol (LDP) auto-configuration, use the **igp auto-config disable** command in MPLS LDP interface configuration mode. To return to the default behavior, use the **no** form of this command.

igp auto-config disable
no igp auto-config disable

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS LDP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

IGP auto-configuration can be enabled on ISIS and OSPF. Configuration details are described in *Routing Configuration Guide for Cisco NCS 5500 Series Routers*.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to disable LDP auto-configuration on POS 0/1/0/3:

```
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)# interface pos 0/1/0/3
RP/0/RP0/CPU0:router(config-ldp-if)# igp auto-config disable
```

igp sync delay

To enable Label Distribution Protocol (LDP) Interior Gateway Protocol (IGP) sync delay timer feature, use the **igp sync delay** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

igp sync delay *seconds*
no igp sync delay

Syntax Description

seconds	Time, in seconds, that declaration of LDP sync state being up is delayed after session establishment upon link coming up. Range is 5 to 300.

Command Default

LDP does not delay declaration of sync up and notifies IGP as soon as sync up conditions are met for a link.

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

- By default, LDP declares LDP sync up as soon as all the requisite conditions are met, namely:
  - LDP session is up.
  - LDP has sent all its label bindings to at least one peer.
  - LDP has received at least one label binding from a peer.

  This minimizes traffic loss on link up but can still lead to substantial traffic loss under certain circumstances (for example, when interoperating with an LSR with ordered mode operation). It may be necessary to delay declaration of sync up after the session comes up by configuring a timeout period.
- When the graceful-restart event is configured, the IGP sync delay timer does not take effect.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure LDP to delay declaration of sync-up to 30 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)# igp sync delay 30
```

igp sync delay on-proc-restart

To delay the declaration of synchronization events to the Interior Gateway Protocol (IGP) when the label distribution protocol (LDP) fails or restarts, use the **igp sync delay on-proc restart** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

igp sync delay on-proc restart *seconds*
no igp sync delay on-proc restart *seconds*

Syntax Description

seconds	Time, in seconds, duration of process-level delay for synchronization events when the LDP fails or restarts. Range is from 60 to 600.

Command Default

This command is disabled by default.

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **igp sync delay on-proc restart** command enables a process-level delay for synchronization events when the LDP fails or restarts. This delay defers the sending of sync-up events to the IGP until most or all the LDP sessions converge and also allows the LDP to stabilize. This allows the LDP process failure to be less stressful because IGPs receive all the sync-up events in bulk. This means that the IGP is required to run the shortest path first (SPF) and link-state advertisements (LSAs) only one time with an overall view of the sync-up events.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure LDP to delay the declaration of synchronization events to IGP by 60 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)# igp sync delay on-proc restart 60
```

The following example shows the status following execution of the command:

```
RP/0/RP0/CPU0:router# show mpls ldp igp sync

  Process Restart Sync Delay: 60 sec, Gloal timer running (15 sec remaining)
  GigabitEthernet0/3/0/2:
  Sync status: Deferred
  ….
```

When the timer is not running, the output displays the following:

```
Process Restart Sync Delay: 60 sec, Global timer not running
```

implicit-null-override

To configure a router to advertise implicit null labels to a set of prefixes, for which a non-null label is to be advertised by default, use the **implicit-null-override** command in MPLS LDP label configuration mode. To return to the default behavior, use the **no** form of this command.

[**vrf** *vrf-name*] **address-family** {**ipv4** | **ipv6**} **label local implicit-null-override** {**for** *prefix-acl*}
no [**vrf** *vrf-name*] **address-family** {**ipv4** | **ipv6**} **label local implicit-null-override**

Syntax Description

vrf *vrf-name*	(Optional) Specifies the VRF name.
address-family ipv4	Specifies IP version 4 address family.
ipv6	Specifies IP version 6 address family.
label	Configure label control and policies.
local	Configure local label control and policies.
for *prefix-acl*	Specifies the usage of implicit-null label to a set of prefixes. Range is 1 to 99. **Note** This command works with any prefix including static, IGP, and BGP, when specified in the ACL.

Command Default

Implicit null is advertised as default null label for routes, such as directly connected routes, whereas a non-null label is advertised for IGP, BGP, and static prefixes.

Command Modes

MPLS LDP label configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read, write

The following command shows how to advertise implicit-null label to a specific LDP peer:

```
RP/0/RP0/CPU0:router(config-ldp-af-lbl-lcl)# implicit-null-override for 80
```

interface (MPLS LDP)

To configure or enable Multiprotocol Label Switching (MPLS) Label Distribution Protocol (LDP) on an interface, use the **interface** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

interface *type interface-path-id*
no interface *type interface-path-id*

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

When you configure LDP on an interface, the LDP process begins neighbor discovery, sending link hello messages on the interface. This can result in a session setup with discovered neighbors. When LDP is enabled on tunnel-te interfaces, targeted discovery procedures apply.

LDP interface configuration supports forward reference; accordingly, it is possible to configure a nonexisting interface under LDP.



Note You cannot enable LDP on loopback and GRE tunnel interfaces.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure LDP on POS interface 0/1/0/0:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)# interface POS 0/1/0/0
RP/0/RP0/CPU0:router(config-ldp-if)#
```

The following example shows how to configure LDP on an MPLS TE tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)# interface tunnel-te 123
RP/0/RP0/CPU0:router(config-ldp-if)#
```

This example shows how to configure MPLS LDP over BVI interfaces:

```
RP/0/RP0/CPU0:router#configure
RP/0/RP0/CPU0:router(config)#mpls ldp
RP/0/RP0/CPU0:router(config-ldp)#interface BVI 65535
RP/0/RP0/CPU0:router(config-ldp-if)#
```

Only static MPLS tunnels can use BVI as next hop. You can use a BVI for static MPLS configuration, and not for dynamic MPLS configuration, such as label distribution using LDP.

label accept

To control the receipt of labels (remote bindings) for a set of prefixes from a peer, use the **label accept** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

label accept for *prefix-acl* **from** *ip-address*
no label accept for *prefix-acl* **from** *ip-address*

Syntax Description

for *prefix-acl*	Accepts and retains remote bindings for prefixes that are permitted by the prefix access list *prefix-acl* argument.
from *ip-address*	Displays the peer IP address.

Command Default

LDP accepts and retains label bindings for all prefixes from all peers.

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

By default, LDP accepts labels (as remote bindings) for all prefixes from all its peers. To save resources (such as memory) configure the access list to specify label and binding acceptance for a set of prefixes from a peer.

If the inbound label filtering policy changes such that it now allows previously denied prefixes from a peer, you must reset the LDP session with the peer using the **clear mpls ldp neighbor** command.

LDP supports IPv4 standard access lists only.

Note Label acceptance control is also referred to as LDP inbound label filtering.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure inbound label filtering policy. In this example, an LSR is configured to accept and retain label bindings for prefixes 192.168.1.1 (pfx_acl_1) from peer 10.0.0.1, prefix 192.168.2.2 (pfx_acl_2) from peer 172.16.0.1, and prefixes 192.168.1.1, 192.168.2.2, 192.168.3.3 (pfx_acl_3) from peer 209.165.201.1:

```
RP/0/RP0/CPU0:router(config-ldp)# label accept
RP/0/RP0/CPU0:router(config-ldp-lbl-acpt)# for pfx_acl_1 from 10.0.0.1
RP/0/RP0/CPU0:router(config-ldp-lbl-acpt)# for pfx_acl_2 from 172.16.0.1
```

```
RP/0/RP0/CPU0:router(config-ldp-lbl-acpt)# for pfx_acl_3 from 209.165.201.1
```

label advertise

To control the advertisement of local labels, use the **label advertise** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

label advertise [**disable** | **for** *prefix-acl* [**to** *peer-acl*] | **interface** *type interface-path-id*]
no label advertise [**disable** | **for** *prefix-acl* [**to** *peer-acl*] | **interface** *type interface-path-id*]

Syntax Description

disable	(Optional) Disables label advertisement to all peers for all prefixes.
for *prefix-acl*	(Optional) Specifies prefix destinations for which labels will be advertised.
to *peer-acl*	(Optional) Specifies which LDP neighbors will receive label advertisements.
interface	(Optional) Specifies an interface for label allocation and advertisement of its interface IP address.
type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

LDP advertises labels for all known prefixes to all peers. LDP does not advertise labels for local interfaces addresses other than Loopback interfaces.

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **label advertise** command determines how the label switch router (LSR) advertises local labels. The following rules describe the effects of running multiple commands:

- Every command has a prefix-acl or peer-acl pair associated with it, as follows:
  - In the absence of the **for** or **to** keywords, the access list pair is (none, none).
  - When using the **for** keyword without the **to** keyword, the access list is (prefix-acl, none).
- A prefix can have a maximum of one (prefix-acl, peer-acl) pair, as follows:
  - A (prefix-acl, peer-acl) pair applies to a prefix only if the prefix-acl matches the prefix. A match occurs if the prefix-acl permits the prefix.

- If more than one (prefix-acl, peer-acl) pair from multiple **label advertise** commands matches a prefix, the (prefix-acl, peer-acl) pair in the first command applies to the prefix. The order in which the **label advertise** commands are processed is sorted based on the ACL names in a MIB-lexicographical way (shorter ACL name length is processed first, if two ACLs are of equal length, then dictionary ordering is used).

- When an LSR is ready to advertise a label for a prefix, the LSR determines whether a (prefix-acl, peer-acl) pair applies to the prefix.
  - If none applies, and if the **disable** keyword has been configured for the command, the label for the prefix is not advertised to any peer; otherwise, the label is advertised to all peers.
  - If a (prefix-acl, peer-acl) pair applies to the prefix, and if the prefix-acl denies the prefix, the label is not advertised to any peer.
  - If (prefix-acl, peer-acl) pair applies to the prefix and if the prefix-acl denies the prefix, the label is not advertised to peers defined in the peer-acl. Nevertheless, the prefix may be matched in subsequent (prefix-acl, peer-acl) entries and advertised to other peers.
  - If the prefix-acl permits the prefix and there is a peer-acl, the label is advertised to all peers permitted by the peer-acl.

Normally, LDP advertises labels for non-BGP routes present in the routing table. Additionally, LDP advertises labels from /32 IP addresses on Loopback interfaces and does not advertise /32 addresses for other non-Loopback interfaces. To control advertisement of labels for /32 IP addresses on these interfaces, use the **label advertise interface** command.

LDP supports IPv4 standard access lists only.



Note Label advertisement control is also referred to as LDP outbound label filtering.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to disable advertisement of all locally assigned labels to all peers:

```
RP/0/RP0/CPU0:router(config-ldp)# label advertise
RP/0/RP0/CPU0:router(config-ldp-lbl-advt)# disable
```

The following example shows how to send labels only for prefixes 10.1.1.0 and 20.1.1.0 to all peers:

```
RP/0/RP0/CPU0:router(config)# ipv4 access-list pfx_acl_1
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 10.1.1.0
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 20.1.1.0

RP/0/RP0/CPU0:router(config-ldp)# label advertise
RP/0/RP0/CPU0:router(config-ldp-lbl-advt)# disable
```

```
RP/0/RP0/CPU0:router(config-ldp-lbl-advt)# for pfx_acl_1
```

The following example shows how to send labels for prefix 10.0.0.0 to peers 10.1.1.1 and 10.2.2.2, labels for prefix 20.0.0.0 to peer 20.1.1.1, and labels for all other prefixes to all other peers:

```
RP/0/RP0/CPU0:router(config)# ipv4 access-list pfx_acl_10
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 10.0.0.0

RP/0/RP0/CPU0:router(config)# ipv4 access-list pfx_acl_20
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 20.0.0.0

RP/0/RP0/CPU0:router(config)# ipv4 access-list peer_acl_10
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 10.1.1.1
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 10.2.2.2

RP/0/RP0/CPU0:router(config)# ipv4 access-list peer_acl_20
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 20.1.1.1

RP/0/RP0/CPU0:router(config-ldp)# label advertise
RP/0/RP0/CPU0:router(config-ldp-lbl-advt)# for pfx_acl_10 to peer_acl_10
RP/0/RP0/CPU0:router(config-ldp-lbl-advt)# for pfx_acl_20 to peer_acl_20
```

Note To advertise pfx_acl_10 to peer_acl_10 and pfx_acl_20 to peer_acl_20 and disable all other advertisements to all other peers, include the **disable** keyword with the **label advertise** command.

The following example shows how to use the **interface** keyword to advertise /32 IP address for HundredGigE 0/0/0/1:

```
RP/0/RP0/CPU0:router(config-ldp)# label advertise
RP/0/RP0/CPU0:router(config-ldp-lbl-advt)# interface POS 0/1/0/0
```

label allocate

To control allocation of local label only for a set of prefixes, use the **label allocate** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

label allocate for {*prefix-acl* | **host-routes**}
no label allocate

Syntax Description

for	Specifies set of prefixes for which local label needs to be allocated.
prefix-acl	IP access-list name or number. Range is from 1 to 99.
host-routes	Allocates the label for host routes only.

Command Default

LDP allocates local label for all learned routes (prefixes).

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Local label allocation control lets you override the default label allocation policy and provides many benefits, including reduced memory usage and fewer forwarding and network updates.

By default, LDP allocates local labels for all learned routes. There are times when you may want to limit label allocation for a given set of prefixes; for example, when using LDP in the core network to provide MPLS transport from one edge to another edge. In such cases, it is necessary to set up label switch packets (LSPs) for Loopback /32 addresses for provider edge (PE) routers (rendering it unnecessary to allocate and advertise local labels for other Interior Gateway Protocol (IGP) prefixes).

LDP supports IPv4 standard access lists only.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure LDP to limit allocation of local labels to prefixes 192.168.1.1, 192.168.2.2, and 192.168.3.3 only:

```
RP/0/RP0/CPU0:router(config)# ipv4 access-list pfx_acl_1
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 192.168.1.1
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 192.168.2.2
RP/0/RP0/CPU0:router(config-ipv4-acl)# permit 192.168.3.3

RP/0/RP0/CPU0:router(config-ldp)# label allocate for pfx_acl_1
```

log graceful-restart

To set up notification describing graceful-restart (GR) session events, use the **log graceful-restart** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

log graceful-restart
no log graceful-restart

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **log graceful-restart** command to receive a syslog/console message when a graceful restart-related session event occurs, including LDP graceful restart session disconnection, reconnection, and timeout.

Note A logging message is issued upon graceful restart session events.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to enable logging messages for graceful restart session events:

```
RP/0/RP0/CPU0:router(config-ldp)# log graceful-restart
```

The following sample output shows the logging events that can be displayed on the console:

```
RP/0/RP0/CPU0:router: mpls_ldp[340]: %ROUTING-LDP-5-GR : GR session 4.4.4.4:0 (instance 1)
 disconnected

RP/0/RP0/CPU0:router: mpls_ldp[340]: %ROUTING-LDP-5-GR : GR session 4.4.4.4:0 (instance 2)
 reconnected

RP/0/RP0/CPU0:router: mpls_ldp[340]: %ROUTING-LDP-5-GR : GR session 5.5.5.5:0 (instance 3)
 timed out

RP/0/RP0/CPU0:router: mpls_ldp[336]: %ROUTING-LDP-5-GR_RESTART_COMPLETE : GR forwarding
state hold timer has expired
```

log neighbor

To enable logging of notices describing session changes, use the **log neighbor** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

log neighbor
no log neighbor

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **log neighbor** command to receive a syslog or console message when a neighbor goes up or down.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to enable logging messages for neighbor session up and down events:

```
RP/0/RP0/CPU0:router(config-ldp)# log neighbor
```

Note A logging message is issued when an LDP session state changes from up to down (and down to up).

The following shows sample output of logging events that can be displayed on the console:

```
RP/0/RP0/CPU0:router:10 21:11:32.111:mpls_ldp[113]:%LDP-5-NBR_CHANGE: Nbr 10.44.44.44:0,
DOWN
```

log nsr

To enable logging of nonstop routing (NSR) synchronization events, use the **log nsr** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

log nsr
no log nsr

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to enable logging of NSR synchronization events:

```
RP/0/RP0/CPU0:router(config-ldp)# log nsr
```

log session-protection

To enable logging of notices describing LDP session protection events, use the **log session-protection** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

log session-protection
no log session-protection

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **log session-protection** command to receive a syslog or console message when LDP session protection event occurs. These events include LDP session protection initiation, recovery, and timeout.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to enable logging messages for session protection events:

```
RP/0/RP0/CPU0:router(config-ldp)# log session-protection
```

Note Logging messages are issued when session protection events occur.

The following sample output shows the logging events that are displayed on the console:

```
RP/0/RP0/CPU0:router:Apr 21 12:15:01.742: mpls_ldp[315]:%ROUTING-LDP-5-SESSION_PROTECTION:
 Session hold up initiated for peer 4.4.4.4:0

RP/0/RP0/CPU0:router:Apr 21 12:18:04.987: mpls_ldp[315]:%ROUTING-LDP-5-SESSION_PROTECTION:
 Session recovery succeeded for peer 4.4.4.4:0
```

make-before-break

To enable Multicast Label Distribution Protocol (MLDP) make-before-break (MBB) support, use **make-before-break** command in MPLS LDP MLDP configuration.

address-family ipv4 make-before-break
[**delay** *seconds* | **route-policy** *name* | **duplicate-mitigation** *delay*]

Syntax Description

delay *seconds*	(Optional) Specifies the MBB forwarding delay in seconds. Range is 0 to 600.
route-policy *name*	(Optional) Specifies the route policy name.
duplicate-mitigation *delay*	(Optional) Activate new LSP after de-activating the old LSP during MBB session. The delay timer (0–50 milliseconds) specifies the switchover interval between the old and new LSPs.

Command Default

No default behavior or values

Command Modes

MPLS LDP MLDP configuration

Command History

Release	Modification
Release 26.1.1	The **duplicate-mitigation** keyword is introduced.
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read, write

The following example shows how to enable MLDP MBB support:

```
RP/0/RP0/CPU0:router(config-ldp-mldp)# address-family ipv4 make-before-break
```

The following example shows how to configure duplicate-mitigation delay timer of 10 milliseconds to control the switchover interval between the old and new LSPs.

```
RP/0/RP0/CPU0:router(config-ldp-mldp)# address-family ipv4
RP/0/RP0/CPU0:router(config-ldp-mldp-af)# make-before-break delay 60 duplicate-mitigation
10
```

mpls ldp

To enter MPLS Label Distribution Protocol (LDP) configuration mode, use the **mpls ldp** command in XR Config mode

mode.

mpls ldp

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to MPLS LDP configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)
```

neighbor dual-stack transport-connection max-wait

To configure the maximum time (in seconds) the preferred address family connection must wait to establish before resorting to non-preferred address family or FCFS, use the **neighbor dual-stack transport-connection max-wait** command in MPLS LDP configuration mode.

neighbor dual-stack transport-connection max-wait *seconds*

Syntax Description

seconds	Specifies the maximum wait time in seconds for preferred transport connection establishment. The range is from 0 to 60. Zero indicates no preference.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls ldp	read, write

Example

The following example shows how to configure the maximum wait time for preferred transport connection establishment:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#mpls ldp
RP/0/0/CPU0:ios(config-ldp)#neighbor dual-stack transport-connection max-wait 5
```

neighbor dual-stack transport-connection prefer ipv4 for-peers

To configure preferred transport as IPv4 for set of peers to establish TCP connection in a dual-stack setup, use the **neighbor dual-stack transport-connection prefer ipv4 for-peers** command in the MPLS LDP configuration mode.

neighbor dual-stack transport-connection prefer ipv4 for-peers *access-list*

Syntax Description

access-list	IPv4 access-list (specifies peer LSR IDs in A.B.C.D format).

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls ldp	read, write

Example

The following example shows how to configure preferred transport as IPv4 for set of peers:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#mpls ldp
RP/0/0/CPU0:ios(config-ldp)#neighbor dual-stack transport-connection prefer ipv4 for-peers
 192.168.0.1
```

neighbor password

To configure password authentication using the TCP Message Digest 5 (MD5) option for a neighbor, use the **neighbor password** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

[**vrf** *vrf-name*] **neighbor** *ldp-id* **password** **{clear | disable | encrypted** *password* **}**
no [**vrf** *vrf-name*] **neighbor** *ldp-id* **password**

Syntax Description

vrf *vrf-name*	(Optional) Specifies the VRF name.
ldp-id	LDP ID of neighbor in A.B.C.D:0 format.
clear	Clears the password for the encyrption parameter to specify that an unencrypted password will follow.
disable	Disables the global password from the specified neighbor.
encrypted	Specifies that an encrypted password will follow.
password	(Clear text) Encrypted or unencrypted password string.

Command Default

LDP sessions are negotiated without any password (and MD5).

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

This security feature is enabled per neighbor, so that a session establishment attempt is allowed only when a password match has been configured. This option must be configured so that both peer passwords match.

To override the default password for a specific neighbor, use the **neighbor** *ldp-id* **password** command, where the *ldp-id* argument is the LDP ID of the neighbor.



Note The global default password must be configured before being able to override the default password for a specific neighbor.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure the password *abc* for neighbor 10.20.20.20 and how to clear it:

```
RP/0/RP0/CPU0:router(config-ldp)# neighbor 10.20.20.20:0 password clear abc
```

neighbor password disable

To override an individual neighbor which requires no password, use the **neighbor password disable** command in MPLS LDP configuration mode.

neighbor *IP-address* **password disable**

Syntax Description

IP-address	Neighbor IP address.

Command Default

LDP sessions are negotiated without any password (and MD5).

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The system uses the global password to compute each neighbor's effective password and overrides the global password with the individual neighbor password, if configured. The session remains stable if you shift from an individual neighbor password to an equal global password. However, if the effective password changes during configuration, the session might be rendered unstable.

Note You must configure the password for an individual neighbor using the neighbor's LSR ID.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to override the individual password *abc*, for the neighbor:

```
RP/0/RP0/CPU0:router(config-ldp)# neighbor 10.20.20.20 password disable abc
RP/0/RP0/CPU0:router(config-ldp)#
```

neighbor targeted

To configure transmission of targeted hellos toward a neighbor for setting up an LDP session, use the **neighbor targeted** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

address-family {**ipv4** | **ipv6**} **neighbor** *Ip-address* **targeted**
no address-family {**ipv4** | **ipv6**} **neighbor** *ip-address* **targeted**

Syntax Description

ip-address	Neighbor IP address.
ipv4	Specifies IP version 4 address family.
ipv6	Specifies IP version 6 address family.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to set up a targeted discovery session for neighbor 200.1.1.1:

```
RP/0//CPU0:router(config-ldp)# neighbor 200.1.1.1 targeted
```

nsr (MPLS-LDP)

To configure nonstop routing for LDP protocols in the event of a disruption in service, use the **nsr** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

nsr
no nsr

Syntax Description

This command has no arguments or keywords.

Command Default

By default, MPLS LDP NSR is disabled.

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

A disruption in service may include any of the following events:

- Route Switch Processor (RSP) switchover
- Route processor (RP) or distributed route processor (DRP) failover
- LDP process restart
- In-service system upgrade (ISSU)
- Minimum disruption restart (MDR)

Enabling NSR causes events such as these to be invisible to the routing peers and provide minimal service disruption.

Note The LDP Process restart is supported by NSR only if the NSR process-failures switchover is configured, else the process restart causes the session to be unstable.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to enable MPLS LDP NSR:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)# nsr
```

recursive-fec

To enable Multicast Label Distribution Protocol (MLDP) recursive-fec support, use **recursive-fec** command in MPLS LDP MLDP configuration.

address-family ipv4 recursive-fec [**route-policy** *name*]

Syntax Description

route-policy *name*	(Optional) Specifies the route policy name.

Command Default

No default behavior or values

Command Modes

MPLS LDP MLDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following example shows how to enable MLDP recursive fec support:

```
RP/0/RP0/CPU0:router(config-ldp-mldp)# address-family ipv4 recursive-fec
```

redistribute (MPLS LDP)

To redistribute routes from a Border Gateway Protocol (BGP) autonomous system into an MPLS LDP, use the **redistribute** command in MPLS LDP configuration mode. To disable route redistribution, use the **no** form of this command.

redistribute bgp {**as** *as-number* | **advertise-to** *access-list-name*}
no redistribute bgp {**as** *as-number* | **advertise-to** *access-list-name*}

Syntax Description

bgp	Redistributes information from BGP protocols.
as *as-number*	Specifies the BGP autonomous system number.
advertise-to *access-list*	Advertise the redistributed route information.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
MPLS LDP	read, write

The following example shows how to redistribute BGP information to MPLS LDP peers:

```
RP/0/RP0/CPU0:router(config)# mpls ldp
RP/0/RP0/CPU0:router(config-ldp)# redistribute bgp ?
  advertise-to  IP access list specifying LDP peers to advertise
  as            BGP AS-number
  <cr>
RP/0/RP0/CPU0:router(config-ldp)# redistribute bgp as 10000
RP/0/RP0/CPU0:router(config-ldp)# commit

RP/0/RP0/CPU0:router# show run mpls ldp | b bgp
 bgp
   as 10000
  !
```

router-id (MPLS LDP)

To specify an IPv4 address to act as the router ID, use the **router-id** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

[**vrf** *vrf-name*]
router-id *lsr-id*
no [**vrf** *vrf-name*] **router-id**

Syntax Description

vrf *vrf-name*	(Optional) Specifies the VRF name.
lsr-id	LSR ID in A.B.C.D format.

Command Default

LDP uses router ID as determined by global router ID agent, IP Address Repository Manager (IP ARM).

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

LDP uses the router ID from different sources in the following order:

1. Configured LDP router ID.
2. Global router ID (if configured).
3. Calculated (computed) using the primary IPv4 address of the highest numbered configured loopback address. We recommend configuring at least one loopback address.

Note We recommend that you configure an IP address for the LDP router-id to avoid unnecessary session flaps.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to specify an LSR ID as the router ID:

```
RP/0/RP0/CPU0:router(config-ldp)#router-id 10.0.0.1
```

router ospf

To enable Open Shortest Path First (OSPF) LDP IGP synchronization for a specific VRF or a specific VRF area or a specific VRF area interface, use the **router ospf** command in XR Config mode.

router ospf *process-id* [**vrf** *vrf-name* [**area** {*area-id ip-address*}] [**interface** *type interface-path-id*] **mpls ldp sync** [**disable**]]

Syntax Description

process-id	Internally used identification parameter for an OSPF routing process. It is locally assigned and can be any positive integer. A unique value is assigned for each OSPF routing process.
vrf *vrf-name*	(Optional) Specifies the name of the VRF instance to associate with OSPF VRF processes.
area	(Optional) Enters the OSPF area configuration submode.
area-id	Specifies the OSPF area ID as a decimal value.
ip-address	Specifies the OSPF area ID as an IP address in A.B.C.D format.
interface	(Optional) Enters the OSPF interface configuration submode.
type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
sync	Enables LDP IGP synchronization on the specified interface.

disable	(Optional) Disables MPLS LDP synchronization.

Command Default

No default behavior or values

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read, write

Example

The following example shows how to enable OSPF LDP IGP synchronization for a specific VRF:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)#router ospf 109
RP/0/RP0/CPU0:router(config-ospf)#
```

session protection

To enable the LDP session protection feature for keeping LDP peer session up by means of targeted discovery following the loss of link discovery with a peer, use the **session protection** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

session protection [**duration** *seconds* | **infinite**] [**for** *peer-acl*]
no session protection

Syntax Description

duration *seconds*	(Optional) Specifies the protection duration, that is, the number of seconds that targeted discovery should continue following the loss of link discovery to a neighbor. Range is 30 to 2147483.
infinite	(Optional) Specifies session protection to last forever after loss of link discovery.
for *peer-acl*	(Optional) Specifies set of LDP peers for which session protection is to be enabled.

Command Default

By default, session protection is disabled. When enabled without peer-acl and duration, session protection is provided for all LDP peers and continues for 24 hours after a link discovery loss.

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

LDP session protection feature allows you to enable the automatic setup of targeted hello adjacencies with all or a set of peers and specify the duration for which session needs to be maintained using targeted hellos after loss of link discovery.

LDP supports only IPv4 standard access lists.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to enable session protection for all discovered peers with unlimited duration to maintain the session after link discovery loss:

```
RP/0/RP0/CPU0:router(config-ldp)# session protection
```

The following example shows how to enable session protection for a set of peers (as permitted by a peer ACL) with duration of 30 seconds to maintain the session after link discovery loss:

```
RP/0/RP0/CPU0:router(config-ldp)# session protection for peer_acl duration 30
```

show mpls ldp backoff

To display information about the configured session setup backoff parameters and any potential LDP peers with which session setup attempts are being throttled, use the **show mpls ldp backoff** command in XR EXEC mode.

show mpls ldp [**vrf** *vrf-name*] **backoff** [**location** *node-id* | **standby**]

Syntax Description

vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You must enable the MPLS LDP application to use the **show mpls ldp backoff** command.

Task ID

Task ID	Operations
mpls-ldp	read

Examples

The following shows a sample output from the **show mpls ldp backoff** command:

```
RP/0/RP0/CPU0:router# show mpls ldp backoff

Backoff Time:
  Initial:15 sec, Maximum:120 sec

Backoff Table: (2 entries)

  LDP Id               Backoff (sec)  Waiting (sec)
  -------------------- -------------- ----------------
  33.33.33.33:0          15               15
  11.11.11.11:0          30               30
```

This table describes the significant fields shown in the display.

Table 1: show mpls ldp backoff Command Field Descriptions

Field	Description
Backoff Time	Initial and maximum backoff time parameters, in seconds.

Field	Description
Backoff Table	List of discovered LDP neighbors for which session setup is being delayed because of previous failures to establish a session due to incompatible configuration. The backoff table incorporates the following information: **LDP Id** Identifies the LDP neighbors. **Backoff (sec)** Specifies the time that the session setup is delayed. **Waiting (sec)** Specifies an approximate time the session setup has been delayed.

show mpls ldp bindings

To display the contents of the Label Information Base (LIB), use the **show mpls ldp bindings** command in XR EXEC mode command.

show mpls ldp [**afi-all**] [**vrf all**] [**vrf** *vrf-name*] [**ipv4** | **ipv6**] **bindings** [*prefix*/*length*] [**advertisement-acls**] [**brief**] [**detail**] [**local**] [**local-label** *label* [**to** *label*]] [**local-only**] [**neighbor** *address*] [**remote-only**][**remote-label** *label* [**to** *label*]] [**summary**] [**location** *node-id* | **standby**] **[all]**

Syntax Description

afi-all	(Optional) Displays all address families.
vrf all	(Optional) Displays all LDP configured VRFs.
vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
ipv4	(Optional) Specifies IP version 4 address family.
ipv6	(Optional) Specifies IP version 6 address family.
prefix	(Optional) Destination prefix, written in A.B.C.D format.
length	(Optional) Network mask length, in bits. Range is 0 to 32.
advertisement-acls	(Optional) Displays the label bindings as applied for (advertisement) outbound label filtering ACLs.
brief	(Optional) Displays all the prefixes in the LDP database.
detail	(Optional) Displays the total counts of advertised-to and remote-binding peers in IP address sort order, with remote bindings in tabular format.
local	(Optional) Displays the local label bindings.
local-label *label* [**to** *label*]	(Optional) Displays entries matching local label values. Add the *label* **to** *label* argument to indicate the label range.

local-only	(Optional) Displays binding matches with a local label only.
neighbor *address*	(Optional) Displays the label bindings assigned by the selected neighbor.
remote-only	(Optional) Displays bindings matches with a remote label only.
remote-label *label* [**to** *label*]	(Optional) Displays entries matching the label values assigned by a neighbor router. Add the *label* **to** *label* argument to indicate the label range. Range is from 0 to 2147483647.
summary	(Optional) Displays a summary of the contents of the Label Information Base (LIB).
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.
all	(Optional) Displays the aggregate summary across LDP processes and all VRFs.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls ldp bindings** command displays local and remote label bindings learned from neighbors for non-BGP routes (such as IGP prefixes and static routes).

You can choose to view the entire database or a subset of entries according to the following criteria:

- Prefix
- Input or output label values or ranges
- Neighbor advertising the label

Note The **show mpls ldp bindings summary** command displays summarized information from the LIB and is used when testing scalability or when deployed in a large scale network.

Task ID

Task ID	Operations
mpls-ldp	read

Examples

The following sample output displays the contents of the LIB for the default routing domain:

```
RP/0/RP0/CPU0:router# show mpls ldp bindings

     5.41.0.0/16 , rev 4
          local binding: label:IMP-NULL
          No remote bindings
  5.43.9.98/32 , rev 6
          local binding: label:IMP-NULL
          No remote bindings
  10.10.2.0/24 , rev 12
          local binding: label:IMP-NULL
          remote bindings :
              lsr:10.255.255.255:0, label:16
              lsr:10.256.256.256:0, label:IMP-NULL
  10.10.3.0/24 , rev 10
          local binding: label:IMP-NULL
          remote bindings :
              lsr:10.255.255.255:0, label:IMP-NULL
              lsr:10.256.256.256:0, label:22
  22.22.22.22/32 , rev 14
          local binding: label:16
          remote bindings :
              lsr:10.255.255.255:0, label:17
              lsr:10.256.256.256:0, label:IMP-NULL
  33.33.33.33/32 , rev 2
          local binding: label:IMP-NULL
          remote bindings :
              lsr:10.255.255.255:0, label:18
              lsr:10.256.256.256:0, label:23
```

The following sample output shows detailed information for the total counts of advertised-to and remote-binding peers in IP address sort order, with remote bindings for 150.150.150.150/32:

```
RP/0/RP0/CPU0:router# show mpls ldp bindings 150.150.150.150/32 detail

  150.150.150.150/32, rev 2
       Local binding: label: IMP-NULL
         Advertised to: (6 peers)
           120.120.120.120:0  130.130.130.130:0  150.150.150.1:0  150.150.150.2:0
           150.150.150.3:0    150.150.150.4:0
       Remote bindings:    (3 peers)
           Peer                Label
  -----------------          --------
         120.120.120.120:0     27018
         130.130.130.130:0     26017
```

```
        160.160.160.160:0     27274
```

The following sample output specifies a network number and displays labels learned from label switched router (LSR) 10.255.255.255 for all networks. The **neighbor** keyword is used to suppress the output of remote labels learned from other neighbors:

```
RP/0/RP0/CPU0:router# show mpls ldp bindings neighbor 10.255.255.255

  10.10.2.0/24 , rev 12
          local binding: label:IMP-NULL
          remote bindings :
              lsr:10.255.255.255, label:16
  10.10.3.0/24 , rev 10
          local binding: label:IMP-NULL
          remote bindings :
              lsr:10.255.255.255:0, label:IMP-NULL
  22.22.22.22/32 , rev 14
          local binding: label:16
          remote bindings :
              lsr:10.255.255.255:0, label:17
  33.33.33.33/32 , rev 2
          local binding: label:IMP-NULL
          remote bindings :
              lsr:10.255.255.255:0, label:18
  44.44.44.44/32 , rev 16
          local binding: label:17
          remote bindings :
              lsr:10.255.255.255:0, label:IMP-NULL
```

This table describes the significant fields shown in the display.

Table 2: show mpls ldp bindings and show mpls ldp bindings neighbor Command Field Descriptions

Field	Description
a.b.c.d/n	IP prefix and mask for a particular destination (network/mask).
rev	Revision number (rev) that is used internally to manage label distribution for this destination.
local binding	Locally assigned label for a prefix.
remote bindings	Outgoing labels for this destination learned from other LSRs.[1] Each item in this list identifies the LSR from which the outgoing label was learned and reflects the label associated with that LSR. Each LSR in the transmission path is identified by its LDP identifier.
(rewrite)	Binding has been written into MPLS forwarding and is in use.

Field	Description
(no route)	Route is not valid. LDP times it out before the local binding is deleted.

[1] Label switched routers.

The following sample output summarizes the content by using the **summary** keyword:

```
RP/0/RP0/CPU0:router# show mpls ldp bindings summary

  LIB Summary:
    Total Prefix   : 20
    Revision No    : Current:34, Advertised:34
    Local Bindings : 14
        NULL    : 10 (implicit:10, explicit:0)
        Non-NULL: 4 (lowest:48, highest:51)
    Remote Bindings: 24
```

This table describes the significant fields shown in the display.

Table 3: show mpls ldp bindings summary Command Field Descriptions

Field	Description
Total Prefix	Number of prefixes (routes) known to LDP LIB. All invalid and timed-out routes display as no-routes.
Revision No	Current revision number of LIB entries as well as the minimum revision number that has been advertised to all peers.
Local Bindings	Total number of local bindings, with information on how many of them are Null, non-null, and lowest/highest label assigned or allocated by LDP.
Remote Bindings	Number of remote bindings.

The following sample output shows the access-list advertisement:

```
RP/0/RP0/CPU0:router# show mpls ldp bindings advertisement-acls

  Advertisement Spec:
          Prefix ACL = 'pfx_11'
          Prefix ACL = 'pfx_22'
          Prefix ACL = 'pfx_40_1'; Peer ACL = 'peer_11'

  5.41.0.0/16 , rev 82
  11.11.11.11/32 , rev 69
          Advert ACL(s): Prefix ACL 'pfx_11'
  20.20.20.20/32 , rev 83
  22.22.22.22/32 , rev 78
          Advert ACL(s): Prefix ACL 'pfx_22'
  40.1.1.0/24 , rev 79
          Advert ACL(s): Prefix ACL 'pfx_40_1'; Peer ACL 'peer_11'
```

This table describes the significant fields shown in the display.

Table 4: show mpls ldp bindings advertisement-acls Command Field Descriptions

Field	Description
Advertisement Spec	Lists all prefix and peer access-lists used as outbound label advertisement control.
Advert ACL(s)	Lists the first matching rule (if any) for the prefix entry for outbound label advertisement control (for prefix-acl).

The following sample output shows all the prefixes in the LDP database using the **brief** keyword:

```
RP/0/RP0/CPU0:router# show mpls ldp bindings brief

  Prefix               Local Advertised Remote Bindings
                       Label (peers)         (peers)
  ------------------ -------- ---------- ---------------
  1.1.2.2/32           -          0           1
  1.2.3.4/32           16010      396         0
  4.4.4.4/32           16004      396         3
  10.0.0.0/24          19226      396         395
```

The following sample output shows that the binding matches with a local label:

```
RP/0/RP0/CPU0:router# show mpls ldp bindings local-only

  10.12.32.2/32, rev 4
          Local binding: label: IMP-NULL
          No remote bindings
```

The following sample output shows that the binding matches with a remote label:

```
RP/0/RP0/CPU0:router# show mpls ldp bindings remote-only

  10.26.4.0/24, rev 0
          No local binding
          Remote bindings: (1 peers)
              Peer                Label
              -----------------   --------
              10.6.6.6:0          IMP-NULL
  10.43.4.0/24, rev 0
          No local binding
          Remote bindings: (1 peers)
              Peer                Label
              -----------------   --------
              10.4.4.4:0          IMP-NULL
  10.46.4.0/24, rev 0
          No local binding
          Remote bindings: (2 peers)
              Peer                Label
              -----------------   --------
              10.4.4.4:0          IMP-NULL
              10.6.6.6:0          IMP-NULL
```

show mpls ldp capabilities

To display the database capability information for an LDP session, use the **show mpls ldp capabilities** command in XR EXEC mode.

show mpls ldp [**vrf** *vrf-name*] **capabilities** [**detail**] [**location** *node-id* | **standby**]

Syntax Description

vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
detail	(Optional) Displays detailed database capability information for an LDP session.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following shows a sample output from the **show mpls ldp capabilities** command:

```
RP/0/RP0/CPU0:router# show mpls ldp capabilities

  Type     Description                                Owner
  ------   ----------------------------------------   ------------
  0x50b    Typed Wildcard FEC                         LDP
  0x3eff   Cisco IOS-XR                               LDP
  0x508    MP: Point-to-Multipoint (P2MP)             mLDP
  0x509    MP: Multipoint-to-Multipoint (MP2MP)       mLDP
  0x703    P2MP PW                                    L2VPN-AToM
```

show mpls ldp discovery

To display the status of the LDP discovery process, use the **show mpls ldp discovery** command in XR EXEC mode.

show mpls ldp [**afi-all**] [**vrf all**][**vrf** *vrf-name*] [**ipv4** | **ipv6**] **discovery** [*lsr-id ldp-id*] [*type interface-path-id* | **brief** | **link** | **targeted** | **summary** [**all**]] [**detail**] [**location** *node-id* | **standby**]

Syntax Description

afi-all	(Optional) Displays all address families.
vrf all	(Optional) Displays all LDP configured VRFs.
vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
ipv4	(Optional) Specifies IP version 4 address family.
ipv6	(Optional) Specifies IP version 6 address family.
lsr-id	(Optional) Neighbor LSR ID in A.B.C.D format.
ldp-id	(Optional) Neighbor LDP ID in A.B.C.D: format.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
brief	(Optional) Displays concise information about a specified LDP-enabled interface.

link	(Optional) Displays link information for LDP discovery.
targeted	(Optional) Displays targeted information for LDP discovery.
summary	(Optional) Displays summarized information for LDP discovery.
all	(Optional) Displays the aggregate summary across LDP processes and all VRFs.
detail	(Optional) Displays detailed information (including, inbound label filtering, session KAs, and session protection state) for an LDP session.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls ldp discovery** command shows both link discovery and targeted discovery. When no interface filter is specified, this command generates a list of interfaces running the LDP discovery process. This command also displays neighbor discovery information for the default routing domain.

Task ID

Task ID	Operations
mpls-ldp	read

Examples

The following sample output is from the **show mpls ldp discovery** command:

```
RP/0/RP0/CPU0:router# show mpls ldp discovery

  Local LDP Identifier: 10.44.44.44:0
  Discovery Sources:
    Interfaces:
       HundredGigE 0/1/0/0 : xmit/recv
        LDP Id: 10.33.33.33:0, Transport address: 10.33.33.33
```

```
        Hold time: 15 sec (local:15 sec, peer:15 sec)
```

This table describes the significant fields shown in the display.

Table 5: show mpls ldp discovery Command Field Descriptions

Field	Description
Local LDP Identifier	LDP identifier for the local router. An LDP identifier is a 6-byte construct displayed in the form IP address:number. By convention, the first 4 bytes of the LDP identifier constitute the router ID; integers, starting with 0, constitute the final two bytes of the IP address:number construct.
Interfaces	Interfaces engaged in LDP discovery activity, as follows: **xmit field** Indicates that the interface is transmitting LDP discovery hello packets. **recv field** indicates that the interface is receiving LDP discovery hello packets. The LDP identifiers indicate the LDP neighbors discovered on the interface.
Transport Address	Address associated with this LDP peer (advertised in hello messages).
LDP Id	LDP identifier of the LDP peer.
Hold time	State of the forwarding hold timer and its current value.

The following sample output summarizes information for LDP discovery by using the **summary** keyword:

```
RP/0/RP0/CPU0:router# show mpls ldp discovery summary

  LDP Identifier: 139.0.0.1:0
  Interfaces:
    Configured: 2
    Enabled   : 1
  Discovery:
    Hello xmit: 1 (1 link)
    Hello recv: 1 (1 link)
```

This table describes the significant fields shown in the display.

Table 6: show mpls ldp discovery summary Command Field Descriptions

Field	Description
LDP Identifier	The LDP identifier for the local router.

Field	Description
Interfaces	Summary of interfaces engaged in LDP activity. **Configured** Number of interfaces configured for LDP. **Enabled** Number of interfaces on which LDP is actively enabled and is thus sending LDP hellos. An interface configured for LDP is enabled only if running IP and not in the down state.
Discovery	Summary of LDP discovery process. **Hello xmit** Number of local LDP discovery sources (including link and targeted hellos) emitting LDP hellos. **Hello recv** Number of discovered hello sources via link or targeted hello mechanics.

The following sample output shows the MPLS LDP discovery hello information in brief form:

```
RP/0/RP0/CPU0:router# show mpls ldp discovery brief

  Local LDP Identifier: 192.168.0.3:0

  Discovery Source          VRF Name       Peer LDP Id          Holdtime   Session
  ------------------------  ------------   -------------------  ---------  -----------
  PO0/3/0/2                 default        192.168.0.1:0        15         Y
```

The following sample shows the MPLS LDP afi-all discovery brief command output:

```
RP/0/0/CPU0:router#show mpls ldp afi-all discovery brief

Local LDP Identifier: 192.168.0.1:0

Discovery Source     AFI  VRF Name          Peer LDP Id           Holdtime Session
-------------------- ---- ----------------- -------------------- -------- -------
PO0/3/0/0            IPv6 default           192.168.0.2:0           15       Y
                     IPv4 default           192.168.0.2:0           15       Y
PO0/3/0/1            IPv4 default           192.168.0.3:0           15       Y
PO0/3/0/2            IPv4 default           192.168.0.4:0           15       Y
PO0/3/0/3            IPv6 default           192.168.0.3:0           15       Y
PO0/3/0/4            IPv6 default           192.168.0.5:0           15       Y
```

show mpls ldp forwarding

To display the Label Distribution Protocol (LDP) forwarding state installed in MPLS forwarding, use the **show mpls ldp forwarding** command in XR EXEC mode mode.

show mpls ldp [**afi-all**][**vrf all**] [**vrf** *vrf-name*] [**ipv4** | **ipv6**] **forwarding** [*prefix*/*length*] [**fast-reroute**] [**detail**] [**next-hop** {**address** *ip-address* | **interface** *interface-path-id* | **label** *label-value* | **neighbor** *ldp-id* | **unlabelled**}] [**local-label** *label-value*] [**location** *node-id* | **summary** | **standby**] **[all]**

Syntax Description

afi-all	(Optional) Displays all address families.
vrf all	(Optional) Displays all LDP configured VRFs.
vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
ipv4	(Optional) Specifies IP version 4 address family.
ipv6	(Optional) Specifies IP version 6 address family.
prefix	(Optional) Destination prefix, written in A.B.C.D format.
length	(Optional) Network mask length, in bits. Range is 0 to 32.
detail	(Optional) Displays detailed informati on for the LDP timestamp that is used for the routing and forwarding update.
fast-reroute	(Optional) Displays the prefix that is LFA FRR protected in nature.
next-hop	Matches prefixes by next-hop IP address.
local-label *label-value*	(Optional) Displays the prefix with the specified local label. Range is from 0 to 1048575.
neighbor	Matches prefixes with a path through specified LDP neighbor.
unlabelled	Matches prefixes containing unlabelled paths.
location *node-id*	(Optional) Displays location information for the specified node ID.
summary	(Optional) Displays the summary information for the LDP forwarding information base (LFIB).
standby	(Optional) Displays standby-node specific information.
all	(Optional) Displays the aggregate summary across LDP processes and all VRFs.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls ldp forwarding** command displays the LDP forwarding entries and provides LDP view of its installed forwarding entries.

Task ID

Task ID	Operations
mpls-ldp	read

Examples

This is a sample output from the **show mpls ldp forwarding** command:

Note The (!) symbol referes to a non-primary LFA backup path.

This sample output shows detailed information for the LDP timestamp that is used for routing and forwarding update from the **detail** keyword:

```
RP/0/RP0/CPU0:router# show mpls ldp forwarding 10.0.0.1/32 detail

  Prefix           Label   Label      Outgoing     Next Hop        GR Stale
                   In      Out        Interface
  ---------------- ------- ---------- ------------ --------------- -- -----
  209.165.201.1/32       16000   16001     PO0/2/0/3.1   131.1.1.4         N  N
                           [ Protected; path-id 1 backup-path-id 33;
                           [peer 13.13.13.1:0 ]
                           16002      PO0/2/0/3.2  131.1.2.4         Y  N
                           [ Protected; path-id 2 backup-path-id 33;
                           peer 13.13.13.1:0 ]
                           16003      PO0/2/0/3.3  131.1.3.4         N  N
                           [ Protected; path-id 3 backup-path-id 34;
                           peer 13.13.13.2:0 ]
                           16002      PO0/2/0/1    192.11.1.1 (!)    Y  N
                           [ Backup; path-id 33; peer 14.14.14.1:0 ]
                           Unlabelled PO0/2/0/2    192.11.2.1 (!)    N  N
                           [ Backup; path-id 34 ]


    Routing update   : Mar 31 13:35:25.348 (00:55:32 ago)
    Forwarding update: Mar 31 13:35:25.349 (00:55:32 ago)
```

Note The (!) symbol referes to a non-primary LFA backup path.

This sample output shows only LDP prefixes with protection (ECMP or secondary LFA backups) update from the **fast-reroute** keyword:

This sample output shows the statistics of protected prefixes and protected paths from the **summary** keyword:

```
RP/0/RP0/CPU0:router# show mpls ldp forwarding summary
Forwarding Server (LSD):
  Connected: Yes
  Forwarding State Holdtime: 360 sec
Forwarding States:
  Interfaces: 10
  Local labels: 8
  Rewrites:
    Prefix:
      Total: 8 (0 with ECMP, 8 FRR protected)
      Labelled:
        Primary pathset : 8 labelled (0 partial), 0 unlabelled
        Backup pathset  : 8 labelled (0 partial), 0 unlabelled
        Complete pathset: 8 labelled (0 partial), 0 unlabelled
    Paths:
      Total: 16 (8 backup, 8 FRR protected)
      Labelled: 16 (8 backup)
```

This table describes the significant fields shown in the display.

Table 7: show mpls ldp forwarding Command Field Descriptions

Field	Description
Prefix/mask	Prefix on the FEC[2] for an MPLS forwarding entry.
Label In	Local label assigned to the prefix/mask.
Label Out	Outgoing label for the prefix/mask.
Outgoing Interface	Outgoing physical interface.
Next Hop	Next Hop address.
GR	Graceful restart status (Y or N).
Stale	Status of the entry, stale or not stale. An entry is marked stale when the next-hop graceful restart neighbor disconnects and is unmarked when neighbor reconnects and refreshes the label.
Chkpt	Status of the entry, checkpointed or not checkpointed.
path-id	Primary Path-id.
Backup-path-id	The backup path-id is the path-id of the path protecting a given primary path. A protecting path can be primary path or a non-primary path.
Peer	Displays next-hop LDP peer's LDP identifier.
Connected	Displays LDP connection state with LSD forwarding server.
Forwarding State Holdtime	Displays time that LDP has registered with LSD server to keep LDP forwarding state intact upon LDP disconnect event.
Interfaces	Number of LDP enabled MPLS interfaces.
Local Labels	Number of LDP allocated local labels from LSD.

Field	Description
Rewrites	Counts of Forwarding rewrites. Displays total number of known IPv4 prefixes alongwith information on number of prefixes with more than one ECMP path. This also displays number of prefixes with LFA-FRR protection. The labelled set prints the counts related to prefixes with none, all, partial labelled paths as shown by unlabeled, labelled, and partial keywords. This information is available for primary, backup, and complete path set.
Paths	Forwarding path counts. Displays count of total number of known forwarding paths, along with number of backup paths and number of FRR protected paths. It also displays the count of labelled paths indicating how many of non-primary paths are labelled.

[2] Forwarding Equivalence Class.

show mpls ldp graceful-restart

To display the status of the Label Distribution Protocol (LDP) graceful restart, use the **show mpls ldp graceful-restart** command in XR EXEC mode.

show mpls ldp [**vrf all**] [**vrf** *vrf-name*] **graceful-restart** [**location** *node-id*] [**standby**] **[detail]**

Syntax Description

vrf all	(Optional) Displays all LDP configured VRFs.
vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.
detail	(Optional) Displays detailed information about the specified VRF.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls ldp graceful-restart** command displays LDP graceful-restart-related information when the **graceful-restart** command is enabled.

Task ID

Task ID	Operations
mpls-ldp	read

Examples

The following shows a sample output from the **show mpls ldp graceful-restart** command:

```
RP/0/RP0/CPU0:router# show mpls ldp graceful-restart

    Forwarding State Hold timer : Not Running
    GR Neighbors                : 1

     Neighbor ID      Up  Connect Count  Liveness Timer      Recovery Timer
     ---------------  --  -------------  ------------------  ------------------
```

```
10.0.0.2                Y        1                -                -
```

This table describes the significant fields shown in the display.

Table 8: show mpls ldp graceful-restart Command Field Descriptions

Field	Description
Forwarding State Hold timer	State of the hold timer—running or not running.
GR Neighbors	Number of graceful restartable neighbors.
Neighbor ID	Router ID of each neighbor.
Up	Neighbor up or down.
Connect Count	Number of times the same neighbor has reconnected.
Liveness Timer	State of the liveness timer (running or not running) and its expiration time, if running.
Recovery Timer	State of the recovery timer (running or not running) and its expiration time, if running.

show mpls ldp igp sync

To display Label Distribution Protocol (LDP) Interior Gateway Protocol (IGP) synchronization information on interface(s), use the **show mpls ldp igp sync** command in XR EXEC mode mode.

show mpls ldp [**afi-all**] [**vrf all**] [**vrf** *vrf-name*] [**ipv4** | **ipv6**] **igp sync** [**interface** *type interface-path-id*] **[brief]** [**location** *node-id*] [**standby**]

Syntax Description

afi-all	(Optional) Displays all address families.
vrf all	(Optional) Displays all LDP configured VRFs.
vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
ipv4	(Optional) Specifies IP version 4 address family.
ipv6	(Optional) Specifies IP version 6 address family.
brief	(Optional) Displays brief information about a specified LDP-enabled interface.
interface	(Optional) Displays the interface type.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	(Optional) Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
location *node-id*	(Optional) Displays location information for the specified node ID.

standby	(Optional) Displays standby node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

LDP IGP synchronization addresses traffic loss issues as a result of synchronization between MPLS LDP and IP (IGP). For instance, upon a link up, IGP can advertise a link before MPLS converges on the link. Also, the IGP link is still used even when MPLS session goes down and MPLS LSP is broken on this link. The use of IGP link is determined based on MPLS LDP convergence synchronization status on the link.

Use the **show mpls ldp igp sync** command to display MPLS convergence status. The configuration for LDP IGP synchronization resides in IGPs (OSPF, ISIS); accordingly, LDP displays and advertises this information for all LDP-enabled interfaces (regardless if the interface is configured for LDP IGP).

Task ID

Task ID	Operations
mpls-ldp	read

Examples

The following shows a sample output from the **show mpls ldp igp sync** command:

```
RP/0/RP0/CPU0:router# show mpls ldp igp sync

  POS0/3/0/2:
    VRF: 'default' (0x60000000)
    Sync delay: Disabled
    Sync status: Ready
      Peers:
      192.168.0.1:0   (GR)
```

This table describes the significant fields shown in the display.

Table 9: show mpls ldp igp sync Command Field Descriptions

Field	Description
VRF	VRF of the interface.

Field	Description
Sync status	MPLS LDP convergence status on a given link. Ready indicates that the link is converged and is ready to be used by IGP. Not Ready with Deferred means that the link fulfills LDP IGP synchronization requirements but is deferred by LDP IGP synchronization delay timeout configuration setting. Not Ready means that the link is not ready to be used by IGP.
Peers	List of peers converged on the given link. If the peer session is GR[3]-enabled, output is tagged as GR. If GR-only reachability is indicated due to a GR neighbor record recovered from checkpoint after local start, then Chkpt-created flag is also set.

[3] Graceful Restart.

show mpls ldp interface

To display information about LDP-enabled interfaces, use the **show mpls ldp interfaces** command in XR EXEC mode mode.

show mpls ldp [**afi-all**] [**ipv4** | **ipv6**] **interface** [*type interface-path-id* | **summary**] [**brief**] [**location** *node-id* | **standby**]

Syntax Description

afi-all	(Optional) Displays all address families.
ipv4	(Optional) Specifies IP version 4 address family.
ipv6	(Optional) Specifies IP version 6 address family.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
summary	(Optional) Displays summary information about a specified LDP-enabled interface.
brief	(Optional) Displays concise information about a specified LDP-enabled interface.
detail	(Optional) Displays detailed information about a specified LDP-enabled interface.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-ldp	read

Examples

The following shows a sample output from the **show mpls ldp interface** command:

```
RP/0/RP0/CPU0:router# show mpls ldp interface

  Interface GigabitEthernet0/3/0/3
      No LDP config
  Interface POS0/2/0/0
      No LDP config
      Auto-config items:
         ospf/100/0
  Interface POS0/2/0/1
      No LDP config
      Auto-config items:
         ospf/100/0
  Interface POS0/2/0/2
      No LDP config
      Auto-config items:
         ospf/100/0
  Interface POS0/2/0/3
      No LDP config
      Auto-config items:
         ospf/100/0
```

This table describes the significant fields shown in the display.

Table 10: show mpls ldp interface Command Field Descriptions

Field	Description
Auto-config items	Lists IGPs that specify an interface for MPLS LDP auto-configuration: **OSPF** *ospf instance area* **ISIS** *isis instance*

The following shows a sample output from the **show mpls ldp interface detail** command for the mesh groups:

```
RP/0/RP0/CPU0:router# show mpls ldp interface detail

Interface GigabitEthernet0/2/0/0 (0x20200040)
 Enabled via config: LDP interface
Interface GigabitEthernet0/2/0/1 (0x20200060)
 Disabled via config: IGP Auto-config disable
   Ignoring: LDP interface
Interface GigabitEthernet0/2/0/2 (0x20200080)
 Disabled via config: IGP Auto-config disable
   Ignoring: LDP interface
Interface tunnel-te1 (0x200000f0)
 Disabled
```

```
Interface tunnel-te100 (0x20000110)
 Enabled via config: TE Mesh-group 123, TE Mesh-group all
Interface tunnel-te101 (0x20000130)
 Enabled via config: TE Mesh-group 123, TE Mesh-group all
```

show mpls ldp neighbor

To display the status of Label Distribution Protocol (LDP) sessions, use the **show mpls ldp neighbor** command in XR EXEC mode mode.

show mpls ldp [**vrf all**] [**vrf** *vrf-name*] **neighbor** [*ip-address ldp-id*] [*type interface-path-id*] [**brief**] [**capabilities**] [**detail**] [**gr**] [**location** *node-id*] [**non-gr**] [**sp**] [**standby**]

Syntax Description

vrf all	(Optional) Displays all LDP configured VRFs.
vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
ip-address	(Optional) Neighbor IP address.
ldp-id	(Optional) Neighbor LDP ID in A.B.C.D: format.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
brief	(Optional) Displays the existing LDP sessions in brief format.
capabilities	(Optional) Displays the neighbor capabilities information.
detail	(Optional) Displays detailed information (including, inbound label filtering, session KAs, and session protection state) for an LDP session.
gr	(Optional) Displays graceful restartable neighbors.

location *node-id*	(Optional) Displays location information for the specified node ID.
non-gr	(Optional) Displays non-graceful restartable neighbors.
sp	(Optional) Displays neighbors with session protection.
standby	(Optional) Displays standby-node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls ldp neighbor** command provides information about all LDP neighbors in the entire routing domain—conversely, the show output is filtered to display:

- LDP neighbors with specific IP addresses
- LDP neighbors on a specific interface
- LDP neighbors that are graceful restartable
- LDP neighbors that are nongraceful restartable
- LDP neighbors enabled with session protection

Task ID

Task ID	Operations
mpls-ldp	read

Examples

The following shows a sample output from the **show mpls ldp neighbor** command using an IP address:

```
RP/0/RP0/CPU0:router# show mpls ldp neighbor 4.4.4.4

Peer LDP Identifier: 4.4.4.4:0
  TCP connection: 14.1.0.41:38022 - 10.0.0.1:646
  Graceful Restart: Yes (Reconnect Timeout: 120 sec, Recovery: 96 sec)
  Session Holdtime: 180 sec
  State: Oper; Msgs sent/rcvd: 1721/1716; Downstream-Unsolicited
  Up time: 1d00h
  LDP Discovery Sources:
    IPv4: (1)
      GigabitEthernet0/1/0/0
    IPv6: (0)
  Addresses bound to this peer:
    IPv4: (3)
      4.4.4.4        14.1.0.41      24.1.0.4
```

```
    IPv6: (0)
```

The following shows a sample output from the **show mpls ldp neighbor** command using the **non-gr** keyword:

```
RP/0/RP0/CPU0:router# show mpls ldp neighbor non-gr

  Peer LDP Identifier: 10.44.44.44:0
    TCP connection: 10.44.44.44:65535 - 10.33.33.33:646
    Graceful Restart: No
    State: Oper; Msgs sent/rcvd: 49/46
    Up time: 00:33:33
    LDP Discovery Sources:
      POS 0/1/0/0
    Addresses bound to this peer:
      10.44.44.44     10.10.3.2
  Peer LDP Identifier: 10.22.22.22:0
    TCP connection: 10.22.22.22:646 - 10.33.33.33:65530
    Graceful Restart: No
    State: Oper; Msgs sent/rcvd: 48/45
    Up time: 00:33:11
    LDP Discovery Sources:
      POS 0/2/0/0
    Addresses bound to this peer:
      10.22.22.22     10.10.2.1
```

This table describes the significant fields shown in the display.

Table 11: show mpls ldp neighbor Command Field Descriptions

Field	Description
Peer LDP Identifier	LDP identifier of the neighbor (peer) for this session.
TCP connection	TCP connection used to support the LDP session, shown in the following format: **neighbor IP address** peer port **local IP address** local port
Graceful Restart	Graceful-restart status (Y or N).
State	State of the LDP session. Generally this is Oper (operational), but transient is another possible state.
Msgs sent/rcvd	Number of LDP messages sent to and received from the session peer. The count includes the transmission and receipt of periodic keepalive messages, which are required for maintenance of the LDP session.
Up time	The length of time that this session has been up for (in *hh:mm:ss* format).
LDP Discovery Sources	The source(s) of LDP discovery activity leading to the establishment of the LDP session.

Field	Description
Addresses bound to this peer	The known interface addresses of the LDP session peer. These are addresses that might appear as "next hop" addresses in the local routing table. They are used to maintain the LFIB[4].

[4] LFIB = Label Forwarding Information Base.

The following shows a sample output from the **show mpls ldp neighbor** command using the **brief** keyword:

```
RP/0/RP0/CPU0:router# show mpls ldp neighbor brief

Peer                GR  NSR  Up Time     Discovery   Addresses     Labels
                                         ipv4  ipv6  ipv4  ipv6  ipv4   ipv6
------------------  --  ---  ----------  ----------  ----------  ------------
4.4.4.4:0           Y   N    1d00h       1     0     3     0     5      0
46.46.46.2:0        N   N    1d00h       1     1     3     3     5      5
46.46.46.46:0       Y   N    1d00h       2     2     4     4     5      5
6.6.6.1:0           Y   N    23:25:50    0     1     0     2     0      5
```

This table describes the significant fields shown in the display.

Table 12: show mpls ldp neighbor brief Command Field Descriptions

Field	Description
Peer	LDP identifier of the neighbor (peer) for this session.
GR	Graceful-restart status (Y or N).
Up Time	Time the session has been up (in hh:mm:ss format).
Discovery	Number of LDP discovery sources corresponding to the neighbor.
Address	Number of addresses bound to this peer.

The following shows a sample output from the **show mpls ldp neighbor** command using the **detail** keyword:

```
RP/0/RP0/CPU0:router# show mpls ldp neighbor detail

  Peer LDP Identifier: 172.16.0.1:0
    TCP connection: 172.16.0.1:11707 - 10.0.0.1:646
    Graceful Restart: No
    Session Holdtime: 180 sec
    State: Oper; Msgs sent/rcvd: 33/29
    Up time: 00:13:37
    LDP Discovery Sources:
       POS0/2/0/1
      Targeted Hello (10.0.0.1 ->172.16.0.1, active)
    Addresses bound to this peer:
      23.0.0.2 2.0.0.2        123.0.4.2       10.42.37.119
      10.2.2.2
    Peer holdtime: 180 sec; KA interval: 60 sec; Peer state: Estab
    Clients: Dir Adj Client
    Inbound label filtering: accept acl 'pfx_acl2'
```

```
Session Protection:
  Enabled, state: Ready
  Duration: 30 seconds
```

This table describes the significant fields shown in the display.

Table 13: show mpls ldp neighbor detail Command Field Descriptions

Field	Description
Peer LDP Identifier	LDP identifier of the neighbor (peer) for this session.
TCP connection	TCP connection used to support the LDP session, shown in the following format: **neighbor IP address** peer port **local IP address** local port
Graceful Restart	Graceful-restart status (Y or N).
Session Holdtime	Session hold time, in seconds.
State	State of the LDP session (operational or transient).
Msgs sent/rcvd	Number of LDP messages sent to and received from the session peer. The count includes the transmission and receipt of periodic keepalive messages, which are required for maintenance of the LDP session.
Up time	Time the session has been up for (in *hh:mm:ss* format).
Peer holdtime	Time to keep LDP peer session up without receipt of LDP protocol message from a peer.
Peer state	Peer session state.
Peer holdtime	Time to keep LDP peer session up without receipt of LDP protocol message from a peer.
Clients	LDP (internal) clients requesting session with a neighbor.
Inbound label filtering	LDP neighbor inbound filtering policy.

Field	Description
Session Protection	State of the session protection: **Incomplete** Targeted discovery requested but not yet up. **Ready** Targeted discovery and at least one link hello adjacency to the peer are up. **Protecting** Targeted discovery is up and there is no link hello adjacency to the peer. Targeted discovery is protecting and backing up link discoveries.
Duration	Maximum time to maintain session through targeted discovery upon loss of primary link discovery.
Holdtimer	When in “protecting” state, time to keep LDP peer session up without receipt of LDP protocol message from a peer.

show mpls ldp nsr pending neighbor

To display the nonstop routing (NSR) pending neighbor information for an LDP session, use the **show mpls ldp nsr pending neighbor** command in the XR EXEC mode.

show mpls ldp [**vrf** *vrf-name*] **nsr pending neighbor** [*lsr-id ldp-id*][**location** *node-id* | **standby**]

Syntax Description

vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
lsr-id	(Optional) LSR ID of neighbor in A.B.C.D format.
ldp-id	(Optional) LDP ID of neighbor in A.B.C.D: format.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following example shows how to display NSR pending neighbor information for an LDP session:

```
RP/0/RP0/CPU0:router# show mpls ldp nsr pending neighbor
```

show mpls ldp nsr statistics

To display the nonstop routing (NSR) statistics for an LDP session, use the **show mpls ldp nsr statistics** command in XR EXEC mode.

show mpls ldp [**vrf** *vrf-name*] **nsr statistics** [**location** *node-id* | **standby**] [**neighbor** [*lsr-id ldp-id*] [**location** *node-id* | **standby**]]

Syntax Description

vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.
neighbor	(Optional) Displays neighbor information.
lsr-id	(Optional) LSR ID of neighbor in A.B.C.D format.
ldp-id	(Optional) LDP ID of neighbor in A.B.C.D: format.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following shows a sample output from the **show mpls ldp nsr statistics** command:

```
RP/0/RP0/CPU0:router# show mpls ldp nsr statistics

Global Init Sync:
```

```
  Start: Oct 27 12:12:23 (00:01:20 ago)
  End:   Oct 27 12:12:23 (00:01:20 ago)

Protocol message stats:
  4 Peer, 5 Adj, 0 DHCB, 14/20 sent/rcvd Capabilities
  23 peer label for 18 FEC
  Send-Ack: 0 Lcl-Addr-WD

Sync message stats:
  Tx msgs/bytes = 32/5024
  Rx msgs/bytes = 0/0
  Max IPC Tx/Rx bytes = 4396/0
  Default MTU bytes = 4768, IPCs exceeding MTU = 0
  TX current/total fail count = 0/0
  IPC restart count = 1
```

show mpls ldp nsr summary

To display the nonstop routing (NSR) summary for an LDP session, use the **show mpls ldp nsr summary** command in XR EXEC mode.

show mpls ldp [**vrf all**] [**vrf** *vrf-name*] **nsr summary** [**location** *node-id* | **standby**] **[all]**

Syntax Description

vrf all	(Optional) Displays all LDP configured VRFs.
vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.
all	(Optional) Displays the aggregate summary across LDP processes and all VRFs.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following shows a sample output from the **show mpls ldp nsr summary** command:

```
RP/0/RP0/CPU0:router# show mpls ldp nsr summary

Sessions:
   Total: 1, NSR-eligible: 1, Sync-ed: 1
      (1 Oper)
```

show mpls ldp parameters

To display current LDP parameters, use the **show mpls ldp parameters** command in XR EXEC mode mode.

show mpls ldp [**vrf** *vrf-name*] **parameters** [**location** *node-id* | **standby**]

Syntax Description

vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls ldp parameters** command displays all LDP operational and configuration parameters.

Task ID

Task ID	Operations
mpls-ldp	read
network	read

Examples

The following shows a sample output from the **show mpls ldp parameters** command:

```
RP/0/RP0/CPU0:router# show mpls ldp parameters

  LDP Parameters:
    Protocol Version: 1
    Router ID: 10.11.11.11
    Null Label: Implicit
    Session:
      Hold time: 180 sec
      Keepalive interval: 60 sec
      Backoff: Initial:15 sec, Maximum:120 sec
    Discovery:
      Link Hellos:     Holdtime:15 sec, Interval:5 sec
      Targeted Hellos: Holdtime:90 sec, Interval:10 sec
                       (Accepting peer ACL 'peer_acl_10')
    Graceful Restart:
      Enabled (Configured)
      Reconnect Timeout:120 sec, Forwarding State Holdtime:180 sec
```

```
Timeouts:
  Binding with no-route: 300 sec
  LDP application recovery (with LSD): 360 sec
OOR state
  Memory: Normal
```

This table describes the significant fields shown in the display.

Table 14: show mpls ldp parameters Command Field Descriptions

Field	Description
Protocol Version	Version of LDP running on the platform.
Router ID	Currently used router ID.
Null Label	LDP use of implicit-null or explicit-null as label for prefixes where it has to use a null label.
Session Hold time	Time LDP session is to be maintained with an LDP peer without receiving LDP traffic or an LDP keepalive message from the peer.
Session Keepalive interval	Time interval between consecutive transmissions of LDP keepalive messages to an LDP peer.
Session Backoff	Initial maximum backoff time for sessions.
Discovery Link Hellos	Time to remember that a neighbor platform wants an LDP session without receiving an LDP hello message from the neighbor (hold time), and the time interval between the transmission of consecutive LDP hello messages to neighbors (interval).
Discovery Targeted Hellos	Indicates the time: • To remember that a neighbor platform wants an LDP session when the neighbor platform is not directly connected to the router or the neighbor platform has not sent an LDP hello message. This intervening interval is known as *hold time*. • Interval between the transmission of consecutive hello messages to a neighbor not directly connected to the router and if targeted hellos are being accepted, displaying peer-acl (if any).
Graceful Restart	Status of graceful-restart status (Y or N).
Timeouts	Various timeouts (of interest) that the LDP is using. One timeout is *binding no route*, which indicates how long the LDP waits for an invalid route before deleting it. It also shows restart recovery time for LSD and LDP.
OOR state	Out of resource memory state: Normal, Major, or Critical.

show mpls ldp statistics fwd-setup

To display the statistics of the forwarding setup counters related to RIB/LSD, use the **show mpls ldp statistics fwd-setup** command in XR EXEC mode.

show mpls ldp [**vrf** *vrf-name*] **statistics fwd-setup** [**location** *node-id* | **standby**]

Syntax Description

vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following shows a sample output from the **show mpls ldp statistics fwd-setup** command:

```
RP/0/RP0/CPU0:router# show mpls ldp statistics fwd-setup

RIB
===

Thread counters:
  Events In           : 10
  Events Out          : 39
  RIB fetch throttled : 0 (0 during last throttle)

TC Thread counters:
  Events In           : 39 (3 skipped)
  Events Out          : 12 (0 failed, 2 skipped)

Address Family: IPv4
```

```
  RIB server connects: 1
  RIB converged: Yes
  Op counters:
    Fetch          : 4 (2 buffers per fetch)
                     no-data: 0
                     callbacks: 33 routes, 3 convg, 0 rcmd
    Route Up       : 33 (0 protected; Paths: 29/0/0 total/backup/protected)
    Route Down     : 0
    Route Filtered : 5 (0 intern, 5 misc, 0 alloc, 0 admin,
                        0 unsupp-intf 0, unsupp-protection,
                        0 bgp, 0 bgp-unlabelled, 0 ibgp-no-lbl-ucast)

MFI
===

Thread counters:
  Events In           : 9
  Events Out          : 8
  LSD Rsrc-Complete   : 1
  LSD server connects : 1

Op counters:
                              Successful      Failed
                              ----------      ------
    Control              :            3           0
    RCMD Markers         :            0           0
    State cleanup        :            0           0
    Interface Enable     :            5           0
    Interface Disable    :            0           0
    Label alloc          :            4           0
    Label alloc - mldp   :            0           0
    Label free           :            0           0
    Label free - mldp    :            0           0
    Rewrite create       :            6           0
    Rewrite delete       :            0           0
    Label/Rewrite create :            0           0
    Label/Rewrite delete :            0           0
    Label OOR cleared    :            3           0

    Total LSD Reqs/Msgs  :            7           0

LSD flow control status:
  Flow control            : 0
  Flow control cnt        : 0
  Evt queue item cnt      : 0
  Last flow control       : N/A
```

show mpls ldp statistics msg-counters

To display statistics of the messages exchanged between neighbors, use the **show mpls ldp statistics msg-counters** command in XR EXEC mode mode.

show mpls ldp [**vrf** *vrf-name*] **statistics msg-counters** [*lsr-id ldp-id*] [**location** *node-id* | **standby**]

Syntax Description

vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
lsr-id	(Optional) LSR ID of neighbor in A.B.C.D format.
ldp-id	(Optional) LDP ID of neighbor in A.B.C.D: format.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls ldp statistics msg-counters** command can provide counter information about different types of messages sent and received between neighbors.

Task ID

Task ID	Operations
mpls-ldp	read

Examples

The following shows a sample output from the **show mpls ldp statistics msg-counters** command:

```
RP/0/RP0/CPU0:router# show mpls ldp statistics msg-counters

  Peer LDP Identifier: 10.33.33.33:0
     Msg Sent: (80)
       Init             : 1
       Address          : 1
       Address_Withdraw : 0
       Label_Mapping    : 5
       Label_Withdraw   : 0
```

```
    Label_Release    : 0
    Notification     : 0
    KeepAlive        : 73

  Msg Rcvd: (81)
    Init             : 1
    Address          : 1
    Address_Withdraw : 0
    Label_Mapping    : 8
    Label_Withdraw   : 0
    Label_Release    : 0
    Notification     : 0
    KeepAlive        : 71
```

The below table describes the significant fields shown in the display.

Table 15: show mpls ldp statistics msg-counters Command Field Descriptions

Field	Description
Peer LDP Identifier	LDP identifier of the neighbor (peer).
Msg Sent	Summary of messages sent to the LDP peer.
Msg Rcvd	Summary of messages received from the LDP peer.

show mpls ldp summary

To display a summary of LDP information, use the **show mpls ldp summary** command in System Admin EXEC mode mode.

show mpls ldp [**vrf all**] [**vrf** *vrf-name*] **summary** [**location** *node-id* | **standby**] **[all]**

Syntax Description

vrf all	(Optional) Displays all LDP configured VRFs.
vrf *vrf-name*	(Optional) Displays the VRF information for the specified VRF.
location *node-id*	(Optional) Displays location information for the specified node ID.
standby	(Optional) Displays standby-node-specific information.
all	(Optional) Displays the aggregate summary across LDP processes and all VRFs.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls ldp summary** command can provide information about the number of LDP neighbors, interfaces, forwarding state (rewrites), servers connection/registration, and graceful-restart information.

Task ID

Task ID	Operations
mpls-ldp	read

Examples

The following example shows a sample output from the **show mpls ldp summary** command:

```
RP/0/RP0/CPU0:router# show mpls ldp summary

   AFIs      : IPv4
   Routes    : 4
   Neighbors : 1 (1 GR)
   Hello Adj : 1
   Addresses : 3
```

```
   Interfaces: 4 LDP configured
```

The following example shows a sample output from the **show mpls ldp summary all** command:

```
RP/0/RP0/CPU0:router# show mpls ldp summary all

   VRFs         : 1 (1 oper)
   AFIs         : IPv4
   Routes       : 4
   Neighbors    : 1 (1 GR)
   Hello Adj    : 1
   Addresses    : 3
   Interfaces   : 4 (1 forward reference, 2 LDP configured)
   Collaborators:

                  Connected   Registered
                  ---------   ----------
      SysDB           Y          Y
      IM              Y          Y
      RSI             Y          -
      IP-ARM          Y          -
      IPv4-RIB        Y          Y (1/1 tables)
      LSD             Y          Y
      LDP-NSR-Partner Y          -
      L2VPN-AToM      Y          -
      mLDP            -          N
```

This table describes the significant fields shown in the display.

Table 16: show mpls ldp summary Command Field Descriptions

Field	Description
Routes	Number of known IP routes (prefixes).
Neighbors	Number of LDP neighbors, including targeted and graceful restartable neighbors.
Hello Adj	Number of discovered LDP discovery sources.
Interfaces	Number of known IP interfaces and number of LDP configured interfaces. LDP is configured on a forward-referenced interface which may not exist or for which no IP address is configured.
Addresses	Number of known local IP addresses.

show mpls ldp trace

To display the Label Distribution Protocol (LDP) VRF event traces, use the **show mpls ldp trace vrf** command in XR EXEC mode.

show mpls ldp trace vrf
[binding] [capabilities] [config] [dev] [discovery] [error] [**file** *file-name*]
[forwarding] [gr] [hexdump] [iccp] [igp-sync] [interface] [last]
[**location** {*node-id name all mgmt-nodes*}] **[misc] [mldp] [nsr] [peer] [process] [pw]**
[reverse] [route] [since] [stats] [tailf] [unique] [usec]
[verbose] [wide] [wrapping]

Syntax Description

binding	(Optional) Displays the binding event traces.
capabilities	(Optional) Displays the capabilities event traces.
config	(Optional) Displays the configuration event traces.
dev	(Optional) Displays the development private traces.
discovery	(Optional) Displays Hello or discovery and adj event traces.
error	(Optional) Displays error traces.
file *file-name*	(Optional) Displays trace of a specific file.
forwarding	(Optional) Displays forwarding event traces.
gr	(Optional) Displays graceful-restart event traces.
hexdump	(Optional) Displays traces in hexadecimal.
iccp	(Optional) Displays ICCP signaling event traces.
igp-sync	(Optional) Displays IGP sync event traces.
interface	(Optional) Displays interface event traces.
last	(Optional) Displays last number of entries.

location	(Optional) Identifies the location of the card whose CPU controller trace information you want to display.
node-id	The node-id argument is expressed in the **rack/slot/module** notation.
name	Specifies the name of the card.
all	Specifies all locations.
mgmt-nodes	Specifies all managements nodes.
misc	(Optional) Displays miscellaneous event traces.
mldp	(Optional) Displays MLDP event traces.
nsr	(Optional) Displays non-stop routing event traces.
peer	(Optional) Displays peer session event traces.
process	(Optional) Displays process-level event traces.
pw	(Optional) Displays L2VPN pseudo-wire event traces.
reverse	(Optional) Displays latest traces first.
route	(Optional) Displays route event traces.
since last-start	(Optional) Displays traces since the last start time.
stats	(Optional) Displays statistics.
tailf	(Optional) Displays new traces as they are added.
unique	(Optional) Displays unique entries with count.
usec	(Optional) Displays timestamp w/usec detail.
verbose	(Optional) Displays internal debugging information.

wide	(Optional) Do not display buffer name, node name and tid.
wrapping	(Optional) Displays wrapping entries.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read

Example

The following example shows how to display the LDP VRF event traces:

```
RP/0/RP0/CPU0:router# show mpls ldp trace vrf

4 wrapping entries (992576 possible, 38720 allocated, 4377 filtered, 4381 total)
Nov 23 05:54:44.332 mpls/ldp/vrf 0/RP0/CPU0 t7181 [VRF]:718: Tbl(0xe0000000):
ldp_vrf_tbl_go_active: afi IPv4
Nov 23 05:54:44.335 mpls/ldp/vrf 0/RP0/CPU0 t7181 [VRF]:604: VRF(0x60000000):
ldp_vrf_ctx_enable done
Nov 23 05:54:44.360 mpls/ldp/vrf 0/RP0/CPU0 t7181 [VRF]:703: VRF(0x60000000):
ldp_vrf_ctx_af_enable done: afi IPv4
Nov 23 05:54:44.360 mpls/ldp/vrf 0/RP0/CPU0 t7181 [VRF]:718: Tbl(0xe0800000):
ldp_vrf_tbl_go_active: afi IPv6
```

show mpls mldp database

To display Multicast Label Distribution Protocol (MLDP) information, use the **show mpls mldp database**command in user EXEC or privileged EXEC mode.

show mpls mldp database [**id** *id*] [**opaque_type** *type*] [**detail**] [**summary**]

Syntax Description

id *id*	(Optional) The Label Switched Multicast (LSM) ID whose MLDP entry is to be displayed.
opaque_type *type*	(Optional) The opaque type to be used for filtering. The following types are supported: • **ipv4** *source-group* --this represents the "IPv4 Protocol Independent Source-Specific Transit" multicast application type. The IPv4 source address and group address are also specified. • **ipv6** *source-group* --this represents the "IPv6 Protocol Independent Source-Specific Transit" multicast application type.The IPv6 source address and group address are also specified. • **mdt** *vpn-id mdt-number* --this represents the "Multicast Virtual Private Network (MVPN)" multicast application type. The VPN identifier and the Multicast Distribution Tree (MDT) number are also specified. • **vpnv4** *source-group route-distinguisher* --this represents the "Direct MDT (VPNv4) " multicast application type.The IPv4 source address, group address, and the VPN route distinguisher are also specified. • **vpnv6** *source-group route-distinguisher*—this represents the "Direct MDT (VPNv6)" multicast application type. The IPv6 source address, group address, and the VPN route distinguisher are also specified. • *type-number* --the type-number. Valid values are from 0-65535.
detail	(Optional) Displays detailed database information for an MLDP session.
summary	(Optional) The MLDP database summary.

Command Modes

User EXEC (>) Privileged EXEC (#)

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

This command displays the contents for MLDP entries in the MLDP database. Each MLDP entry provides the configuration details associated with each point-to-multipoint (P2MP) and multipoint-to-multipoint (MP2MP) Label Switched Path (LSP) used to transmit multicast traffic within an MPLS core network.

Examples

The following is sample output from the **show mpls mldp database**command.

```
Router# show mpls mldp database opaque_type mdt 100:2
* Indicates MLDP recursive forwarding is enabled
LSM ID : D3000001 (RNR LSM ID: 8A000002)   Type: MP2MP   Uptime : 00:04:54
  FEC Root           : 172.30.20.1
  Opaque decoded     : [mdt 100:2 0]
  Opaque length      : 11 bytes
  Opaque value       : 07 000B 00000100000000100000000
  RNR active LSP     : (this entry)
  Upstream client(s) :
    172.30.20.1:0    [Active]
      Expires        : Never         Path Set ID  : 99000001
      Out Label (U)  : 32            Interface    : Ethernet1/0*
      Local Label (D): 30            Next Hop     : 10.0.1.7
  Replication client(s):
    MDT  (VRF blue)
      Uptime         : 00:04:54      Path Set ID  : 5000002
      Interface      : Lspvif0
```

The table below describes the significant fields shown in the display.

Table 17: show mpls mldp database Field Descriptions

Field	Description
LSM ID	The LSM ID whose MLDP entry is displayed.
Type	The type of LSP used. This can P2MP or MP2MP.
FEC Root	The root of the MDT.
Opaque value	A value which is used to uniquely identify the MP LSP.
RNR active LSP	The primary root for upstream forwarding.
Upstream client(s)	The upstream clients are the upstream nodes of the MP2MP LSP.
Replication client(s)	The Replication Clients are the downstream nodes of the MP2MP LSP. They receive multipoint replicated traffic.

Related Commands

Command	Description
show mpls mldp bindings	Displays the bindings (the upstream and downstream label assignments) for MLDP traffic.

show lcc

To display label consistency checker (LCC) information, use the **show lcc** command in XR EXEC mode mode.

show lcc {**ipv4** | **ipv6**} **unicast** {**all** | **label** | **tunnel-interface** | **statistics** | [**summary** | **scan-id** *scan-id*]} [**vrf** *vrfname*]

Syntax Description

ipv4	Specifies IP version 4 address prefixes.
ipv6	Specifies IP version 6 address prefixes.
unicast	Specifies unicast address prefixes.
all	Scans all routes.
label	Scans all labels.
tunnel-interface	Specifies the interface of a tunnel.
statistics	Displays route consistency check statistics information.
scan-id	Specifies the value of scan-id. Range is from 0 to 100000.
summary	Displays background route consistency check statistics summary information.
vrf *vrfname*	(Optional) Specifies a particular VPN routing and forwarding (VRF) instance or all VRF instances.

Command Default

None

Command Modes

IPv4 address family configuration

IPv6 address family configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
IPv4	read
IPv6	read

Examples

The following example shows an outcome of the label consistency checker information:

```
RP/0/RP0/CPU0:router# show lcc ipv4 unicast all

Sending scan initiation request to IPv4 LSD ... done
Waiting for scan to complete (max time 600 seconds).....................
Scan Completed
Collecting scan results from FIBs (max time 30 seconds)... done
Number of nodes involved in the scan: 2
Number of nodes replying to the scan: 2

Legend:
        ? - Currently Inactive Node, ! - Non-standard SVD Role
        * - Node did not reply

   Node                 Checks Performed               Errors

   0/2/CPU0                    6                            0
   0/0/CPU0                    6                            0
```

signalling dscp (LDP)

To assign label distribution protocol (LDP) signaling packets a differentiated service code point (DSCP) to assign higher priority to the control packets while traversing the network, use the **signalling dscp** command in MPLS LDP configuration mode. To return to the default behavior, use the **no** form of this command.

signalling dscp *dscp*
no signalling dscp

Syntax Description

dscp	DSCP priority value. Range is 0 to 63.

Command Default

LDP control packets are sent with precedence 6 (*dscp* : 48)

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

DSCP marking improves signaling setup and teardown times.

Ordinarily, when LDP sends hello discovery or protocol control messages, these are marked using the default control packet precedence value (6, or *dscp* 48). You can use the **signalling dscp** command to override that DSCP value to ensure that all control messages sent are marked with a specified DSCP.

Note While the **signalling dscp** command controls LDP signaling packets (Discovery hellos and protocol messages), it has no effect on ordinary IP or MPLS data packets.

Task ID

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to assign LDP packets a DSCP value of 56:

```
RP/0/RP0/CPU0:router(config-ldp)# signalling dscp 56
```

snmp-server traps mpls ldp

To inform a network management system of session and threshold cross changes, use the **snmp-server traps mpls ldp** command in global configuration mode.

snmp-server traps mpls ldp {**up** | **down** | **threshold**}

Syntax Description

up	Displays the session-up notification.
down	Displays the session-down notification.
threshold	Displays the session-backoff-threshold crossed notification.

Command Default

LDP does not send SNMP traps.

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **snmp-server traps mpls ldp** command sends notifications to the SNMP server. There are three types of traps sent by LDP:

Session up

Generated when sessions go up.

Session down

Generated when sessions go down.

Threshold

Generated when attempts to establish a session fails. The predefined value is 8.

Task ID

Task ID	Operations
mpls-ldp	read, write
mpls-te	read, write
snmp	read, write

Examples

The following example shows how to enable LDP SNMP trap notifications for Session up:

```
RP/0/RP0/CPU0:router(config)# snmp-server traps mpls ldp up
```

address-family ipv4/ipv6 label

To configure label control and policies on a specific IPv4 or IPv6 destination, use the **address-family ipv4/ipv6 label** command in the MPLS LDP configuration mode.

[vrf *vrf-name*] **address-family** {**ipv4** | **ipv6**}
label [**remote accept from** *ldp-id* **for** *prefix-acl*]
local [**default-route**] [**allocate for** {*prefix-acl* | **host-routes**}]
[advertise [**to** *ldp-id* **for** *prefix-acl*]
[**interface** *type interface-path-id*]]

Syntax Description

address-family	Configure address-family and its parameters.
ipv4	Specifies IP version 4 address family.
ipv6	Specifies IP version 6 address family.
label	(Optional) Configure label control and policies.
remote	(Optional) Configure remote/peer label control and policies.
accept	(Optional) Configure inbound label acceptance control.
from *ldp-id*	Specifies which LDP neighbors will receive label advertisements. LDP ID is written in A.B.C.D: format.
for *prefix-acl*	Specifies prefix destinations for which labels will be advertised.
local	(Optional) Configure local label control and policies.
default-route	(Optional) Enable MPLS forwarding for default route.
allocate	(Optional) Configure label allocation control.
for *prefix-acl*	Specifies prefix destinations for which labels will be allocated.
host-routes	Allocates labels for host routes only.

advertise	(Optional) Configure outbound label advertisement control.
to *ldp-id*	(Optional) Specifies which LDP neighbors will receive label advertisements. LDP ID is written in A.B.C.D: format.
for *prefix-acl*	(Optional) Specifies prefix destinations for which labels will be advertised.
interface	(Optional) Advertise interface host address.
type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

MPLS LDP configuration

Command History

Release	Modification
Release 6.0	This command was introduced

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-ldp	read, write

Example

The following example shows how to configure label control and policies on a specific IPv4 destination:

```
RP/0/RP0/CPU0:router(config-ldp)# address-family ipv4 label
```



MPLS Static Commands

Note All commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router that is introduced from Cisco IOS XR Release 6.3.2. References to earlier releases in Command History tables apply to only the Cisco NCS 5500 Series Router.

Note

- Starting with Cisco IOS XR Release 6.6.25, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 560 Series Routers.
- Starting with Cisco IOS XR Release 6.3.2, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router.
- References to releases before Cisco IOS XR Release 6.3.2 apply to only the Cisco NCS 5500 Series Router.
- Cisco IOS XR Software Release 7.0.1 specific updates are not applicable for the following variants of Cisco NCS 540 Series Routers:
  - N540-28Z4C-SYS-A
  - N540-28Z4C-SYS-D
  - N540X-16Z4G8Q2C-A
  - N540X-16Z4G8Q2C-D
  - N540X-16Z8Q2C-D
  - N540-12Z20G-SYS-A
  - N540-12Z20G-SYS-D
  - N540X-12Z16G-SYS-A
  - N540X-12Z16G-SYS-D

This module describes the commands used to configure static MPLS labels in a Multiprotocol Label Switching (MPLS) network on the .

For detailed information about MPLS concepts, configuration tasks, and examples, see *MPLS Configuration Guide for Cisco NCS 5500 Series RoutersMPLS Configuration Guide for Cisco NCS 540 Series RoutersMPLS Configuration Guide*.

- address family ipv4 unicast (mpls-static), on page 119
- clear mpls static local-label discrepancy, on page 121
- interface (mpls-static), on page 122
- show mpls static local-label, on page 123
- show mpls static summary, on page 124

address family ipv4 unicast (mpls-static)

To enable static MPLS label binding on a specific IPv4 unicast destination address prefix and on the forwarding next-hop address, use the **address-family ipv4 unicast** command in MPLS static configuration mode. To remove MPLS static binding, use the **no** form of this command.

address-family ipv4 unicast local-label *label_value* **allocate** [**per-prefix** *ipv4_prefix_value*] **forward path** *path_value* **nexthop** *nexthop_information interface-type interface-path-id* **out-label** {*label_value* | **pop** | **exp-null**}
no address-family ipv4 unicast

Syntax Description

local-label *label_value*	Specifies MPLS local-label value for static binding and forwarding. The range is from 16 to 1048575.
allocate	Displays local-label allocation options.
per-prefix *ipv4_prefix_value*	Specifies IPv4 prefix value to which the specified MPLS label will be statically bound.
forward	Configure forwarding for traffic with static MPLS label.
path *path-value*	Specifies path-ID for MPLS cross-connect path.
nexthop *nexthop_information*	Specifies the next-hop information that is either an IP address or interface.
interface-type interface-id	Interface type. For more information, use the question mark (?) online help function.
out-label *label_value*	Specifies mpls local-label value for static binding on the egress packet.
pop	Removes label from egress packet.
exp-null	Applies explicit null label on the egress packet.

Command Default

None

Command Modes

MPLS static configuration

Command History

Release	Modification
Release 5.1.1	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-static	read

Example

The following command sequence shows how to specify local label for an ip-prefix and define LSP.

```
RP/0/RP0/CPU0:router#configure
RP/0/RP0/CPU0:router(config)#mpls static
RP/0/RP0/CPU0:router(config-mpls-static)#address-family ipv4 unicast
RP/0/RP0/CPU0:router(config-mpls-static-af)#local-label 30500 allocate per-prefix 10.1.1.1/24
 forward path 1 nexthop 12.2.2.2 out-label 30600
```

clear mpls static local-label discrepancy

To clear any discrepancy between statically allocated and dynamically allocated local labels, use the **clear mpls static local-label discrepancy** command in XR EXEC mode. A label discrepancy is generated when:

- A static label is configured for an IP prefix (per VRF) that already has a binding with a dynamic label.
- A static label is configured for an IP prefix, when the same label value is dynamically allocated to another IP prefix.

clear mpls static local-label discrepancy {*label-value* | **all**}

Syntax Description

label-value	A value that denotes the label for which the discrepancies need to be cleared.
all	Specifies that all discrepancies need to be cleared.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-static	read

```
RP/0/RP0/CPU0:router#clear mpls static local-label discrepancy all
```

interface (mpls-static)

To enable MPLS encapsulation on specified interfaces, use the **interface** command in MPLS static configuration mode. To disable MPLS encapsulation on specified interfaces, us the **no** form of the command.

interface *interface-type interface-id*
no interface *interface-type interface-id*

Syntax Description

interface-type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface instance.

Command Default

None

Command Modes

MPLS static configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-static	read and write

Example

The following command sequence shows how to enable MPLS encapsulation on a HundredGigE port.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls static
RP/0/RP0/CPU0:router(config-mpls-static)# interface HundredGigE 0/1/0/0
```

show mpls static local-label

To display information about local labels allocated using **mpls static** command, use the **show mpls static local-label** command in XR EXEC mode.

show mpls static local-label {*label-value* | **all** **[detail]** | **discrepancy** **[detail]** | **error** **[detail]**}

Syntax Description

local-label *label-value*	Specifies local label value to display MPLS static information for only that label.
all	Displays MPLS static information about all local labels.
discrepancy	Displays label discrepancy between static labels and dynamic labels.
error	Displays MPLS static labeling errors.
detail	(Optional) Detailed information is displayed.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-static	read

The following command sequence shows how to view label discrepancy information:

```
RP/0/RP0/CPU0:router#show mpls static local-label discrepancy detail
Tue Apr 22 18:20:47.183 UTC
Label   VRF             Type         Prefix           RW Configured   Status
------- --------------- ------------ ---------------- --------------- --------
16003   default         Per-Prefix   172.16.0.1/32       No              Discrepancy
          STATUS :  Label has discrepancy
```

The following command sequence shows how to view MPLS static information for all local labels:

```
RP/0/RP0/CPU0:router#show mpls static local-label all
Tue Apr 22 18:21:41.813 UTC
Label   VRF             Type         Prefix           RW Configured   Status
------- --------------- ------------ ---------------- --------------- --------
200     default         Per-Prefix   10.10.10.10/32   Yes             Created
16003   default         Per-Prefix   172.16.0.1/32       No              Discrepancy
```

show mpls static summary

To display MPLS static summary information, use the **show mpls static summary** command in XR EXEC mode.

show mpls static summary

Syntax Description

summary	Displays MPLS static binding information.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-static	read

This is the sample output for **show mpls static summary** command:

```
RP/0/RP0/CPU0:router#show mpls static summary
Tue Apr 22 18:22:17.931 UTC

Label     :  Total      2   Errored     0   Discrepancies         1
VRF       :  Total      1   Active      1
Interface :  Total      7   Enabled     1   Forward-Reference     0

LSD       :  CONNECTED
IM        :  CONNECTED
RSI       :  CONNECTED
```



MPLS Forwarding Commands

Note All commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router that is introduced from Cisco IOS XR Release 6.3.2. References to earlier releases in Command History tables apply to only the Cisco NCS 5500 Series Router.

Note

- Starting with Cisco IOS XR Release 6.6.25, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 560 Series Routers.
- Starting with Cisco IOS XR Release 6.3.2, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router.
- References to releases before Cisco IOS XR Release 6.3.2 apply to only the Cisco NCS 5500 Series Router.
- Cisco IOS XR Software Release 7.0.1 specific updates are not applicable for the following variants of Cisco NCS 540 Series Routers:
  - N540-28Z4C-SYS-A
  - N540-28Z4C-SYS-D
  - N540X-16Z4G8Q2C-A
  - N540X-16Z4G8Q2C-D
  - N540X-16Z8Q2C-D
  - N540-12Z20G-SYS-A
  - N540-12Z20G-SYS-D
  - N540X-12Z16G-SYS-A
  - N540X-12Z16G-SYS-D

This module describes the commands used to configure and use Multiprotocol Label Switching (MPLS) forwarding.

For detailed information about MPLS concepts, configuration tasks, and examples, see *MPLS Configuration Guide for Cisco NCS 5500 Series RoutersMPLS Configuration Guide for Cisco NCS 540 Series RoutersMPLS Configuration Guide*.

- clear mpls forwarding counters, on page 127
- mpls ip-ttl-propagate, on page 129
- hw-module fib mpls ip-ttl-propagate-disable exclude, on page 131
- mpls label range, on page 133
- mpls label-security, on page 135
- show mpls ea interfaces, on page 136
- show mpls forwarding, on page 137
- show mpls forwarding tunnels, on page 141
- show mpls forwarding exact-route, on page 143
- show mpls forwarding label-security interface, on page 147
- show mpls forwarding label-security summary location, on page 148
- show mpls forwarding labels, on page 149
- show mpls forwarding summary, on page 154
- show mpls interfaces, on page 157
- show mpls label range, on page 159
- show mpls label table, on page 160
- show mpls lsd applications, on page 162
- show mpls lsd clients, on page 164
- show mpls lsd forwarding labels, on page 166
- show mpls lsd forwarding summary, on page 167
- show mpls traffic-eng fast-reroute database, on page 168
- show mpls traffic-eng fast-reroute log, on page 173

clear mpls forwarding counters

To clear (set to zero) the MPLS forwarding counters, use the **clear mpls forwarding counters** command in XR EXEC mode.

clear mpls forwarding counters

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **clear mpls forwarding counters** command to set all MPLS forwarding counters to zero so that you can easily see the future changes.

Task ID

Task ID	Operations
mpls-ldp	read, write
mpls-static	read, write

Example:

This a test.

Examples

The following example shows sample output before and after clearing all counters:

```
RP/0/RP0/CPU0:router# show mpls forwarding

LLocal Outgoing    Prefix             Outgoing     Next Hop        Bytes
Label  Label       or ID              Interface                    Switched
------ ----------- ------------------ ------------ --------------- ------------
10001  10002       No ID              BE262        10.1.1.62       0
10003  10004       No ID              BE264        10.1.1.70       0
10005  10006       No ID              BE266        10.1.1.78       0
10007  10008       No ID              BE268        10.1.1.86       0
10009  10010       No ID              BE270        10.1.1.94       0
10011  10012       No ID              BE272        10.1.1.102      0
10013  10014       No ID              BE274        10.1.1.110      0
10015  10016       No ID              BE276        10.1.1.118      0
10017  10018       No ID              BE141        10.13.1.42       0
10022  10023       No ID              BE73         10.17.1.10       0
10026  20001       No ID              Te0/4/0/0/1  10.11.106.2      0
24000  Pop         SR Adj (idx 1)     Hu0/7/0/35   10.11.150.2      0
```

```
24001  Pop         SR Adj (idx 3)     Hu0/7/0/35   10.11.150.2      0
24002  Pop         SR Adj (idx 1)     BE206        10.11.1.58       0
24003  Pop         SR Adj (idx 3)     BE206        10.11.1.58       0
```

```
RP/0/RP0/CPU0:router# show mpls forwarding

Local  Outgoing    Prefix             Outgoing     Next Hop        Bytes
Label  Label       or ID              Interface                    Switched
------ ----------- ------------------ ------------ --------------- ------------
24000  Pop         TE: 65000          BE12         10.0.14.2       0
24001  Pop         TE: 128            BE12         10.0.14.2       0
       Pop         TE: 128            tt65001      10.0.14.2       0            (!)
24002  Pop         TE: 3174           BE12         10.0.14.2       0
       Pop         TE: 3174           tt65001      10.0.14.2       0            (!)
24003  Pop         TE: 1443           BE12         10.0.14.2       0
       Pop         TE: 1443           tt65001      10.0.14.2       0            (!)
24005  Pop         TE: 3009           BE12         10.0.14.2       0
       Pop         TE: 3009           tt65001      10.0.14.2       0            (!)
24006  Pop         TE: 10             BE12         10.0.14.2       0
       Pop         TE: 10             tt65001      10.0.14.2       0            (!)
24007  Pop         TE: 63             BE12         10.0.14.2       0
       Pop         TE: 63             tt65001      10.0.14.2       0            (!)
24010  Pop         TE: 4848           BE12         10.0.14.2       0
       Pop         TE: 4848           tt65001      10.0.14.2       0            (!)
24012  Pop         TE: 1455           BE12         10.0.14.2       0
       Pop         TE: 1455           tt65001      10.0.14.2       0            (!)
24013  Pop         TE: 2932           BE12         10.0.14.2       0
       Pop         TE: 2932           tt65001      10.0.14.2       0            (!)
24014  Pop         TE: 2967           BE12         10.0.14.2       0
       Pop         TE: 2967           tt65001      10.0.14.2       0            (!)
```

```
RP/0/RP0/CPU0:router# clear mpls forwarding counters
```

mpls ip-ttl-propagate

To configure the behavior controlling the propagation of the IP Time-To-Live (TTL) field to and from the MPLS header, use the **mpls ip-ttl-propagate** command in XR Config mode. To return to the default behavior, use the **no** form of this command.

mpls ip-ttl-propagate disable [forwarded | local]
no mpls ip-ttl-propagate

Syntax Description

disable	Disables the IP Time to Live (TTL) propagation to and from the MPLS header for both forwarded and local packets.
forwarded	(Optional) Disables the propagation of IP TTL to and from the MPLS headed for only the forwarded packets. This prevents the **traceroute** command from displaying the MPLS-enabled nodes beyond the device under the configuration.
local	(Optional) Disables the propagation of IP TTL to the MPLS header for only locally generated packets. This prevents the **traceroute** command from displaying the MPLS-enabled nodes beyond the device under the configuration.

Command Default

Enabled

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

By default, the IP TTL is propagated to the MPLS header when IP packets enter the MPLS domain. Within the MPLS domain, the MPLS TTL is decremented at each MPLS hop. When an MPLS encapsulated IP packet exits the MPLS domain, the MPLS TTL is propagated to the IP header. When propagation is disabled, the MPLS TTL is set to 255 during the label imposition phase and the IP TTL is not altered.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples

This example shows how to disable IP TTL propagation.

```
RP/0/RP0/CPU0:router(config)# mpls ip-ttl-propagate disable
```

This example shows how to disable IP TTL propagation for forwarded MPLS packets.

```
RP/0/RP0/CPU0:router(config)# mpls ip-ttl-propagate disable forwarded
```

This example shows how to disable IP TTL propagation for locally generated MPLS packets.

```
RP/0/RP0/CPU0:router(config)# mpls ip-ttl-propagate disable local
```

hw-module fib mpls ip-ttl-propagate-disable exclude

To exclude the propagation of the IP Time-To-Live (TTL) and QoS capability to and from the MPLS header using the MPLS Push, Pop, and Penultimate Hop operations in the **mpls ip-ttl-propagate disable** configuration, use the **hw-module fib mpls ip-ttl-propagate-disable exclude** command in XR Config mode. This configuration either changes the IP TTL and QoS DSCP propagation to Uniform mode or retains one of these propagation in Pipe mode based on the existing traffic flow behavior.

hw-module fib mpls ip-ttl-propagate-disable exclude { **mpls-pop** | **mpls-pop-penultimate-hop** | **mpls-push** } { **cos** | **ttl** | **ttl-and-cos** }

Syntax Description

exclude mpls-pop ttl-and-cos	Changes the IP TTL and QoS DSCP propagation to Uniform mode on the MPLS Pop (disposition) node.
exclude mpls-pop-penultimate-hop ttl	Changes the IP TTL propagation to Uniform mode with the QoS propagation preserved in the Pipe mode on the MPLS Penultimate Hop Pop (PHP) node.
exclude mpls-pop-penultimate-hop cos	Changes the QoS DSCP propagation to Uniform mode whereas the IP TTL propagation remains in the Pipe mode on the MPLS PHP node.
exclude mpls-pop-penultimate-hop ttl-and-cos	Changes the IP TTL and QoS DSCP propagation to Uniform mode on the MPLS PHP node.
exclude mpls-push ttl	Changes the IP TTL propagation on the MPLS Push (imposition) node to Uniform mode.

Command Default

None

Command Modes

XR Config mode

Command History

Release	Modification
Release 24.4.1	This command was introduced.

Usage Guidelines

The **hw-module fib mpls ip-ttl-propagate-disable exclude {mpls pop | mpls pop-penultimate-hop | mpls push}{ttl | cos | ttl-and-cos}** configuration works only if the **mpls ip-ttl-propagate disable** command is configured.

After you have configured the **hw-module fib mpls ip-ttl-propagate-disable exclude {mpls pop | mpls pop-penultimate-hop | mpls push}{ttl | cos | ttl-and-cos}** command, reload the chassis or all the line cards for the configuration to take effect.

Task ID

Task ID	Operations
config-services	read, write
root-lr	read, write

Examples

These examples shows how to configure the **hw-module fib mpls ip-ttl-propagate-disable exclude** command:

Example 1: To change the IP TTL and QoS DSCP propagation to Uniform mode on the MPLS Pop node.

```
RP/0/RP0/CPU0:router(config)# hw-module fib mpls ip-ttl-propagate-disable exclude mpls-pop
 ttl-and-cos
```

Example 2: To change the IP TTL propagation to Uniform mode with the QoS propagation preserved in the Pipe mode on the MPLS Penultimate Hop Pop (PHP) node.

```
RP/0/RP0/CPU0:router(config)# hw-module fib mpls ip-ttl-propagate-disable exclude
mpls-pop-penultimate-hop ttl
```

Example 3: To change the QoS propagation to Uniform mode whereas the IP TTL propagation remains in the Pipe mode on the MPLS PHP node.

```
RP/0/RP0/CPU0:router(config)# hw-module fib mpls ip-ttl-propagate-disable exclude
mpls-pop-penultimate-hop cos
```

Example 4: To change the IP TTL and QoS DSCP propagation to Uniform mode on the MPLS PHP node.

```
RP/0/RP0/CPU0:router(config)# hw-module fib mpls ip-ttl-propagate-disable exclude
mpls-pop-penultimate-hop ttl-and-cos
```

Example 5: To change the IP TTL propagation to Uniform mode on the MPLS Push (imposition) node.

```
RP/0/RP0/CPU0:router(config)# hw-module fib mpls ip-ttl-propagate-disable exclude mpls-push
 ttl
```

mpls label range

To configure the dynamic range of local labels available for use on packet interfaces, use the **mpls label range** command in XR Config mode. To return to the default behavior, use the **no** form of this command.

mpls label range table *table-id minimum maximum*
no mpls label range table *table-id minimum maximum*

Syntax Description

table *table-id*	Identifies a specific label table; the global label table has table-id = 0. If no table is specified, the global table is assumed. Currently, you can specify table 0 only.
minimum	Smallest allowed label in the label space. Default is 16000.
maximum	Largest allowed label in the label space. Default is 1048575.

Command Default

table-id: 0

minimum: 16000

maximum: 1048575

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

After configuring the **mpls label range** command, restart the router for the configuration to take effect.

The label range defined by the **mpls label range** command is used by all MPLS applications that allocate local labels (for dynamic label switching Label Distribution Protocol [LDP], MPLS traffic engineering, and so on).

Labels 0 through 15 are reserved by the Internet Engineering Task Force (IETF) (see the RFC 3032 reference for details)and cannot be included in the range using the **mpls label range** command.

The maximum allowed label limit is 1000000 when Enhanced Ethernet Line Card is used.



Note

- Labels outside the current range and which are allocated by MPLS applications remain in circulation until released.
- The maximum labels that are available are 144K.

Task ID

Task ID	Operations
mpls-te	read, write

Task ID	Operations
mpls-ldp	read, write

Examples

The following example shows how to configure the size of the local label space using a *minimum* of 16200 and a *maximum* of 120000:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls label range 16200 120000
```

mpls label-security

To configure the MPLS label security for the interface, use the **mpls label-security** command in interface configuration mode.

mpls label-security multi-label-packet [drop] rpf

Syntax Description

multi-label-packet	Handles incoming packets with multiple labels on the stack.
drop	Drops packets with multiple labels on the stack.
rpf	Checks for RPF label on incoming packets.

Command Modes

Interface configuration.

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The optional keywords and arguments described allow display of an MPLS label security information.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

This example shows how to configure MPLS label RPF check:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)#interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)#mpls label-security rpf
```

show mpls ea interfaces

To display the interface label security information, use the **show mpls ea interfaces** command in XR EXEC mode.

show mpls ea interface [**location** *node-id*]

Syntax Description

location *node-id*	Displays the interfaces on which MPLS is enabled.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The keywords and arguments described allow display of the interface label security information.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

The following sample output is from the **show mpls ea interfaces** command and specific interface and location:

```
RP/0/RP0/CPU0:router# show mpls ea interfaces location 0/1/CPU0
Interface      IFH         MTU  Flags      Type
-------------- ---------- ----- ---------- ----------
Interface        IFH         MTU
-------------- ----------   -----
Te0/0/0/1     0x08000040     1500
Te0/0/0/1.2   0x08001d90     1500
Te0/0/0/1.3   0x08001d98     1500
Te0/0/0/1.4   0x08001da0     1500
Te0/0/0/1.5   0x08001da8     1500
Te0/0/0/1.6   0x08001db0     1500
Te0/0/0/1.7   0x08001db8     1500
Te0/0/0/1.8   0x08001dc0     1500
Te0/0/0/1.9   0x08001dc8     1500
Te0/0/0/1.10  0x08001dd0     1500
Te0/0/0/1.11  0x08001dd8     1500
Te0/0/0/1.12  0x08001de0     1500
Te0/0/0/1.13  0x08001de8     1500
Te0/0/0/1.14  0x08001df0     1500
Te0/0/0/1.15  0x08001df8     1500
Te0/0/0/1.16  0x08001e00     1500
```

show mpls forwarding

To display the contents of the MPLS Label Forwarding Information Base (LFIB), use the **show mpls forwarding**command in XR EXEC mode.

show mpls forwarding [**detail**] [**hardware** {**ingress** | **egress**}] [**interface** *type interface-path-id*] [**location** *node-id*] [**labels** *low-value* [*high-value*]] [**prefix** {*network/mask* | **ipv4 unicast** *network/mask*}] [**private**] [**summary**] [**tunnels** *tunnel-id*] [**vrf** *vrf-name*]

Syntax Description

detail	(Optional) Displays information in long form (includes length of encapsulation, length of Media Access Control [MAC] string, maximum transmission unit [MTU], Packet switched, and label stack).
hardware	(Optional) Displays the hardware location entry.
ingress	(Optional) Reads information from the ingress PSE.
egress	(Optional) Reads information from the egress PSE.
interface	(Optional) Displays information for the specified interface.
type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
labels *low-value* [*high-value*]	(Optional) Entries with a local labels range. Ranges for both *low-value* and *high-value* are 0 to 1048575.
location *node-id*	(Optional) Displays hardware resource counters on the designated node.
prefix *network/mask /length*	(Optional) Displays the destination address and mask/prefix length. **Note** The forward slash (/) between *network* and *mask* is required.
ipv4 unicast	(Optional) Displays the IPv4 unicast address.
private	(Optional) Displays private information.
summary	(Optional) Displays summarized information.
tunnels *tunnel-id*	(Optional) Displays entries either for a specified label switch path (LSP) tunnel or all LSP tunnel entries.
vrf *vrf-name*	(Optional) Displays entries for VPN routing and forwarding (VRF).

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

- The optional keywords and arguments described allow specification of a subset of the entire MPLS forwarding table.
- This router does not support label accounting for vrf labels. Instead, it supports accounting for the IGP and LDP labels. As a result, the **Bytes Switched** counter is 0 for the **show mpls forwarding vrf** command.
- The **Bytes Switched** counter is not supported in the **show mpls forwarding** command, so the counter remains at 0.
- When the **show mpls forwarding detail** command is executed with the **location** keyword (for example, with the address, 0/1/cpu0), it displays the forwarding information available on this node. If this node hosts a displayed interface, then the FIB displays a configured MTU; otherwise, it displays the default value of 1500. This is because in Cisco IOS XR software, interface information is available only on nodes hosting the interface. Note that for bundle interfaces, the information is available in line cards with bundle-member links. If the location is not specified, the FIB displays the data from the node where the interface is created. For physical interfaces, this **location** keyword value would match the actual address; therefore, FIB displays correct information. It is different in the case of bundles--bundles are created on RP, but located on LC(s); therefore, you would see default values. This is also applicable to any per-interface data; for example, adjacencies.
- The *node-id* argument is entered in the *rack/slot/module* notation.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following sample output is from the **show mpls forwarding** command using the **location** keyword and a specific node ID:

```
RP/0/RP0/CPU0:router# show mpls forwarding location 0/6/CPU0
Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ----------------- ------------ --------------- ------------
24000  Pop         TE: 65000         BE12         10.0.14.2       0
24001  Pop         TE: 128           BE12         10.0.14.2       0
       Pop         TE: 128           tt65001      10.0.14.2       0           (!)
24002  Pop         TE: 3174          BE12         10.0.14.2       0
       Pop         TE: 3174          tt65001      10.0.14.2       0           (!)
24003  Pop         TE: 1443          BE12         10.0.14.2       0
```

```
       Pop         TE: 1443           tt65001      10.0.14.2       0            (!)
24005  Pop         TE: 3009           BE12         10.0.14.2       0
       Pop         TE: 3009           tt65001      10.0.14.2       0            (!)
24006  Pop         TE: 10             BE12         10.0.14.2       0
       Pop         TE: 10             tt65001      10.0.14.2       0            (!)
24007  Pop         TE: 63             BE12         10.0.14.2       0
       Pop         TE: 63             tt65001      10.0.14.2       0            (!)
24010  Pop         TE: 4848           BE12         10.0.14.2       0
       Pop         TE: 4848           tt65001      10.0.14.2       0            (!)
24012  Pop         TE: 1455           BE12         10.0.14.2       0
       Pop         TE: 1455           tt65001      10.0.14.2       0            (!)
24013  Pop         TE: 2932           BE12         10.0.14.2       0
       Pop         TE: 2932           tt65001      10.0.14.2       0            (!)
24014  Pop         TE: 2967           BE12         10.0.14.2       0
       Pop         TE: 2967           tt65001      10.0.14.2       0            (!)
```

The following sample output shows detailed information for the LSP tunnels:

```
RP/0/RP0/CPU0:router#  show mpls forwarding prefix  10.0.143.0/24 detail

Local  Outgoing    Prefix             Outgoing     Next Hop        Bytes
Label  Label       or ID              Interface                    Switched
------ ----------- ------------------ ------------ --------------- ------------
25156  24715       10.0.143.0/24      BE1          10.1.1.1        0
     Updated: Feb  1 11:30:20.150
     Version: 84285, Priority: 3
     Label Stack (Top -> Bottom): { 24715 }
     NHID: 0x0, Encap-ID: 0xe3a, Path idx: 0, Backup path idx: 0, Weight: 0
     MAC/Encaps: 14/18, MTU: 1500
     Packets Switched: 0
```

This table describes the significant fields shown in the display.

Table 18: show mpls forwarding Field Descriptions

Field	Description
Local Label	Label assigned by this router.
Outgoing Label	Label assigned by the next hop or downstream peer. Some of the entries that display in this column are: **Unlabeled** No label for the destination from the next hop, or label switching is not enabled on the outgoing interface. **Pop Label** Next hop advertised an implicit-null label for the destination.
Prefix or Tunnel ID	Address or tunnel to which packets with this label are going.
Outgoing Interface	Interface through which packets with this label are sent.
Next Hop	IP address of neighbor that assigned the outgoing label.
Bytes Switched	Number of bytes switched with this incoming label.

Field	Description
TO	Timeout: Indicated by an "*" if entry is being timed out in forwarding.
Mac/Encaps	Length in bytes of Layer 2 header, and length in bytes of packet encapsulation, including Layer 2 header and label header.
MTU	MTU[5] of labeled packet.
Label Stack	All the outgoing labels on the forwarded packet.
Packets Switched	Number of packets switched with this incoming label.
Label switching	Number of Label switching LFIB[6] forwarding entries.
IPv4 label imposition	Number of IPv4 label imposition forwarding entries (installed at ingress LSR).
MPLS TE tunnel head	Number of forwarding entries (installed at ingress LSR) on MPLS TE tunnel head.
MPLS TE fast-reroute	Number of forwarding entries (installed at PLR) for MPLS-TE fast reroute.
Forwarding updates	Number of forwarding updates sent from LSD (RP/DRP) to LFIB/MPLS (RP/DRP/LC) using BCDL mechanism, indicating the total number of updates and total number of BCDL messages.
Labels in use	Local labels in use (installed in LFIB). These usually indicate the lowest and highest label in use (allocated by applications). Furthermore, some reserved labels, such as explicit-nullv4, explicit-nullv6, are installed in the forwarding plane. The label range is 0 to 15.

[5] MTU = Maximum Transmission Unit.
[6] LFIB = Label Forwarding Information Base.

show mpls forwarding tunnels

To display the contents of the **MPLS** forwarding tunnel, use the **show mpls forwarding tunnel** command in XR EXEC mode.

show mpls forwarding tunnels [**detail**][**tunnels** *tunnel-id*] [**vrf** *vrf-name*]

Syntax Description

detail	(Optional) Displays information in long form (includes length of encapsulation, length of Media Access Control [MAC] string, maximum transmission unit [MTU], Packet switched, and label stack).
tunnels *tunnel-id*	(Optional) Displays entries either for a specified label switch path (LSP) tunnel or all LSP tunnel entries.
vrf *vrf-name*	(Optional) Displays entries for VPN routing and forwarding (VRF).

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The optional keywords and arguments described allow specification of a subset of the entire MPLS forwarding table. This router does not support label accounting for vrf labels. Instead, it supports accounting for the IGP and LDP labels. As a result, the Bytes Switched counter is 0 for the **show mpls forwarding vrf** command.

Note When the **show mpls forwarding tunnels detail** command is executed with the **location** keyword

The *node-id* argument is entered in the *rack/slot/module* notation.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following sample output is from the **show mpls forwarding tunnels** command using the **location** keyword and a specific node ID:

show mpls forwarding tunnels

```
RP/0/RSP0/CPU0:PE1#sh mpls forwarding tunnels 1999 detail
Thu Jul 23 22:56:09.726 PDT
Tunnel        Outgoing    Outgoing     Next Hop        Bytes
Name          Label       Interface                    Switched
------------- ----------- ------------ --------------- ------------
tt1999        50045       BE10         point2point     0
     Updated: Jul 23 20:04:57.416
     Version: 82681, Priority: 2
     Label Stack (Top -> Bottom): { 50045 }
     Local Label: 27972
     NHID: 0x0, Path idx: 0, Backup path idx: 0, Weight: 0
     MAC/Encaps: 14/18, MTU: 1500
     Packets Switched: 0

  Interface Handle: 0x0801f4a0, Local Label: 27972
  Forwarding Class: 0, Weight: 0
  Packets/Bytes Switched: 7045837/7116295370

RP/0/RSP0/CPU0:PE1#sh mpls forwarding tunnels 1999 detail location 0/0/CPU0
Thu Jul 23 22:56:14.526 PDT
Tunnel        Outgoing    Outgoing     Next Hop        Bytes
Name          Label       Interface                    Switched
------------- ----------- ------------ --------------- ------------
tt1999        50045       BE10         point2point     0
     Updated: Jul 23 20:04:57.640
     Version: 82681, Priority: 2
     Label Stack (Top -> Bottom): { 50045 }
     Local Label: 27972
     NHID: 0x0, Path idx: 0, Backup path idx: 0, Weight: 0
     MAC/Encaps: 14/18, MTU: 1500
     Packets Switched: 0

  Interface Handle: 0x0801f4a0, Local Label: 27972
  Forwarding Class: 0, Weight: 0
 Packets/Bytes Switched: 7045837/7116295370

RP/0/RSP0/CPU0:PE1#sh mpls forwarding tunnels 1999
Thu Jul 23 22:56:19.717 PDT
Tunnel        Outgoing    Outgoing     Next Hop        Bytes
Name          Label       Interface                    Switched
------------- ----------- ------------ --------------- ------------
tt1999        50045       BE10         point2point     0
```

show mpls forwarding exact-route

To display the exact path for the source and destination address pair, use the **show mpls forwarding exact-route** command in XR EXEC mode.

show mpls forwarding exact-route label *label-number* {**bottom-label** *value* | **ipv4** *source-address destination-address* | **ipv6***source-addressdestination-address*} [**detail**] [**protocol** *protocol* **source-port** *source-port* **destination-port** *destination-port* **ingress-interface** *type interface-path-id*] [**location** *node-id*] [**policy-class** *value*] [**hardware** {**ingress** | **egress**}]

Syntax Description

label *label-number*	Displays the Label Number. Range is 0 to 1048575.
bottom-label *value*	Displays the bottom label value. Range is 0 to 1048575.
ipv4 *source-address destination-address*	Displays the exact path for IPv4 payload. The IPv4 source address in x.x.x.x format. The IPv4 destination address in x.x.x.x format.
ipv6 *source-address destination-address*	Displays the exact path for IPv6 payload. The IPv6 source address in x:x::x format. The IPv6 destination address in x:x::x format.
detail	(Optional) Displays detailed information.
protocol *protocol*	(Optional) Displays the specified protocol for the route.
source-port *source-port*	Sets the UDP source port. The range is from 0 to 65535.
destination-port *destination-port*	Sets the UDP destination port. The range is from 0 to 65535.
ingress-interface	Sets the ingress interface.
type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
location *node-id*	(Optional) Displays hardware resource counters on the designated node.
policy-class *value*	(Optional) Displays the policy-based tunnel selection (PBTS) to direct traffic into specific TE tunnels. The policy-class attribute maps the correct traffic class to this policy. The range for the policy-class value is from 1 to 7.
hardware	(Optional) Displays the hardware location entry.
ingress	(Optional) Reads information from the ingress PSE.

egress	(Optional) Reads information from the egress PSE.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls forwarding exact-route** command displays information in long form and includes the following information:

- Encapsulation length
- Media Access Control (MAC) string length
- Maximum transmission unit (MTU)
- Packet switching information
- Label stacking information

Note

- If you use the show mpls forwarding exact-route command for a GRE MPLS packet, it shows incorrect egress locations.
- If you use the show mpls forwarding exact-route command for a GRE MPLS packet, it shows incorrect egress locations.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following shows a sample output from the **show mpls forwarding exact-route** command:

```
RP/0/RP0/CPU0:router# show mpls forwarding exact-route label  24075 ipv4 11.255.255.1
12.0.14.1 protocol tcp sou$

Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ------------------ ------------ --------------- ------------
24075  Pop         TE: 4131          BE12         12.0.14.2       N/A
     Via: BE12, Next Hop: 12.0.14.2
     Label Stack (Top -> Bottom): { Imp-Null }
     NHID: 0x0, Encap-ID: 0xab8, Path idx: 0, Backup path idx: 0, Weight: 0
```

```
MAC/Encaps: 14/14, MTU: 1500
```

This table describes the significant fields shown in the display.

Table 19: show mpls forwarding exact-route Field Descriptions

Field	Description
Local Label	Label assigned by this router.
Outgoing Label	Label assigned by the next hop or downstream peer. Some of the entries that display in this column are: **Unlabeled** No label for the destination from the next hop, or label switching is not enabled on the outgoing interface. **Pop Label** Next hop advertised an implicit-null label for the destination.
Prefix or Tunnel ID	Address or tunnel to which packets with this label are going.
Outgoing Interface	Interface through which packets with this label are sent.
Next Hop	IP address of neighbor that assigned the outgoing label.
Bytes Switched	Number of bytes switched with this incoming label.
TO	Timeout: Indicated by an "*" if entry is being timed out in forwarding.
MAC/Encaps	Length in bytes of Layer 2 header, and length in bytes of packet encapsulation, including Layer 2 header and label header.
MTU	MTU[7] of labeled packet.
Label Stack	All the outgoing labels on the forwarded packet.
Packets Switched	Number of packets switched with this incoming label.
Label switching	Number of Label switching LFIB[8] forwarding entries.
IPv4 label imposition	Number of IPv4 label imposition forwarding entries (installed at ingress LSR).
MPLS TE tunnel head	Number of forwarding entries (installed at ingress LSR) on MPLS TE tunnel head.
MPLS TE fast-reroute	Number of forwarding entries (installed at PLR) for MPLS-TE fast reroute.
Forwarding updates	Number of forwarding updates sent from LSD (RP/DRP) to LFIB/MPLS (RP/DRP/LC) using BCDL mechanism, indicating the total number of updates and total number of BCDL messages.
Labels in use	Local labels in use (installed in LFIB). These usually indicate the lowest and highest label in use (allocated by applications). Furthermore, some reserved labels, such as explicit-nullv4, explicit-nullv6, are installed in the forwarding plane. The label range is 0 to 15.

[7] MTU = Maximum Transmission Unit.
[8] LFIB = Label Forwarding Information Base.

show mpls forwarding label-security interface

To display the contents of the MPLS label interface security information, use the **show mpls forwarding label-security interface** command in XR EXEC mode.

show mpls forwarding label-security[**interface** *type interface-path-id*] [**location** *node-id*]

Syntax Description

interface	(Optional) Displays information for the specified interface.
type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
location *node-id*	(Optional) Displays hardware resource counters on the designated node.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The optional keywords and arguments described allow display of an MPLS label security information.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

The following sample output is from the **show mpls forwarding label-security interface** command and specific interface and location:

```
RP/0/RP0/CPU0:router# show mpls forwarding label-security interface HundredGigE location
0/1/CPU0
```

show mpls forwarding label-security summary location

To display the contents of the MPLS label security information summary, use the **show mpls forwarding label-security summary location**command in XR EXEC mode.

show mpls forwarding label-security summary location *node-id*

Syntax Description

location *node-id*	Displays label security information on the designated node.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The optional keywords and arguments described allow display of an MPLS label security information.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

The following sample output is from the **show mpls forwarding label-security summary location** command and a specific location:

```
RP/0/RP0/CPU0:router# show mpls forwarding label-security summary location 0/1/CPU0
```

show mpls forwarding labels

To display the contents of the MPLS label information, use the **show mpls forwarding labels** command in XR EXEC mode.

show mpls forwarding [**labels** *low-value high-value*] **hardware egress** [**detail**] [**npu location** *node-id*] **[rpf]**

Syntax Description

labels *low-value high-value*	(Optional) Entries with a local labels range. Ranges for *low-value* is 0 and *high-value*is 0 1048575.
hardware	(Optional) Displays the hardware location entry.
egress	(Optional) Reads information from the egress PSE.
detail	(Optional) Displays detailed information for the designated node.
npu	(Optional) Displays CEF entries that are processed by the egress NPU.
location*node-id*	(Optional) Displays hardware resource counters on the designated node.
rpf	(Optional) Displays label RPF information. **Note** This will be supported in a future release of Cisco IOS XR software.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 24.2.1	This command was modified. The **npu** keyword was introduced.
Release 6.6.1	The command displays statistics information.
Release 6.0	This command was introduced.

Usage Guidelines

- The optional keywords and arguments described allow display of MPLS label security and RPF information.

- The **show mpls forwarding labels** command displays per-label statistics at "ingress" for Segment Routing labels only if it's enabled using the **hw-module profile stats ingress-sr** command.
- For NCS 560 series routers, the command output doesn't include the per-label statistics information even after enabling the **hw-module profile stats ingress-sr** command.
- The **Bytes Switched** counter is not supported in the **show mpls forwarding** command, so the counter remains at 0.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

The following sample output is from the **show mpls forwarding labels** command using the **rpf**:

```
RP/0/RP0/CPU0:router# show mpls forwarding labels rpf
Forwarding entries:
   Label switching: 0, protected: 0
   MPLS TE tunnel head: 0, protected: 0
   MPLS TE midpoint: 0, protected: 0
   MPLS TE internal: 0, protected: 0
   MPLS P2MP TE tunnel head: 0
   MPLS P2MP TE tunnel midpoint/tail: 0
   MPLS P2MP MLDP tunnel head: 0
   MPLS P2MP MLDP tunnel midpoint/tail: 0
Forwarding updates:
   messages: 2
      p2p updates: 4
Labels in use:
   Reserved: 4
   Lowest: 0
   Highest: 13
   Deleted stale label entries: 0

Pkts dropped:    0
Pkts fragmented: 0
Failed lookups:  0
```

The following sample output is from the **show mpls forwarding labels** command using **hardware egress detail location**:

```
Router-PE1#show mpls forwarding labels 24001 hardware egress detail location 0/0/CPU0
Wed Jul 26 21:24:26.953 UTC
Local  Outgoing    Prefix             Outgoing     Next Hop        Bytes
Label  Label       or ID              Interface                    Switched
------ ----------- ------------------ ------------ --------------- ------------
24001              mLDP/IR: 0x00002 (0x00002)
       Updated Jul 26 21:06:08.921
       mLDP/IR LSM-ID: 0x00002, MDT: 0x2000802c, Head LSM-ID: 0x00002
       IPv4 Tableid: 0xe0000001, IPv6 Tableid: 0xe0800001
       Flags:IP Lookup:set, Expnullv4:not-set, Expnullv6:not-set
             Payload Type v4:not-set, Payload Type v6:not-set, l2vpn:not-set
             Head:set, Tail:not-set, Bud:not-set, Peek:set, inclusive:not-set
             Ingress Drop:not-set, Egress Drop:not-set
```

```
            RPF-ID:0, Encap-ID:0
            Disp-Tun:[ifh:0x0, label:-]
            Platform Data [32]:
             { 0 0 36 10 0 0 36 10
               0 0 0 0 0 0 0 0
               0 0 0 0 0 14 52 154
               255 255 255 255 255 255 255 255
               }
       mpls paths: 1, local mpls paths: 1, protected mpls paths: 1

       24008       mLDP/IR: 0x00002 (0x00002)   \
                                  Te0/0/0/4    10.2.0.2        N/A
         Updated: Jul 26 21:06:08.935
         My Nodeid:0x0
         Interface Nodeids:
           [ 0x0 - - - - - - - - -  ]
         Interface Handles:
           [ 0xe0 - - - - - - - - -  ]
         Backup Interface Nodeids:
           [ 0x0 - - - - - - - - - ]
         Backup Interface Handles:
           [ 0x48 - - - - - - - - - ]
         Packets Switched: 0


 LEAF - HAL pd context :
 sub-type : MPLS_P2MP, ecd_marked:0, has_collapsed_ldi:0
 collapse_bwalk_required:0, ecdv2_marked:0,
HW Walk:
LEAF:
    PI:0x308e3ead68 PD:0x308e3eae10 rev:285 type: MPLS_P2MP (12) TBL: 0
    LEAF location: UNKNOWN
    FEC key: 00
    label action: MPLS_NOP, dpa handle: 0x308e50f740
mplslabel HW:
    npu:0x0 mcid:0xa00240a

    MOL:
        PD: 0x308e892350 rev: 483 dpa-rev: 20058
        fgid: 9226 (0x240a) LSM id: 2 ipmcolist DPA hdl: 0x308ee5f098
        is head: 1 is tail: 0 is bud: 0 drop_flag: 0
        num MPIs: 1
    ipmcolist HW:
        npu:0x0 status:0x0 replications:0x0

        MPI:
            PD: 0x308e9f51d0 rev: 481 p-rev: 478 479 254
            flags: 0x213 in-label: 24001 out-label: 24008 neighbor: 21.21.21.21
            PRIMARY:
            mpls encap id: 0x40011852 mplsnh DPA handle: 0x308ec7b748 dpa-rev: 20056
            LDP local lbl: 24002 out lbl: 1048580
            nh: 10.2.0.2 nh encap hdl: 0x308e78e298 nh ifh: 0xe0 ul ifh: 0
            incomplete: 0 NPU mask: 0x1 sysport: 28
        mplsnh HW:
            npu:0x0 label1:0x5dc8 action:0x2 failover_id:0x80000004 next_encap:0x0
            BACKUP:
            mpls encap id: 0x40011853 mplsnh DPA handle: 0x308ec7baa0 dpa-rev: 20057
            LDP backup out lbl: 24005 pq lbl: 1048577
            nh: 10.0.0.1 nh encap hdl: 0x308e78e5f8 nh ifh: 0x48 ul ifh: 0
            incomplete: 0 NPU mask: 0x1 sysport: 9
        mplsnh HW:
          npu:0x0 label1:0x5dc8 action:0x2 label2:0x5dc5 action:0x2 failover_id:0x80000005
 next_encap:0x0
```

```
                BKUP-FRR-P2MP:
                PI:0x308ee1f048 PD:0x308ee1f138 Rev: 479 parent-rev: 478 356  dpa-rev:
20055
                DPA Handle: 0x308ee0f260, HW Id: 0x80000005, Status: BLK, npu_mask: 0x1,
 Bkup IFH: 0x48
                  lsmprotect HW:
                      npu:0x0 failover_id:0x80000005 state:0x1

                PROT-FRR-P2MP:
                PI:0x308edcf048 PD:0x308edcf160 Rev: 478 parent-rev: 254  dpa-rev: 20054

                FRR Active: 0, DPA Handle: 0x308ee0f0e8, HW Id: 0x80000004, Status: FWD,
 npu_mask: 0x1, Prot IFH: 0xe0
                  lsmprotect HW:
                      npu:0x0 failover_id:0x80000004 state:0x0

            TX-NHINFO:
              PI: 0x308e6e6340 PD: 0x308e6e63d0 rev:254 dpa-rev:2303 Encap hdl: 0x308e78e298

                Encap id: 0x40010001 Remote: 0 L3 int: 16 flags: 0x3 transport_encap_id:0x0

                 npu_mask: 0x1 DMAC: c4:b2:39:dc:02:08
```

The following sample output is from the **show mpls forwarding labels** command with **npu** keyword:

```
Router#show mpls forwarding labels 24000 hardware egress npu location 0/0/CPU0   <<<<<<<<<<<<
 Show output with NPU keyword showing additional data from NPU hardware

Using NPU option is resource intensive and may result in system
instability and possibly result in traffic loss.
Do you really want to continue[confirm with only 'y' or 'n'] [y/n] :Local  Outgoing
Prefix             Outgoing     Next Hop        Bytes
Label  Label       or ID              Interface                  Switched
------ ----------- ------------------ ------------ --------------- ------------
24000  24002       3.3.3.3/32         Hu0/0/0/10   10.1.1.2        N/A


 LEAF - HAL pd context :
 sub-type : MPLS, ecd_marked:0, has_collapsed_ldi:0
 collapse_bwalk_required:0, ecdv2_marked:0,
HW Walk:
LEAF:
    PI:0x308e342928 PD:0x308e3429d0 rev:2014 type: MPLS (2) TBL: 0
    LEAF location: LEM
    FEC key: 0x1440000f7d0
    label action: MPLS_SWAP, dpa handle: 0x308e4672d8
    mplslabel HW:
    npu:0x0 out_label:0x5dc2 fec:0x2001ffd6  <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
    npu:0x1 out_label:0x5dc2 fec:0x2001ffd6
    npu:0x2 out_label:0x5dc2 fec:0x2001ffd6
    npu:0x3 out_label:0x5dc2 fec:0x2001ffd6

    LWLDI:
        PI:0x308d252a08 PD:0x308d252a50 rev:2011 p-rev:2010  ldi type:IMP_EOS0_EOS1
        FEC key: 0x1540000f7d0 fec index: 0x2001ffd5(131029) num paths: 1 bkup paths: 0
        IMP pattern:3
        PI:0x308d252a08 PD:0x308d252a50 rev:2011 p-rev:2010  dpa-rev:4269924
        FEC key: 0x1540000f7d0 fec index: 0x2001ffd5(131029) num paths: 1 bkup paths: 0
        Path:0  fec index: 0x2001ffd5(131029) DSP: 0x9f
                MPLS encap key: 0xf1b0000040011841 MPLS encap id: 0x40011841 Remote: 0
                Label Stack(Top -> Bottom): { 24002 } dpa-rev: 4269923
        FEC:
        npu:0x0 fec:0x2001ffd5 port:0x8001811 encap:0x40011841
```

```
        npu:0x1 fec:0x2001ffd5 port:0x8001811 encap:0x40011841
<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
        npu:0x2 fec:0x2001ffd5 port:0x8001811 encap:0x40011841
        npu:0x3 fec:0x2001ffd5 port:0x8001811 encap:0x40011841
        mplsnh HW:
            npu:0x1 mpls_encap_id:0x40011841 label1:0x5dc2 action:0x2

        SHLDI:
            PI:0x308bec3698 PD:0x308bec37a8 rev:2010 dpa-rev:4269922 cbf_enabled:0
pbts_enabled:0 surpf_enable:0 flag:0x0
            FEC key: 0x1440000f7d0 fec index: 0x2001ffd6(131030) num paths: 1 bkup paths:
0
            p-rev:1973
            Path:0 fec index: 0x2001ffd6(131030) DSP:0x9f Dest fec index: 0x0(0)
            FEC:
            npu:0x0 fec:0x2001ffd6 port:0x8001811 encap:0x40010001
            npu:0x1 fec:0x2001ffd6 port:0x8001811 encap:0x40010001
<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
            npu:0x2 fec:0x2001ffd6 port:0x8001811 encap:0x40010001
            npu:0x3 fec:0x2001ffd6 port:0x8001811 encap:0x40010001

            TX-NHINFO:
                PI: 0x308ea81340 PD: 0x308ea813d0 rev:1973 dpa-rev:4269323 Encap hdl:
0x308eb21298
               Encap id: 0x40010001 Remote: 0 L3 int: 17 flags: 0x3 transport_encap_id:0x0

                npu_mask: 0x2 DMAC: ba:d6:11:de:61:d8
                ENCAP:
                npu:0x1 mac:0xd861de11d6ba vlan:0x11  <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
```

show mpls forwarding summary

To display the summary of the MPLS label table, use the **show mpls forwarding summary** command in XR EXEC mode.

show mpls forwarding summary [**debug**] [**location** *node-id*] **no-counters** **private**

Syntax Description

debug	(Optional) Displays the information for internal debugging in the command output.
location *node-id*	(Optional) Displays the interfaces on which MPLS is enabled.
no-counters	(Optional) Skips displaying counters.
private	(Optional) Displays private information.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The optional keywords and arguments described allow display of an MPLS label security information.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

The following sample output is from the **show mpls forwarding summary** command using the **debug** keyword:

```
RP/0/RP0/CPU0:router# show mpls forwarding summary debug
Forwarding entries:
   Label switching: 0, protected: 0
   MPLS TE tunnel head: 0, protected: 0
   MPLS TE midpoint: 0, protected: 0
   MPLS TE internal: 0, protected: 0
   MPLS P2MP TE tunnel head: 0
   MPLS P2MP TE tunnel midpoint/tail: 0
   MPLS P2MP MLDP tunnel head: 0
   MPLS P2MP MLDP tunnel midpoint/tail: 0
Forwarding updates:
   messages: 2
      p2p updates: 4
Labels in use:
   Reserved: 4
   Lowest: 0
```

```
   Highest: 13
   Deleted stale label entries: 0

Pkts dropped:    0
Pkts fragmented: 0
Failed lookups:  0
```

The following sample output is from the **show mpls forwarding summary** command using the **location** keyword and a specific location:

```
RP/0/RP0/CPU0:router# show mpls forwarding summary location 0/1/CPU0
Forwarding entries:
   Label switching: 0, protected: 0
   MPLS TE tunnel head: 0, protected: 0
   MPLS TE midpoint: 0, protected: 0
   MPLS TE internal: 0, protected: 0
   MPLS P2MP TE tunnel head: 0
   MPLS P2MP TE tunnel midpoint/tail: 0
   MPLS P2MP MLDP tunnel head: 0
   MPLS P2MP MLDP tunnel midpoint/tail: 0
Forwarding updates:
   messages: 2
      p2p updates: 4
Labels in use:
   Reserved: 4
   Lowest: 0
   Highest: 13
   Deleted stale label entries: 0

Pkts dropped:    0
Pkts fragmented: 0
Failed lookups:  0
```

The following sample output is from the **show mpls forwarding summary** command using the **no-counters**:

```
RP/0/RP0/CPU0:router# show mpls forwarding summary no-counters
Forwarding entries:
   Label switching: 0, protected: 0
   MPLS TE tunnel head: 0, protected: 0
   MPLS TE midpoint: 0, protected: 0
   MPLS TE internal: 0, protected: 0
   MPLS P2MP TE tunnel head: 0
   MPLS P2MP TE tunnel midpoint/tail: 0
   MPLS P2MP MLDP tunnel head: 0
   MPLS P2MP MLDP tunnel midpoint/tail: 0
Forwarding updates:
   messages: 2
      p2p updates: 4
Labels in use:
   Reserved: 4
   Lowest: 0
   Highest: 13
   Deleted stale label entries: 0
```

The following sample output is from the **show mpls forwarding summary** command using the **private**:

```
RP/0/RP0/CPU0:router# show mpls forwarding summary private
```

```
Forwarding entries:
   Label switching: 0, protected: 0
   MPLS TE tunnel head: 0, protected: 0
   MPLS TE midpoint: 0, protected: 0
   MPLS TE internal: 0, protected: 0
   MPLS P2MP TE tunnel head: 0
   MPLS P2MP TE tunnel midpoint/tail: 0
   MPLS P2MP MLDP tunnel head: 0
   MPLS P2MP MLDP tunnel midpoint/tail: 0
Forwarding updates:
   messages: 2
      p2p updates: 4
Labels in use:
   Reserved: 4
   Lowest: 0
   Highest: 13
   Deleted stale label entries: 0
Path count:
   Unicast: 0

Pkts dropped:    0
Pkts fragmented: 0
Failed lookups:  0
fwd-flags: 0x5, ttl-expire-pop-cnt: 0
```

This table describes the significant fields shown in the display.

Table 20: show mpls forwarding summary Field Descriptions

Field	Description
Label switching	Number of Label switching Label Forwarding Information Base (LFIB) forwarding entries.
MPLS TE tunnel head	Number of forwarding entries (installed at ingress LSR) on MPLS TE tunnel head.
Forwarding updates	Number of forwarding updates sent from LSD (RP/DRP) to LFIB/MPLS (RP/DRP/LC) using BCDL mechanism, indicating the total number of updates and total number of BCDL messages.
Labels in use	Local labels in use (installed in LFIB). These usually indicate the lowest and highest label in use (allocated by applications). Furthermore, some reserved labels, such as explicit-nullv4, explicit-nullv6, are installed in the forwarding plane. The label range is 0 to 15.

show mpls interfaces

To display information about one or more interfaces that have been configured for MPLS, use the **show mpls interfaces** command in XR EXEC mode.

show mpls interfaces [*type interface-path-id*] [**location** *node-id*] [**detail**]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
location *node-id*	(Optional) Displays hardware resource counters on the designated node.
detail	(Optional) Displays detailed information for the designated node.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

This command displays MPLS information about a specific interface or about all interfaces where MPLS is configured.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following shows a sample output from the **show mpls interfaces** command:

```
RP/0/RP0/CPU0:router# show mpls interfaces
```

```
  Interface                  LDP      Tunnel   Static   Enabled
                                      -------------------------- -------- -------- --------
--------
HundredGigE0/2/0/0         No       No       No       Yes
                                    HundredGigE0/2/0/3         No       No       No       Yes
HundredGigE0/2/0/10        No       No       No       Yes
                                    TenGigE0/2/0/2/3           No       No       No       Yes
TenGigE0/2/0/2/2           No       No       No       Yes
                                    TenGigE0/2/0/2/1           No       No       No       Yes
TenGigE0/2/0/2/0           Yes      No       No       Yes
                                    TenGigE0/4/0/0/0           No       No       No       Yes
TenGigE0/4/0/16/0          No       No       No       Yes
                                    TenGigE0/4/0/12/3          No       No       No       Yes
TenGigE0/4/0/12/2          No       No       No       Yes
                                    TenGigE0/4/0/12/1          No       No       No       Yes
TenGigE0/4/0/12/0          Yes      No       Yes      Yes
                                    TenGigE0/4/0/0/3           No       No       No       Yes
TenGigE0/4/0/0/2           No       No       No       Yes
                                    TenGigE0/4/0/0/1           Yes      No       Yes      Yes
HundredGigE0/7/0/29        No       No       No       Yes
                                    HundredGigE0/7/0/35        No       No       No       Yes
Bundle-Ether1              Yes      No       No       Yes
                                    Bundle-Ether2              No       No       No       Yes
Bundle-Ether3              No       No       No       Yes
                                    Bundle-Ether4              No       No       No       Yes
Bundle-Ether5              No       No       No       Yes
                                    Bundle-Ether6              Yes      No       No       Yes
Bundle-Ether7              No       No       No       Yes
                                    Bundle-Ether8              Yes      No       No       Yes
```

This table describes the significant fields in the sample display.

Table 21: show mpls interfaces Command Field Descriptions

Field	Description
LDP	State of LDP labelling.
Tunnel	State of LSP Tunnel labelling.
MTU	MTU[9] of labeled packet.
Caps	Capsulation switching chains installed on an interface.
M	MPLS switching capsulation/switching chains are installed on the interface and are ready to switch MPLS traffic.

[9] MTU = Maximum Transmission Unit.

show mpls label range

To display the range of local labels available for use on packet interfaces, use the **show mpls label range** command in XR EXEC mode.

show mpls label range

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You can use the **show mpls label range** command to configure a range for local labels that is different from the default range.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following shows a sample output from the **show mpls label range** command:

```
RP/0/RP0/CPU0:router# show mpls label range

  Range for dynamic labels: Min/Max: 16000/144000
```

This table describes the significant fields shown in the display.

Table 22: show mpls label range Command Field Descriptions

Field	Description
Range for dynamic labels	Minimum and maximum allowable range for local labels (which differs from the default range).

show mpls label table

To display the local labels contained in the MPLS label table, use the **show mpls label table** command in XR EXEC mode.

show mpls label table *table-index* [**application** *application*] [**label** *label-value*] [**summary**] [**detail**]

Syntax Description

table-index	Index of the label table to display. The global label table is 0. Currently, you can specify table 0 only.
application *application*	(Optional) Displays all labels owned by the selected application. Options are: **bgp-ipv4**, **bgp-spkr**, **bgp-vpn-ipv4**, **internal**, **ldp**, **none**, **l2vpn**, **static**, **te-control**, **te-link**, and **test**.
label *label-value*	(Optional) Displays a selected label based on the label value. Range is 0 to 1048575.
summary	(Optional) Displays a summary of local labels.
detail	(Optional) Displays detailed information for the MPLS label table.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Labels 16 to 15999 are reserved for static Layer 2 VPN pseudowires.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following shows a sample output from the **show mpls label table** command:

```
RP/0/RP0/CPU0:router# show mpls label table 0

  Table Label   Owner      State  Rewrite
```

```
----- ------- ---------- ------ -------
0     0       LSD        InUse  Yes
0     1       LSD        InUse  Yes
0     2       LSD        InUse  Yes
0     3       LSD        InUse  Yes
0     16      TE-Link    InUse  Yes
```

This table describes the significant fields shown in the display.

Table 23: show mpls label table Command Field Descriptions

Field	Description
Table	Table ID.
Label	Label index.
Owner	Application that allocated the label. All labels displaying “InUse” state have an owner.
State	**InUse** Label allocated and in use by an application. **Alloc** Label allocated but is not yet in use by an application. **Pend** Label was in use by an application that has terminated unexpectedly, and the application has not reclaimed the label. **Pend-S** Label was in use by an application, but the MPLS LSD (Label Switching Database) server has recently restarted and the application has not reclaimed the label.
Rewrite	Number of initiated rewrites.

show mpls lsd applications

To display the MPLS applications registered with the MPLS Label Switching Database (LSD) server, use the **show mpls lsd applications** command in XR EXEC mode.

show mpls lsd applications [**application** *application*]

Syntax Description

application *application*	(Optional) Displays all labels owned by the selected application. Options are: **bgp-ipv4**, **bgp-spkr**, , **internal**, **ldp**, **none**, , **static**, **te-control**, **te-link**, and **test**.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

MPLS applications include Traffic Engineering (TE) control, TE Link Management and label distribution protocol (LDP). The application must be registered with MPLS LSD for its features to operate correctly. All applications are clients (see the show mpls lsd clients, on page 164command), but not all clients are applications.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following shows a sample output from the **show mpls lsd applications** command:

```
RP/0/RP0/CPU0:router# show mpls lsd applications

  Type         State    RecoveryTime Node
  ------------ -------- ------------ ------------
  LDP          Active   300          0/0/CPU0
  TE-Control   Active   100          0/0/CPU0
  TE-Link      Active   600          0/0/CPU0
```

This table describes the significant fields shown in the display.

Table 24: show mpls lsd applications Command Field Descriptions

Field	Description
Type	LSD application type.
State	**Active** Application registered with MPLS LSD and is functioning correctly. **Recover** Application registered with MPLS LSD and is recovering after recently restarting. In this state, the RecoveryTime value indicates how many seconds are left before the application becomes active. **Zombie** Application not re-registered after an unexpected termination. In this case, RecoveryTime indicates how many seconds are left before MPLS LSD gives up on the application.
RecoveryTime	Seconds remaining before MPLS LSD gives up or resumes the application.
Node	Node expressed in standard *rack*/*slot*/*module* notation.

show mpls lsd clients

To display the MPLS clients connected to the MPLS Label Switching Database (LSD) server, use the **show mpls lsd clients** command in XR EXEC mode.

show mpls lsd clients

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

MPLS clients include Traffic Engineering (TE) Control, TE Link Management, Label Distribution Protocol (LDP), and Bulk Content Downloader (BCDL) Agent. Not all clients are applications (see the **show mpls lsd applications** command), but all applications are clients.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following shows a sample output from the **show mpls lsd clients** command:

```
RP/0/RP0/CPU0:router# show mpls lsd clients

  Id Services             Node
  -- -------------------- ------------
  0  BA(p=none)           0/0/CPU0
  1  A(TE-Link)           0/0/CPU0
  2  A(LDP)               0/0/CPU0
  3  A(TE-Control)        0/0/CPU0
```

The following table describes the significant fields shown in the display.

Table 25: show mpls lsd clients Command Field Descriptions

Field	Description
Id	Client identification number.
Services	A(xxx) means that this client is an application and xxx is the application name, BA(yyy) means that this client is a BCDL Agent and yyy is expert data. Depending on system conditions, there can be multiple BCDL Agent clients (this is normal).
Node	Node expressed in standard rack/slot/module notation.

show mpls lsd forwarding labels

To display the LSD label RPF information, use the **show mpls lsd forwarding labels** command in XR EXEC mode.

show mpls lsd forwarding [**labels** *low-value high-value*] [**location** *node-id*]

Syntax Description

labels *low-value high-value*	(Optional) Entries with a local labels range. Ranges for both *low-value* and *high-value* are 0 to 1048575.
location *node-id*	Displays hardware resource counters on the designated node.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The optional keywords and arguments described allow display of an MPLS label security information.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

The following sample output is from the **show mpls lsd forwarding labels** command using a specific location:

```
RP/0/RP0/CPU0:router# show mpls lsd forwarding labels 1 13 detail location 0/1/CPU0
```

show mpls lsd forwarding summary

To display the LSD label RPF information, use the **show mpls lsd forwarding summary** command in XR EXEC mode.

show mpls lsd forwarding summary [**location** *node-id*]

Syntax Description

location *node-id*	Displays hardware resource counters on the designated node.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The optional keywords and arguments described allow display of the interface label security information.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

The following sample output is from the **show mpls lsd forwarding summary** command and a specific location:

```
RP/0/RP0/CPU0:router# show mpls lsd forwarding summary location 0/1/CPU0
Interface      IFH          MTU  Flags      Type
-------------- ---------- ----- ---------- ----------
FI0/1/CPU0     0x02000080  8000 0x01000000 0x0000001b
tt1            0x08000320  1500 0x01000000 0x00000024
```

show mpls traffic-eng fast-reroute database

To display the contents of the fast reroute (FRR) database, use the **show mpls traffic-eng fast-reroute database** command in XR EXEC mode.

show mpls traffic-eng fast-reroute database [*ip-address*] [*ip-address / length*] [**afi-all** { **safi-all** | **unicast**} {*ip-address ip-address/length*}] [**backup-interface**] [**tunnel** *tunnel -id*] [**unresolved**] [**interface** *type interface-path-id*] [**ipv4** { **safi-all** | **unicast**} {*ip-address ip-address/length*}] [**labels** *low-number high-number*] [**state** {**active** | **complete** | **partial** | **ready**}] [**role** {**head** | **midpoint**}] [**summary**] [**fullname**] [**location** *node-id*]

Syntax Description

ip-address	(Optional) IP address of the destination network.
ip-address / length	(Optional) Bit combination indicating the portion of the IP address that is being used for the subnet address.
afi-all	(Optional) Returns data for all specified address family identifiers.
safi-all	(Optional) Returns data for all sub-address family identifiers.
unicast	(Optional) Returns unicast data only.
backup-interface	(Optional) Displays entries with the specified backup interface.
tunnel *tunnel-id*	(Optional) Tunnel and tunnel ID to which packets with this label are going. The **summary** suboption is available.
unresolved	(Optional) Displays entries whose backup interface has not yet been fully resolved.
interface	(Optional) Displays entries with this primary outgoing interface. The **summary** keyword is available.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
ipv4	(Optional) Displays only IPv4 data.
labels	(Optional) Displays database entries that possess in-labels assigned by this router (local labels). Specify either a starting value or a range of values. The **state** suboption is available.

state	(Optional) Filters the database according to the state of the entry: **active** FRR rewrite is in the forwarding active database (where it can be placed onto appropriate incoming packets). **complete** FRR rewrite is assembled, ready or active. **partial** FRR rewrite is fully created; its backup routing information is still incomplete. **ready** FRR rewrite was created but is not in the forwarding active state.
role	(Optional) Displays entries associated either with the tunnel **head** or tunnel **midpoint**. The **summary** suboption is available.
summary	(Optional) Displays summarized information about the FRR database.
location *node-id*	(Optional) Displays hardware resource counters on the designated node.
fullname	(Optional) Displays full name of named tunnels in the command output.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.5.4	The **fullname** keyword was added to the command.
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls traffic-eng fast-reroute database** command when used with the **fullname** option, displays a complete name of the named interfaces in the output.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng fast-reroute database** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng fast-reroute database

Status     Count
---------- ----------
```

```
Active     0
Ready      10000
Partial    0
IGP        0
```

Note The Prefix field indicates the IP address where packets with this label are headed.

The following sample output displays filtering of the FRR database using the **backup-interface** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng fast database backup-interface

LSP midpoint FRR information:
LSP Identifier                  Out Intf/        FRR Intf/        Status
                                Label            Label
------------------------------  ---------------- ---------------- -------
10.10.10.10 1006 [54]           Gi0/6/5/2:Pop    tt1060:Pop       Ready
```

The following sample output displays the FRR database filtered by the primary outgoing interface:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng fast-reroute database interface  bundle-ether
12

  LSP midpoint FRR information:
LSP Identifier                Local  Out Intf/        FRR Intf/        Status
                              Label  Label            Label
----------------------------- ------ ---------------- ---------------- -------
11.255.255.1 128 [145]        24001  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 3174 [112]       24002  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 1443 [121]       24003  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 3009 [121]       24005  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 10 [157]         24006  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 63 [147]         24007  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 4848 [120]       24010  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 292 [144]        24011  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 1455 [131]       24012  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 2932 [116]       24013  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 2967 [146]       24014  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 6 [167]          24016  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 98 [159]         24017  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 2985 [131]       24018  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 334 [132]        24019  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 160 [140]        24020  BE12:Pop         tt65001:Pop      Ready
11.255.255.1 4935 [123]       24021  BE12:Pop         tt65001:Pop      Ready
```

The following sample output displays a summary of the FRR database with the role as head:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng fast-reroute database role head summary

  Status     Count
  ---------- ----------
  Active     0
  Ready      3
  Partial    0
```

The following sample output displays summarized information for the FRR database with the role as midpoint:

```
RP/0/RP0/CPU0:routerr# show mpls traffic-eng fast-reroute database role midpoint summary

  Status     Count
  -------    -----
  Active     0
  Ready      2
  Partial    0
```

This example displays entries associated with the midpoint tunnel on the designated node with a complete name of the interfaces using the **fullname** option:

```
Router# show mpls traffic-eng fast-reroute database role midpoint fullname location 0/0/CPU0

Wed Feb  1 13:55:43.534 EST
LSP midpoint FRR information:
LSP identifier                                      In-label Out Intf : Label
        FRR Intf : Label                        Status
------------------------------------------------------ --------
-------------------------------- ---------------------------------------- -------
R1_t1                                                 24005    GigabitEthernet0/2/0/3:24005
     tunnel-te10000:Pop                         Ready
Router#
```

This table describes the significant fields shown in the display.

Table 26: show mpls traffic-eng fast-reroute database Command Field Descriptions

Field	Description
Tunnel	Short form of tunnel interface name.
Out intf/label	**Out interface** Short name of the physical interface through which traffic goes to the protected link. **Out label** At a tunnel head, this is the label that the tunnel destination device advertises. The value “Unlabeled” indicates that no such label is advertised. At a tunnel midpoint, this is the label selected by the next hop device. The value “Pop Label” indicates that the next hop is the final hop for the tunnel.

Field	Description
FRR intf/label	**Fast reroute interface** Backup tunnel interface. **Fast reroute label** At a tunnel head, this is the label that the tunnel tail selected to indicate the destination network. The value "Unlabeled" indicates that no label is advertised. At a tunnel midpoint, this has the same value as the Out label.
Status	State of the rewrite: partial, ready, or active.

show mpls traffic-eng fast-reroute log

To display a history of fast reroute (FRR) events, use the **show mpls traffic-eng fast-reroute log** command in XR EXEC mode.

show mpls traffic-eng fast-reroute log [**interface***typeinterface-path-id* | **location** *node-id*]

Syntax Description

interface	(Optional) Displays all FRR events for the selected protected interface.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
location *node-id*	(Optional) Displays all FRR events that occurred on the selected node.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng fast-reroute log** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng fast-reroute log

 Location Protected              When                    Switching Time
         Interface                                          (usec)
-------- ---------------------- ----------------------- --------------
0/RP0/CPU0 BE12                   Jan 31 15:42:12.723782        0
0/RP0/CPU0 BE12                   Jan 31 16:27:32.419837        0
0/RP0/CPU0 BE12                   Jan 31 18:31:55.019120        0
```

This table describes the significant fields shown in the display.

Table 27: show mpls traffic-eng fast-reroute log Field Descriptions

Field	Description
Node	Node address.
Protected Interface	Type and interface-path-id that is being protected.
LSPs	LSP[10] associated with each interface being protected.
Rewrites	Number of rewrites initiated on the LSP.
When	Date the interface was protected.
Switching Time	Time required to switch the protected interface in microseconds.

[10] LSP = Link-state Packet.



MPLS Traffic Engineering Commands

Note All commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router that is introduced from Cisco IOS XR Release 6.3.2. References to earlier releases in Command History tables apply to only the Cisco NCS 5500 Series Router.

Note

- Starting with Cisco IOS XR Release 6.6.25, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 560 Series Routers.
- Starting with Cisco IOS XR Release 6.3.2, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router.
- References to releases before Cisco IOS XR Release 6.3.2 apply to only the Cisco NCS 5500 Series Router.
- Cisco IOS XR Software Release 7.0.1 specific updates are not applicable for the following variants of Cisco NCS 540 Series Routers:
  - N540-28Z4C-SYS-A
  - N540-28Z4C-SYS-D
  - N540X-16Z4G8Q2C-A
  - N540X-16Z4G8Q2C-D
  - N540X-16Z8Q2C-D
  - N540-12Z20G-SYS-A
  - N540-12Z20G-SYS-D
  - N540X-12Z16G-SYS-A
  - N540X-12Z16G-SYS-D

This module describes the commands used to configure Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) on .

Your network must support the following Cisco features before you can enable MPLS-TE:

- MPLS
- IP Cisco Express Forwarding (CEF)
- Intermediate System-to-Intermediate System (IS-IS) or Open Shortest Path First (OSPF) routing protocol
- Resource Reservation Protocol (RSVP)

MPLS Label Distribution Protocol (LDP), Resource Reservation Protocol (RSVP), and Universal Control Plane (UCP) command descriptions are documented separately.

For detailed information about MPLS concepts, configuration tasks, and examples, see *MPLS Configuration Guide for Cisco NCS 5500 Series RoutersMPLS Configuration Guide for Cisco NCS 540 Series Routers*.

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accounting interfaces mpls ipv4 rsvp-te

To enable per-application accounting for MPLS RSVP-TE IPv4 traffic and obtain traffic statistics on the interfaces, use the **accounting interfaces mpls ipv4 rsvp-te** command in the MPLS-TE accounting interface configuration mode.

accounting interfaces mpls ipv4 rsvp-te

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS-TE accounting interface configuration mode

Command History

Usage Guidelines

No specific guidelines impact the use of this command.

Examples

This example shows how to enable per-application accounting to obtain statistics for MPLS RSVP-TE IPv4 traffic on the interfaces.

```
RP/0/RP0/CPU0:router# config
RP/0/RP0/CPU0:router(config)# accounting
RP/0/RP0/CPU0:router(config-acct)# interfaces
RP/0/RP0/CPU0:router(config-acct-if)# mpls
RP/0/RP0/CPU0:router(config-acct-if-mpls)# ipv4 rspv-te
```

adjustment-threshold (MPLS-TE)

To configure the tunnel bandwidth threshold to trigger an adjustment, use the **adjustment-threshold** command in MPLS-TE automatic bandwidth interface configuration mode. To disable this feature, use the **no** form of this command.

adjustment-threshold *percentage* [**min** *minimum bandwidth*]
no adjustment-threshold *percentage* [**min** *minimum bandwidth*]

Syntax Description

percentage	Configures the bandwidth percent threshold to trigger an adjustment if the largest sample percentage is higher or lower than the current tunnel bandwidth. The range is from 1 to 100. The default is 5.
min *minimum bandwidth*	(Optional) Configures the bandwidth change value to trigger an adjustment. The tunnel bandwidth is changed only if the largest sample is higher or lower than the current tunnel bandwidth, in kbps. The range is from 10 to 4294967295. The default is 10.

Command Default

percentage: 5

minimum bandwidth: 10

MPLS-TE automatic bandwidth interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If you configure or modify the adjustment threshold while the automatic bandwidth is already running, the next band-aids application is impacted for that tunnel. The new adjustment threshold determines if an actual bandwidth takes place.

Examples

The following example configures the tunnel bandwidth threshold to trigger an adjustment:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# auto-bw
RP/0/RP0/CPU0:router(config-if-tunte-autobw)# adjustment-threshold 20 min 500
```

admin-weight

To override the Interior Gateway Protocol (IGP) administrative weight (cost) of the link, use the **admin-weight** command in MPLS-TE interface configuration mode. To return to the default behavior, use the **no** form of this command.

admin-weight *weight*
no admin-weight *weight*

Syntax Description

weight	Administrative weight (cost) of the link. Range is 0 to 4294967295.

Command Default

weight: IGP Weight (default OSPF 1, IS-IS 10)

Command Modes

MPLS-TE interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

To use the **admin-weight** command for MPLS LSP path computations, path-selection metric must be configured to TE.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to override the IGP cost of the link and sets the cost to 20.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-mpls-te-if)# admin-weight 20
```

affinity

To configure an affinity (attributes which MPLS-TE tunnel requires in its links) for an MPLS-TE tunnel, use the **affinity** command in interface configuration mode. To disable this behavior, use the **no** form of this command.

affinity {*affinity-value* **mask** *mask-value* | **exclude** *name* | **exclude-all** | **include** *name* | **include-strict** *name* | **flex-algo** *name*}
no affinity {*affinity-value* **mask** *mask-value* | **exclude** *name* | **exclude-all** | **include** *name* | **include-strict** *name*}

Syntax Description

affinity-value	Attribute values that are required for links to carry this tunnel. A 32-bit decimal number. Range is from 0x0 to 0xFFFFFFFF, representing 32 attributes (bits), where the value of an attribute is 0 or 1.
mask *mask-value*	Checks the link attribute. A 32-bit decimal number. Range is 0x0 to 0xFFFFFFFF, representing 32 attributes (bits), where the value of an attribute mask is 0 or 1.
exclude *name*	Configures a particular affinity to exclude.
exclude-all	Excludes all affinities.
include *name*	Configures the affinity to include in the loose sense.
include-strict *name*	Configures the affinity to include in the strict sense.

Command Default

affinity-value: 0X00000000

mask-value: 0x0000FFFF

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Affinity determines the link attributes of the tunnel (that is, the attributes for which the tunnel has an affinity). The attribute mask determines which link attribute the router should check. If a bit in the mask is 0, the attribute value of a link or that bit is irrelevant. If a bit in the mask is 1, the attribute value of that link and the required affinity of the tunnel for that bit must match.

A tunnel can use a link if the tunnel affinity equals the link attributes and the tunnel affinity mask.

If there is an affinity failure, a 5-minute timer is started at the LSP headend. If the tunnel is not able to reoptimize within the timeframe, it is torn down. However, if you execute the **mpls traffic-eng reoptimize disable affinity-failure** command, no timer is started and the tunnel is not torn down. At a subsequent time, other triggers for reoptimization may start the timer for the LSPs with affinity failure.

Any properties set to 1 in the affinity should be 1 in the mask. The affinity and mask should be set as follows:

```
tunnel_affinity=tunnel_affinity and tunnel_affinity_mask
```

You can configure up to 16 affinity constraints under a given tunnel. These constraints are used to configure affinity constraints for the tunnel:

Include constraint

Specifies that a link is considered for CSPF if it contains all affinities associated with the include constraint. An acceptable link contains more affinity attributes than those associated with the include statement. You can have multiple include statements under a tunnel configuration.

Include-strict constraint

Specifies that a link is considered for CSPF if it contains only the colors associated with the include-strict statement. The link cannot have any additional colors. In addition, a link without a color is rejected.

Exclude constraint

Specifies that a link satisfies an exclude constraint if it does not have all the colors associated with the constraint. In addition, a link that does not have any attribute satisfies an exclude constraint.

Exclude-all constraint

Specifies that only the links without any attribute are considered for CSPF. An exclude-all constraint is not associated with any color; whereas, all other constraint types are associated with up to 10 colors.

You set 1 bit for each color; however, the sample output shows multiple bits at the same time. For example, you can configure red and orange colors on HundredGigabitEthernet 0/0/0/3 from the **interface** command. The sample output from the show mpls traffic-eng link-management interfaces, on page 366 command shows that the Attributes field is set to 0x21, which means that there are 0x20 and 0x1 bits on the link.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This example shows how to configure the tunnel affinity and mask:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# affinity 0101 mask 303
```

This example shows that a link is eligible for CSPF if the color is red. The link can have any additional colors.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# affinity include red
```

This example shows that a link is eligible for CSPF if it has at least red and orange colors. The link can have any additional colors.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# affinity include red orange
```

This sample output shows that the include constraint from the **show mpls traffic-eng tunnels** command is 0x20 and 0x1:

```
Name: tunnel-te1 Destination: 0.0.0.0
     Status:
       Admin:    up Oper: down   Path: not valid   Signalling: Down
       G-PID: 0x0800 (internally specified)

     Config Parameters:
       Bandwidth:        0 kbps (CT0) Priority:  7  7
       Number of configured name based affinity constraints: 1
       Name based affinity constraints in use:
       Include bit map       : 0x21
       Metric Type: TE (default)
       AutoRoute:  disabled  LockDown: disabled
       Loadshare:          0 equal loadshares
       Auto-bw: disabled(0/0) 0  Bandwidth Requested:        0
       Direction: unidirectional
       Endpoint switching capability: unknown, encoding type: unassigned
       Transit switching capability: unknown, encoding type: unassigned

     Reason for the tunnel being down: No destination is configured
     History:
```

This example shows that a tunnel can go over a link that contains red or orange affinity. A link is eligible for CSPF if it has a red color or a orange color. Thus, a link with red and any other colors and a link with orange and other additional colors must meet the constraint.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# affinity include red
RP/0/RP0/CPU0:router(config-if)# affinity include orange
```

This sample output shows that the include constraint from the **show mpls traffic-eng tunnels** command is 0x20 or 0x1:

```
Name: tunnel-te1 Destination: 0.0.0.0
     Status:
       Admin:    up Oper: down   Path: not valid   Signalling: Down
       G-PID: 0x0800 (internally specified)

     Config Parameters:
       Bandwidth:        0 kbps (CT0) Priority:  7  7
       Number of configured name based affinity constraints: 2
       Name based affinity constraints in use:
          Include bit map       : 0x1
          Include bit map       : 0x20
       Metric Type: TE (default)
       AutoRoute:  disabled  LockDown: disabled
       Loadshare:          0 equal loadshares
       Auto-bw: disabled(0/0) 0  Bandwidth Requested:        0
       Direction: unidirectional
```

```
    Endpoint switching capability: unknown, encoding type: unassigned
    Transit switching capability: unknown, encoding type: unassigned

  Reason for the tunnel being down: No destination is configured
  History:
```

This example shows that a link is eligible for CSPF if it has only red color. The link must not have any additional colors.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# affinity include-strict red
```

This example shows that a link is eligible for CSPF if it does not have the red attribute.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# affinity exclude red
```

This example shows that a link is eligible for CSPF if it does not have red and blue attributes. Thus, a link that has only a red attribute or only a blue attribute is eligible for CSPF.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# affinity exclude red blue
```

This example shows that a link is eligible for CSPF if it does not have either a red or a blue attribute.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# affinity exclude red
RP/0/RP0/CPU0:router(config-if)# affinity exclude blue
```

affinity-map

To assign a numerical value to each affinity name, use the **affinity-map** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

affinity-map *affinity name* {*affinity value* | **bit-position** *value*}
no affinity-map *affinity name* {*affinity value* | **bit-position** *value*}

Syntax Description

affinity name	Affinity map name-to-value designator (in hexadecimal, *0-ffffffff*).
affinity value	Affinity map value designator. Range is from 1 to 80000000.
bit-position	Configures the value of an affinity map for the bit position of the 32-bit number.
value	Bit position value. Range is from 0 to 31.Range is from 0 to 255.

Command Default

No default behavior or values

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The name-to-value mapping must represent a single bit of a 32-bit value.

Repeat the affinity-map command to define multiple colors up to a maximum of 256 colors.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to assign a numerical value to each affinity name:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# affinity-map red 1
RP/0/RP0/CPU0:router(config-mpls-te)# affinity-map blue 2
```

The following example shows how to configure the value of 15 for an affinity map by bit position:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
```

```
RP/0/RP0/CPU0:router(config-mpls-te)# affinity-map red2 bit-position 15
```

application (MPLS-TE)

To configure the application frequency, in minutes, for the applicable tunnel, use the **application** command in MPLS-TE automatic bandwidth interface configuration mode. To disable this feature, use the **no** form of this command.

application *minutes*
no application *minutes*

Syntax Description

minutes	Frequency, in minutes, for the automatic bandwidth application. The range is from 5 to 10080 (7 days). The default is 1440.

Command Default

minutes : 1440 (24 hours)

Command Modes

MPLS-TE automatic bandwidth interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If you configure and modify the application frequency, the application period can reset and restart for that tunnel. The next bandwidth application for the tunnel happens within the specified minutes.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure application frequency to 1000 minutes for MPLS-TE interface 1:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# auto-bw
RP/0/RP0/CPU0:router(config-if-tunte-autobw)# application 1000
```

attribute-flags

To configure attribute flags for an interface, use the **attribute-flags** command in MPLS-TE interface configuration mode. To return to the default behavior, use the **no** form of this command.

attribute-flags *attribute-flags*
no attribute-flags *attribute-flags*

Syntax Description

attribute -flags	Links attributes that are compared to the affinity bits of a tunnel during selection of a path. Range is 0x0 to 0xFFFFFFFF, representing 32 attributes (bits) where the value of an attribute is 0 or 1.

Command Default

attributes : 0x0

Command Modes

MPLS-TE interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **attribute-flags** command assigns attributes to a link so that tunnels with matching attributes (represented by their affinity bits) prefer this link instead of others that do not match.

The interface attribute is flooded globally so that it can be used as a tunnel headend path selection criterion.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set attribute flags to 0x0101:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-mpls-te-if)# attribute-flags 0x0101
```

attribute-names

To configure attributes for the interface, use the **attribute-names** command in MPLS-TE interface configuration mode. To return to the default behavior, use the **no** form of this command.

attribute-names *attribute name*
no attribute-names *attribute name*

Syntax Description

attribute name	Attribute name expressed using alphanumeric or hexadecimal characters.Up to 32 attribute-names can be assigned.
index	Specifies an entry index for attribute names.
index-number	Specifies the index number. Range is from 1 to 8.

Command Default

No default behavior or values

Command Modes

MPLS-TE interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The name-to-value mapping must represent a single bit of a 32-bit256-bit value.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to assign an attribute name (in this case, red) to a TE link:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigabitEthernet 0/0/0/3

RP/0/RP0/CPU0:router(config-mpls-te-if)# attribute-name red
```

attribute-set

To configure attribute-set for auto-backup tunnels, use the **attribute-set** command in MPLS-TE configuration mode.

attribute-set auto-backup *attribute-set-name* { **affinity** { *affinity-value* **mask** *mask-value* | **exclude** *name* | **exclude-all** | **include** *name* | **include-strict** *name* } | **logging events lsp-status** { **reoptimize** | **state** } | **policy-class** { *range* | **default** } | **priority** *setup-range hold-range* | **record-route** | **signalled-bandwidth** *value* | **soft-preemption** }

To configure attribute-set for auto-mesh tunnels, use the **attribute-set** command in MPLS-TE configuration mode.

attribute-set auto-mesh *attribute-set-name* {**affinity** {*affinity-value* **mask** *mask-value* | **exclude** *name* | **exclude-all** | **include** *name* | **include-strict** *name*} | **auto-bw collect-bw-only** | **autoroute announce** | **bandwidth** *bandwidth* | **fast-reroute** [**protect** {**bandwidth node** | **node bandwidth**}] | **logging events lsp-status** {**insufficient-bandwidth** | **reoptimize** | **reroute** | **state**} | **policy-class** {*range* | **default**} | **priority** *setup-range hold-range* | **record-route** | **signalled-bandwidth** *bandwidth* [**class-type** *cl*] | **soft-preemption**}

To configure attribute-set for a path-option, use the **attribute-set** command in MPLS-TE configuration mode.

attribute-set path-option *attribute-set-name* {**affinity** {*affinity-value* **mask** *mask-value* | **exclude** *name* | **exclude-all** | **include** *name* | **include-strict** *name*} | **signalled-bandwidth** *bandwidth* [**class-type** *cl*]}

To disable this behavior, use the **no** form of this command.

```
no attribute-set
```

Syntax Description

auto-backup	Specifies the values of an attribute set for the auto-backup group.
auto-mesh	Specifies the values of an attribute set for the auto-mesh group.
path-option	Specifies the values of an attribute set for the path option.
xro	Specifies that the attribute-set is used to define an XRO.
attribute-set-name	A 32-bit character string, specifies the name of the attribute-set template.
affinity-value	Attribute values that are required for links to carry this tunnel. A 32-bit decimal number, representing 32 attributes (bits), where the value of an attribute is 0 or 1. Range is from 0x0 to 0xFFFF.

mask *mask-value*	Checks the link attribute. A 32-bit decimal number, representing 32 attributes (bits), where the value of an attribute mask is 0 or 1. Range is from 0x0 to 0xFFFF.
exclude *name*	Configures a specific affinity that is to be excluded.
exclude-all	Excludes all affinities.
include *name*	Configures the affinity to include in the loose sense.
include-strict *name*	Configures the affinity to include in the strict sense.
logging	Per-interface logging configuration.
events	Per-interface logging events.
lsp-status	Enables interface LSP state change alarms.
reoptimize	Enables interface LSP REOPT change alarms.
state	Enables interface LSP UP/DOWN change alarms.
policy-class	Specifies class for policy-based tunnel selection.
range	Tunnel policy class range 1 to 7.
default	Default class for policy-based tunnel selection.
priority	Specifies the tunnel priority.
setup-range	Specifies setup priority. Range is 0 to 7.
hold-range	Specifies hold priority. Range is 0 to 7.
record-route	Records the route used by the tunnel.
signalled-bandwidth	Specifies the tunnel bandwidth requirement to be signaled.
bandwidth	Bandwidth required for an MPLS-TE tunnel, specified in kilobits per second. By default, bandwidth is reserved in the global pool. Range is from 0 to 4294967295.
class-type *ct*	(Optional) Configures the class type of the tunnel bandwidth request. Range is 0 to 1. Class-type 0 is equivalent to global-pool. Class-type 1 is equivalent to subpool.
soft-preemption	Enables the soft-preemption feature on this tunnel.

Command Default

affinity-value: 0x0

mask-value: 0xFFFF

Command Modes

MPLS TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.
Release 7.5.1	The **signalled-bandwidth** and **soft-preemption** options were added for auto-backup tunnels.

Usage Guidelines

The values specified for an attribute within a **path-option attribute-set** does not prevent the configuration of the same attribute at the tunnel level. However, only one level is taken into consideration. The configuration at the **path-option** level is considered more specific than the one at the level of the tunnel, and is therefore used.

Attributes that are **not** specified within an **attribute-set** picks their default values, as usual, from the configuration at the tunnel level, the configuration at the global mpls level, or default values.

An XRO attribute-set can be specified as part of the path-option, if required. An empty XRO attribute set results in the GMPLS tunnel being signaled with no exclusions, and therefore no XRO.

This example shows how to configure an attribute-set to a TE interface for an auto-backup tunnel:

```
RP/0/RP0/CPU0:router# config
RP/0/RP0/CPU0:router(config)#  mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigabitEthernet 0/0/0/3
RP/0/RP0/CPU0:router(config-mpls-te-if)# auto-tunnel backup
RP/0/RP0/CPU0:router(config-mpls-te-if-auto-backup)#  attribute-set ab
RP/0/RP0/CPU0:router(config-mpls-te-if-auto-backup)#
```

This example shows how to configure an attribute-set to a TE interface for an auto-mesh tunnel:

```
RP/0/RP0/CPU0:router# config
RP/0/RP0/CPU0:router(config)#  mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#  auto-tunnel mesh
RP/0/RP0/CPU0:router(config-te-auto-mesh)#  group 1
RP/0/RP0/CPU0:router(config-te-mesh-group)#  attribute-set am1
RP/0/RP0/CPU0:router(config-te-mesh-group)#  destination-list dl1
```

This example shows how to configure the attribute-set for auto-backup tunnels:

```
RP/0/RP0/CPU0:router# config
RP/0/RP0/CPU0:router(config)#  mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#  attribute-set auto-backup ab
RP/0/RP0/CPU0:router(config-te-attribute-set)# affinity 0x1 mask 0x1
RP/0/RP0/CPU0:router(config-te-attribute-set)# priority 3 3
RP/0/RP0/CPU0:router(config-te-attribute-set)# policy-class 6
RP/0/RP0/CPU0:router(config-te-attribute-set)# logging events lsp-status reoptimize
RP/0/RP0/CPU0:router(config-te-attribute-set)# logging events lsp-status state
RP/0/RP0/CPU0:router(config-te-attribute-set)# policy-class default
RP/0/RP0/CPU0:router(config-te-attribute-set)# record-route
```

This example shows how to configure the attribute-set for auto-mesh tunnels:

```
RP/0/RP0/CPU0:router# config
RP/0/RP0/CPU0:router(config)#  mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#  attribute-set auto-mesh mesh1
RP/0/RP0/CPU0:router(config-te-attribute-set)# affinity include red blue
```

```
RP/0/RP0/CPU0:router(config-te-attribute-set)# affinity include-strict yellow green
RP/0/RP0/CPU0:router(config-te-attribute-set)# affinity exclude orange
RP/0/RP0/CPU0:router(config-te-attribute-set)# affinity exclude-all
RP/0/RP0/CPU0:router(config-te-attribute-set)# policy-class default
```

This example shows how to configure the tunnel affinity and signalled-bandwidth for a path-option:

```
RP/0/RP0/CPU0:router# config
RP/0/RP0/CPU0:router(config)#  mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#  attribute-set path-option myset
RP/0/RP0/CPU0:router(config-te-attribute-set)# affinity 0x3 mask 0x3
RP/0/RP0/CPU0:router(config-te-attribute-set)# signalled-bandwidth 2000
```

The following example shows how to configure attribute set attr01:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# attribute-set xro attr01
RP/0/RP0/CPU0:router(config-te-attribute-set)#
```

This example shows how to enable signaled bandwidth for a backup auto-tunnel:

```
Router # configure
Router(config)# mpls traffic-eng attribute-set auto-backup MyBackupConfig
Router(config-te-attribute-set)# signalled-bandwidth 700000
Router(config-te-attribute-set)# commit
```

This example shows how to enable soft-preemption for backup auto tunnels' reserved bandwidth:

```
Router# configure
Router(config)# mpls traffic-eng attribute-set auto-backup MyBackupConfig
Router(config-te-attribute-set)# soft-preemption
Router(config-te-attribute-set)# commit
```

auto-bw (MPLS-TE)

To configure automatic bandwidth on a tunnel interface and to enter MPLS-TE automatic bandwidth interface configuration mode, use the **auto-bw** command in MPLS-TE interface configuration mode. To disable the automatic bandwidth on that tunnel, use the **no** form of this command.

auto-bw
no auto-bw

Syntax Description

This command has no arguments or keywords.

Command Default

By default, automatic bandwidth is not enabled.

Command Modes

MPLS-TE interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **auto-bw** command to enter MPLS-TE automatic bandwidth interface configuration mode.

The **auto-bw** and **load-share unequal** commands should not be used together.

The **load-share unequal** command determines the load-share for a tunnel based on the bandwidth. However, the MPLS-TE automatic bandwidth feature changes the bandwidth around. If you are configuring both the **load-share unequal** command and the MPLS-TE automatic bandwidth feature, it is recommended that you specify an explicit load-share value configuration under each MPLS-TE automatic bandwidth tunnel.

The following automatic bandwidth scenarios are described:

- If you configure the automatic bandwidth on a tunnel, the automatic bandwidth is enabled on that tunnel. If no other configuration is specified, defaults for the various parameters are used, the operation stops.
- The automatic operation (for example, output rate collection) starts when the automatic bandwidth is enabled on one tunnel. If automatic bandwidth is disabled from all tunnels, the operation stops.
- If the output rate collection is already active when the automatic bandwidth is configured on a tunnel, the statistics collection for that tunnel starts at the next collection configuration.



Note Because the collection timer is already running, the first collection event for that tunnel happens in less than C minutes (for example, on an average of C/2 minutes).

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enter MPLS-TE automatic bandwidth interface configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# auto-bw
RP/0/RP0/CPU0:router(config-if-tunte-autobw)#
```

auto-bw collect frequency (MPLS-TE)

To configure the automatic bandwidth collection frequency, use the **auto-bw collect frequency** command in MPLS-TE configuration mode. To reset the automatic bandwidth frequency to its default value, use the **no** form of this command.

auto-bw collect frequency *minutes*
no auto-bw collect frequency *minutes*

Syntax Description

minutes	Interval between automatic bandwidth adjustments, in minutes. The range is from 1 to 10080. The default is 5.

Command Default

minutes: 5

In addition, the **no** form of this command resets to the default.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **auto-bw collect frequency** command configures the automatic bandwidth collection frequency for all the tunnels.

Modifying the global collection frequency does not restart the tunnel for the current application period. The application period continues with the modified collection frequency.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example configures a tunnel for an automatic bandwidth adjustment of 100 minutes:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# auto-bw collect frequency 100
```

autoroute announce

To specify that the Interior Gateway Protocol (IGP) should use the tunnel (if the tunnel is up) in its enhanced shortest path first (SPF) calculation, use the **autoroute announce** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

autoroute announce [**include-ipv6**] [**destination ipv6** *ip-address*] [**metric** *value*] [**exclude-ipv4**]
no autoroute announce

Syntax Description

include-ipv6	(Optional) Announces the MPLS-TE tunnel to IS-IS IGP for IPv6 routing.
destination ipv6 *ip-address*	(Optional) Allows to install an MPLS-TE tunnel as nexthop for the IPv6 destination.
metric *value*	(Optional) Specifies the MPLS-TE tunnel metric that the Interior Gateway Protocol (IGP) enhanced Shortest Path First (SPF) calculation uses.
exclude-ipv4	(Optional) Disbables IPv4 autoroute announce.

Syntax Description

This command has no arguments or keywords.

Command Default

Announces IPv4 tunnel

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.
Release 25.2.1	The **destination** and **ipv6** keywords were added to configure the IPv6 destination.
Release 25.4.1	A new keyword, **exclude-ipv4**, was added to the **autoroute announce** command.

Usage Guidelines

When more than one IGP is configured, the tunnel is announced as autoroute to the IGP that is used to compute the TE tunnel path.

When the **autoroute announce** command is configured, the route metric of the tunnel path to the destination equals the route metric of the shortest IGP path to that destination.

The **autoroute announce metric** configuration overrides the autoroute metric, on page 202 configuration, if present.

Note IS-IS is the only IGP supporting IPv6 MPLS-TE tunnel announcements.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This example shows how to configure IGP to use the tunnel in its enhanced SPF calculation when the tunnel is up:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# autoroute announce
```

This example shows how an MPLS-TE tunnel can be announced to IS-IS IGP for IPv6 routing:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 65534
RP/0/RP0/CPU0:router(config-if)# autoroute announce
RP/0/RP0/CPU0:router(config-if-tunte-aa)# include-ipv6
```

This example shows how an MPLS-TE tunnel can be announced to IS-IS IGP for IPv6-only routing.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# autoroute announce
RP/0/RP0/CPU0:router(config-if-tunte-aa)# exclude-ipv4
RP/0/RP0/CPU0:router(config-if-tunte-aa)# include-ipv6
```

This example shows how to configure the IPv6 destination and the running configuration for the specified destination.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# autoroute announce
RP/0/RP0/CPU0:router(config-if-tunte-aa)# include-ipv6
RP/0/RP0/CPU0:router(config-if-tunte-aa)# destination ipv6 2000::1

RP/0/RP0/CPU0:router(config)# show running-config interface tunnel-te 1
Thu Jan  9 14:36:37.398 EST
interface tunnel-te1
 ipv4 unnumbered Loopback0
 autoroute announce
  destination ipv6 2000::1
 !
 destination 192.168.0.3
 path-option 1 dynamic
!
end
```

autoroute destination

To install multiple static routes in the routing information base (RIB) per MPLS TE tunnel, use the **autoroute destination** command in interface TE tunnel configuration mode. To disable autoroute destination, use the **no** form of this command.

autoroute destination *ip-address*
no autoroute destination *ip-address*

Syntax Description

ip-address	Specifies the host address of the route to be installed in the RIB. A maximum of six routes can be specified apart from the default route.

Command Default

Autoroute destination is disabled.

Command Modes

Interface Tunnel TE

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to configure installing four routes in RIB for TE tunnel *10*:

```
RP/0/RP0/CPU0:router#configure
RP/0/RP0/CPU0:router(config)#interface tunnel-te 10
RP/0/RP0/CPU0:router(config-if)# autoroute destination 192.168.1.2
RP/0/RP0/CPU0:router(config-if)# autoroute destination 192.168.2.2
RP/0/RP0/CPU0:router(config-if)# autoroute destination 192.168.3.2
RP/0/RP0/CPU0:router(config-if)# autoroute destination 192.168.4.2
```

autoroute metric

To specify the MPLS-TE tunnel metric that the Interior Gateway Protocol (IGP) enhanced Shortest Path First (SPF) calculation uses, use the **autoroute metric** command in interface configuration mode. If no specific metric is to be specified, use the **no** form of this command.

autoroute metric {**absolute** | **relative**} *value*
no autoroute metric {**absolute** | **relative**} *value*

Syntax Description

absolute	Enables the absolute metric mode; you can enter a positive metric value.
relative	Enables the relative metric mode; you can enter a positive, negative, or zero value.
value	Metric that the IGP enhanced SPF calculation uses. Relative value range is from –10 to 10. Absolute value range is from 1 to 2147483647.

Command Default

The relative value is 0.

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **autoroute metric** command overwrites the default tunnel route metric of the shortest IGP path to the destination.

Note The autoroute announce, on page 199 configuration overrides the **autoroute metric** configuration, if present.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure the IGP enhanced SPF calculation using MPLS-TE tunnel metric as relative negative 1:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# autoroute metric relative -1
```

auto-tunnel backup (MPLS-TE)

To automatically build next-hop (NHOP) and next-next-hop (NNHOP) backup tunnels, and to enter auto-tunnel backup configuration mode, use the **auto-tunnel backup** command in MPLS-TE configuration mode. To clear the NHOP and NNHOP backup tunnels, use the **no** form of this command.

auto-tunnel backup
no auto-tunnel backup

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The range of *tunnel-ID* is required to be mentioned for the auto-tunnel backup tunnels; otherwise, none of the tunnels are created.

The **no** form of this command deletes both NHOP and NNHOP backup tunnels that are configured using either the **auto-tunnel backup** command or the **nhop-only** command.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example automatically builds NHOP and NNHOP backup tunnels:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# auto-tunnel backup
```

auto-tunnel backup reoptimize (MPLS-TE)

To configure the reoptimization frequency for next-hop (NHOP) and next-next-hop (NNHOP) backup tunnels and to enter the auto-tunnel backup interface configuration mode, use the **auto-tunnel backup reoptimize** command in MPLS-TE configuration mode. To return to the default behaviour, use the **no** form of this command.

auto-tunnel backup reoptimize *frequency*

Syntax Description

frequency	Reoptimization frequency for MPLS-TE NHOP and NNHOP backup tunnels. The frequency ranges from 0 to 65535 seconds.

Command Default

Disabled

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 7.11.1	This command was introduced.

Usage Guidelines

For any frequency in the range from 1 to 60 seconds, periodic reoptimization occurs every 60 seconds.

Task ID

Task ID	Operation
mpls-te	read, write

Example

This example shows how to set the reoptimization frequency for MPLS-TE backup tunnels:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-mpls-te-if)# auto-tunnel backup
RP/0/RP0/CPU0:router(config-mpls-te-if-auto-backup)# reoptimize 90
```

backup-bw

To configure the backup bandwidth for an MPLS-TE backup tunnel (that is used to protect a physical interface), use the **backup-bw** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

backup-bw {*backup bandwidth* {**any-class-type** | **class-type ct**} | **global-pool** {*bandwidth* | **unlimited**} | **sub-pool** {*bandwidth* | **unlimited**} | **unlimited** {**any-class-type** | **class-type ct**}}
no backup-bw {*backup bandwidth* {**any-class-type** | **class-type ct**} | **global-pool** {*bandwidth* | **unlimited**} | **sub-pool** {*bandwidth* | **unlimited**} | **unlimited** {**any-class-type** | **class-type ct**}}

Syntax Description

backup bandwidth	Backup bandwidth in any-pool provided by an MPLS-TE backup tunnel. Bandwidth is specified in kilobits per second (kbps). Range is 1 to 4294967295.
any-class-type	Displays the backup bandwidth assigned to any class-type protected tunnels.
class-type ct	Displays the class type of the backup bandwidth. Range is 0 to 1.
global-pool *bandwidth*	(In Prestandard DS-TE with RDM) Displays the backup bandwidth in global pool provided by an MPLS-TE backup tunnel. Bandwidth is specified in kilobits per second. Range is 1 to 4294967295.
unlimited	Displays the unlimited bandwidth.
sub-pool *bandwidth*	(In Prestandard DS-TE with RDM) Displays the backup bandwidth in sub-pool provided by an MPLS-TE backup tunnel. Bandwidth is specified in kilobits per second. Range bandwidth is 1 to 4294967295. Only label switched paths (LSPs) using bandwidth from the sub-pool can use the backup tunnel.

Command Default

Any class-type unlimited.

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Backup bandwidth can be limited or unlimited or specific to a global pool, sub-pool, or non-specific any-pool. Backup with backup-bw in global-pool protects global-pool LSPs only; backup-bw in sub-pool protects sub-pool LSPs only.

Backup tunnels configured with limited backup bandwidth (from any/global/sub pool) are not assigned to protect LSPs configured with zero signaled bandwidth.

Backup bandwidth provides bandwidth protection for fast reroute (FRR). Bandwidth protection for FRR supports DiffServ-TE with two bandwidth pools (class-types).

Class-type 0 is strictly equivalent to global-pool; class-type 1 is strictly equivalent to sub-pool bandwidth using the Russian Doll Model (RDM).

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure backup tunnel 1 for use only by LSPs that take their bandwidth from the global pool (class-type 0 tunnels). Backup tunnel 1 does not provide bandwidth protection.

```
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# backup-bw global-pool unlimited
```

or

```
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# backup-bw unlimited class-type 0
```

In the following example, backup tunnel 2 is used by LSPs that take their bandwidth from the sub-pool (class-type 1 tunnels) only. Backup tunnel 2 provides bandwidth protection for up to 1000 units.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 2
RP/0/RP0/CPU0:router(config-if)# backup-bw sub-pool 1000
```

or

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 2
RP/0/RP0/CPU0:router(config-if)# backup-bw 1000 class-type 1
```

backup-path tunnel-te

To set an MPLS-TE tunnel to protect a physical interface against failure, use the **backup-path tunnel-te** command in MPLS-TE interface configuration mode. To return to the default behavior, use the **no** form of this command.

backup-path tunnel-te *tunnel-number*
no backup-path tunnel-te *tunnel-number*

Syntax Description

tunnel-number	Number of the tunnel protecting the interface. Range is 0 to 65535.

Command Default

No default behavior or values

Command Modes

MPLS-TE interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

When the protected interface is down (shut down or removed), the traffic it was carrying (for the other label switched paths [LSPs], referred to as the protected LSPs) is rerouted, using fast reroute (FRR) onto the backup tunnels.

The following guidelines pertain to the FRR process:

- Multiple (backup) tunnels can protect the same interface by entering this command multiple times for different tunnels. The same (backup) tunnel can protect multiple interfaces by entering this command for each interface.
- The backup tunnel used to protect a physical interface must have a valid IP address configured.
- The backup tunnel cannot pass through the same interface that it is protecting.
- TE tunnels that are configured with the FRR option, cannot be used as backup tunnels.
- For the backup tunnel to provide protection to the protected LSP, the backup tunnel must have a terminating-end node in the path of a protected LSP.
- The source IP address of the backup tunnel and the merge point (MP) address (the terminating-end address of the backup tunnel) must be reachable.



Note You must configure record-route on TE tunnels that are protected by multiple backup tunnels merging at a single node.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to protect the interface using tunnels:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigabitEthernet 0/0/0/3
RP/0/RP0/CPU0:router(config-mpls-te-if)# backup-path tunnel-te 100
RP/0/RP0/CPU0:router(config-mpls-te-if)# backup-path tunnel-te 150
```

bandwidth-accounting

To enable RSVP-TE bandwidth accounting and dark bandwidth advertisement for all MPLS-TE enabled links, use the **bandwidth-accounting** command in MPLS-TE configuration mode.

bandwidth-accounting [**adjustment-factor** *percentage* | **application interval** *seconds* | **application enforced** | **sampling-interval** *seconds* | **flooding threshold** { **up** | **down** } *percentage*]

Syntax Description

adjustment-factor *percentage*	Configures TE to over-book (>100%) or under-book (<100%) the effective maximum reservable bandwidth. The measured dark-bandwidth will be scaled based on the adjustment factor. Range is 0 to 200. The default value is 100.
application interval *seconds*	Configures the length of the application interval in seconds. At the end of application interval, dark bandwidth rates are computed and applied to all RSVP-TE enabled interfaces. Range is 90 to 1800. The default value is 180. **Note** Model-driven telemetry supports dark bandwidth. The telemetry polling interval is reduced to 10 seconds.
application enforced	Enables enforcement of the calculated effective maximum reservable bandwidth rate. This configuration is mandatory for the RSVP-TE dark bandwidth accounting feature to work properly.
sampling-interval *seconds*	Configures the length of the sampling interval in seconds. The bandwidth rate is collected from the statistics collector process (statsD) at the end of each sampling interval for each TE link. Range is from 30 to 600. The default is 60.
flooding threshold { **up** | **down** } *percentage*	Configures the reserved bandwidth change percentages threshold. When bandwidth change percentage crosses one of these thresholds, flooding is triggered. Range is from 0 to 100. The default value for up and **down** is 10.

Command Default

RSVP-TE bandwidth accounting is disabled.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.3.1	This command was introduced.

Usage Guidelines

If the interval is reconfigured while the timer is running, the new value is compared to the time remaining for the running timer. The timer is adjusted so that the lower of these two values is used for this interval. The subsequent interval will use the newly configured value.

Note The actual application interval might be different from the configured interval. The actual application interval is rounded based on the number of samples in one application. For example, if the sample interval is 31, and the application interval is 90, then the actual application interval will be rounded to 93.

```
RP/0/0/CPU0:ios(config-mpls-te-if)#show running-config mpls traffic-eng             \
bandwidth-accounting
Fri Feb 23 13:37:24.583 EST
mpls traffic-eng
bandwidth-accounting
  application
   interval 90
  !
  sampling-interval 31
!
!
```

Whereas the output of the **do show mpls traffic-eng link-management interfaces** command shows an application interval of 93.

```
RP/0/0/CPU0:ios(config-mpls-te-if)#do show mpls traffic-eng link-management        \
interfaces gigabitEthernet 0/0/0/1 detail
Fri Feb 23 13:37:27.345 EST

  System Information::
      Links Count         : 1 (Maximum Links Supported 800)

  Link ID:: GigabitEthernet0/0/0/1 (0.0.0.0)
    Local Intf ID: 5
    Link Status:

      Link Label Type          : PSC
      Physical BW              : 1000000 kbits/sec
      BCID                     : RDM
      Max Reservable BW        : 0 kbits/sec (reserved: 100% in, 100% out)
      Flooded Max Reservable BW: 0 kbits/sec
      BC0 (Res. Global BW)     : 0 kbits/sec (reserved: 100% in, 100% out)
      BC1 (Res. Sub BW)        : 0 kbits/sec (reserved: 100% in, 100% out)
      MPLS TE Link State       : MPLS TE on, RSVP on, admin-down
      IGP Neighbor Count       : 0
      Max Res BW (RDM)    : 0 kbits/sec
      BC0 (RDM)           : 0 kbits/sec
      BC1 (RDM)           : 0 kbits/sec
      Max Res BW (MAM)    : 0 kbits/sec
      BC0 (MAM)           : 0 kbits/sec
      BC1 (MAM)           : 0 kbits/sec
      Bandwidth Accounting: Segment-Routing
      Bandwidth Accounting Enforced: No
      Bandwidth Utilization Details:
        Sampling Interval              : 31 sec
        Application Interval           : 93 sec
        Adjustment Factor              : 100%
        Max Reservable BW Up Threshold  : 10 (default)
        Max Reservable BW Down Threshold: 10 (default)
        Last Application at:  Never
        Next Application at:  13:38:56 Fri 23 Feb 2018 (in 89 seconds)
```

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to enable RSVP-TE bandwidth accounting and dark bandwidth advertisement for all RSVP-TE enabled links:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# bandwidth-accounting
RP/0/RP0/CPU0:router(config-mpls-te-bw-account)# adjustment-factor 85
RP/0/RP0/CPU0:router(config-mpls-te-bw-account)# application-interval 90
RP/0/RP0/CPU0:router(config-mpls-te-bw-account)# application enforced
RP/0/RP0/CPU0:router(config-mpls-te-bw-account)# sampling-interval 30
RP/0/RP0/CPU0:router(config-mpls-te-bw-account)# flooding threshold up 30 down 30
```

bandwidth-protection maximum-aggregate

To reserve bandwidth for a backup auto-tunnel, use the **bandwidth-protection maximum-aggregate** command in auto-tunnel backup configuration mode. To remove the bandwidth protection setting, use the **no** form of this command.

bandwidth-protection maximum-aggregate *value*
no bandwidth-protection [**maximum-aggregate** [*value*]]

Syntax Description

value	Reserves bandwidth for a backup auto-tunnel. By default, bandwidth is not reserved for a backup auto-tunnel.

Command Default

The command is disabled.

Command Modes

Auto-tunnel backup configuration (config-te-if-auto-backup)

Command History

Release	Modification
Release 7.5.1	This command was introduced.

Examples

This example shows how to reserve bandwidth for a backup auto-tunnel:

```
Router# configure
Router(config)# mpls traffic-eng
Router(config-mpls-te)# interface GigabitEthernet 0/2/0/0 auto-tunnel backup
Router(config-te-if-auto-backup)# bandwidth-protection maximum-aggregate 100000
Router(config-te-if-auto-backup)# commit
```

bidirectional

To configure a bidirectional LSP for a MPLS TE tunnel and define other parameters for the LSP, use the **bidirectional** command in the MPLS-TE interface configuration mode.

bidirectional association {**id** *value* | **source-address** *IP address* | **global-id** *value* | **type co-routed** | **fault-oam**}

Syntax Description

bidirectional	Configures a bidirectional LSP.
association	Specifies association parameters for the bidirectional LSP.
id *value*	Value number that identifies the association. Range is 0 to 65535.
source-address *value*	Specifies the source IP address of the LSP from which a reverse path is required.
global-id *value*	Value number that identifies the global ID. Range is 0 to 4294967295. The default value is 0.
co-routed	Configures co-routed LSPs with bidirectional CSPF.
fault-oam	Configures fault OAM for the bidirectional co-routed LSPs.

Command Default

Tunnel interfaces are disabled.

Command Modes

Interface configuration mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write

Example

This example shows you how to configure an associated bidirectional co-routed MPLS-TE tunnel.

```
RP/0/RSP0/CPU0:router# configure
RRP/0/RSP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RSP0/CPU0:router(config-if)# bidirectional
RP/0/RSP0/CPU0:router(config-if-bidir)# association id 1 source-address 11.0.0.1
RP/0/RSP0/CPU0:router(config-if-bidir)#association type co-routed
```

bw-limit (MPLS-TE)

To configure the minimum and maximum automatic bandwidth to be set on a tunnel, use the **bw-limit** command in MPLS-TE automatic bandwidth interface configuration mode. To disable this feature, use the **no** form of this command.

bw-limit min *bandwidth* {**max** *bandwidth*}
no bw-limit

Syntax Description

min *bandwidth*	Configures the minimum automatic bandwidth, in kbps, on a tunnel. The range is from 0 to 4294967295. The default is 0.
max *bandwidth*	Configures the maximum automatic bandwidth, in kbps, on a tunnel. The range is from 0 to 4294967295. The default is 4294967295.

Command Default

min: 0

max: 4294967295

Command Modes

MPLS-TE automatic bandwidth interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Both the **min** and **max** keywords must be configured.

The **bw-limit** command automatically sets the minimum bandwidth to the default value of 0, or the **bw-limit** command automatically sets the maximum to the default value of 4294967295 kbps.

If the value of the **min** keyword is greater than the **max** keyword, the **bw-limit** command is rejected. If you configure and modify the minimum or maximum bandwidth while the automatic bandwidth is already running, the next bandwidth application for that tunnel is impacted. For example, if the current tunnel requested bandwidth is 30 Mbps and the minimum bandwidth is modified to 50 Mbps, the next application sets the tunnel bandwidth to 50 Mbps.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure the minimum and maximum bandwidth for the tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# auto-bw
```

```
RP/0/RP0/CPU0:router(config-if-tunte-autobw)# bw-limit min 30 max 80
```

clear mpls traffic-eng auto-bw (MPLS-TE EXEC)

To clear automatic bandwidth sampled output rates and to restart the application period for the specified tunnel, use the **clear mpls traffic-eng auto-bw** command in XR EXEC mode.

clear mpls traffic-eng auto-bw {**all** | **internal** | **tunnel-te** *tunnel-number*}

Syntax Description

all	Clears the automatic bandwidth sampled output rates for all tunnels.
internal	Clears all the automatic bandwidth internal data structures.
tunnel-te *tunnel-number*	Clears the automatic bandwidth sampled output rates for a specific tunnel. The *tunnel-number* argument is the tunnel ID used to clear the sampled output rates.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If no tunnel is specified, the **clear mpls traffic-eng auto-bw** command clears all the automatic bandwidth enabled tunnels.

For each tunnel in which the automatic bandwidth adjustment is enabled, information is maintained about the sampled output rates and the time remaining until the next bandwidth adjustment. The application period is restarted and values such as the largest collected bandwidth get reset. The tunnel continues to use the current bandwidth until the next application.

Task ID

Task ID	Operations
mpls-te	execute

Examples

The following example displays the information for the automatic bandwidth for tunnel number 0 from the **show mpls traffic-eng tunnels auto-bw brief** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels 0 auto-bw brief

  Tunnel    LSP  Last appl  Requested  Signalled    Highest    Application
            Name     ID   BW(kbps)   BW(kbps)   BW(kbps)   BW(kbps)      Time Left
  ------------- ------ ---------- ---------- ---------- ---------- --------------
    tunnel-te0     278      100         100        100          150      12m 38s
```

The following example shows how to clear the automatic bandwidth sampled output rates for tunnel number 0:

```
RP/0/RP0/CPU0:router# clear mpls traffic-eng auto-bw tunnel-te 0

RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels 0 auto-bw brief

  Tunnel    LSP  Last appl  Requested  Signalled    Highest    Application
            Name     ID   BW(kbps)   BW(kbps)   BW(kbps)   BW(kbps)       Time Left
  ------------- ------ ---------- ---------- ---------- ---------- --------------
    tunnel-te0     278      100         100        100          0         24m 0s
```

clear mpls traffic-eng auto-tunnel backup unused

To remove unused automatic backup tunnels, use the **clear mpls traffic-eng auto-tunnel backup unused** command in XR EXEC mode.

clear mpls traffic-eng auto-tunnel backup unused {**all** | **tunnel-te** *tunnel-number*}

Syntax Description

all		Clears all the unused automatic backup tunnels.
tunnel-te	*tunnel-number*	Clears a specific unused automatic backup tunnel.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **unused** auto-tunnel backup tunnel is the tunnel that is not assigned to protect any FRR tunnel.

The behavior of this command is the same as the expiration of the **timers removal unused** command in which, when the timeout value is reached, the automatic backup tunnel is removed.

Task ID

Task ID	Operation
mpls-te	execute

Example

The following example displays the information for the unused backup automatic tunnels from the **show mpls traffic-eng tunnels unused** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels unused
```

The following example shows how to clear the unused backup automatic tunnels:

```
RP/0/RP0/CPU0:router# clear mpls traffic-eng auto-tunnel backup unused all
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels unused
```

clear mpls traffic-eng auto-tunnel mesh

To clear all unused auto-tunnel mesh destinations, use the **clear mpls traffic-eng auto-tunnel mesh**command in XR EXEC mode.

clear mpls traffic-eng auto-tunnel mesh unused {**all** | **tunnel-te**}

Syntax Description

all	Clears all applicable unused auto-tunnel destinations.
tunnel-te *id*	Clears an unused auto-tunnel destinations identified by a tunnel identifier.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute

Examples

This is sample output from the **clear mpls traffic-eng auto-tunnel mesh** command:

```
clear mpls traffic-eng auto-tunnel mesh
```

clear mpls traffic-eng counters auto-tunnel mesh

To clear all auto-tunnel mesh counters, use the **clear mpls traffic-eng counters auto-tunnel mesh** command in XR EXEC mode.

clear mpls traffic-eng counters auto-tunnel mesh

This command has no arguments or keywords.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute

Examples

This is sample output from the **clear mpls traffic-eng counters auto-tunnel mesh** command:

```
RP/0/RP0/CPU0:routerclear mpls traffic-eng counters auto-tunnel mesh
```

clear mpls traffic-eng counters auto-tunnel backup

To clear MPLS-TE automatic tunnel backup counters, use the **clear mpls traffic-eng counters auto-tunnel backup** command in XR EXEC mode.

clear mpls traffic-eng counters auto-tunnel backup

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	execute

Example

The following example removes all counters for the automatic backup tunnels:

```
RP/0/RP0/CPU0:router# clear mpls traffic-eng counters auto-tunnel backup
```

clear mpls traffic-eng counters global

To clear the internal MPLS-TE tunnel counters, use the **clear mpls traffic-eng counters global** command in XR EXEC mode.

clear mpls traffic-eng counters global

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute

Examples

The following example shows how to clear the internal MPLS-TE tunnel counters:

```
RP/0/RP0/CPU0:router# clear mpls traffic-eng counters global
```

clear mpls traffic-eng counters signaling

To clear (set to zero) the MPLS tunnel signaling counters, use the **clear mpls traffic-eng counters signaling** command in XR EXEC mode.

clear mpls traffic-eng counters signaling {**all** | [**heads** | **mids** | **tails**] | **name** *name* | **summary**}

Syntax Description

all	Clears counters for all MPLS-TE tunnels.
heads	(Optional) Displays tunnels with their heads at this router.
mids	(Optional) Displays tunnels with their midpoints at this router.
tails	(Optional) Displays tunnels with their tails at this router.
name *name*	Clears counters for an MPLS-TE tunnel with the specified name.
summary	Clears the counter's summary.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **clear mpls traffic-eng counters signaling** command to set all MPLS counters to zero so that changes can be seen easily.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to clear all counters:

```
RP/0/RP0/CPU0:router# clear mpls traffic-eng counters signaling all
```

clear mpls traffic-eng counters soft-preemption

To clear (set to zero) the counters for soft-preemption statistics, use the **clear mpls traffic-eng counters soft-preemption** command in XR EXEC mode.

clear mpls traffic-eng counters {**all** | **soft-preemption**}

Syntax Description

all	Clears counters for all MPLS-TE tunnels.
soft-preemption	Clears the statistics for soft preemption counters.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

When all counters are cleared using the **clear mpls traffic-eng counters all** command, the counters for soft-preemption statistics are automatically cleared.

Task ID

Task ID	Operations
mpls-te	execute

Examples

This example shows how to clear all counters:

```
RP/0/RP0/CPU0:router# clear mpls traffic-eng counters signaling all
```

clear mpls traffic-eng event-history tunnels

To clear the event history for MPLS-TE tunnels, use the **clear mpls traffic-eng event-history tunnels** command in XR EXEC mode.

clear mpls traffic-eng event-history tunnels { **all** }

Syntax Description

all	Clears the event history for all MPLS-TE headend tunnels.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 25.4.1	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute

Examples

This example shows how to clear the event history for all MPLS-TE headend tunnels:

```
RP/0/RP0/CPU0:router# clear mpls traffic-eng event-history tunnels all
```

clear mpls traffic-eng fast-reroute log

To clear the log of MPLS fast reroute (FRR) events, use the **clear mpls traffic-eng fast-reroute log** command in XR EXEC mode.

clear mpls traffic-eng fast-reroute log

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows sample output before clearing the log of FRR events:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng fast-reroute log

  Node     Protected LSPs  Rewrites When                    Switching Time
           Interface                                           (usec)
  -------- --------- ----- -------- ----------------------- --------------
  0/0/CPU0 PO0/1/0/1 1     1        Feb 27 19:12:29.064000      147
  0/1/CPU0 PO0/1/0/1 1     1        Feb 27 19:12:29.060093      165
  0/2/CPU0 PO0/1/0/1 1     1        Feb 27 19:12:29.063814      129
  0/3/CPU0 PO0/1/0/1 1     1        Feb 27 19:12:29.062861      128

RP/0/RP0/CPU0:router# clear mpls traffic-eng fast-reroute log
```

clear mpls traffic-eng link-management statistics

To clear all the MPLS-TE admission control statistics, use the **clear mpls traffic-eng link-management statistics** command in XR EXEC mode.

clear mpls traffic-eng link-management statistics

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to clear all the MPLS-TE statistics for admission control:

```
RP/0/RP0/CPU0:router# clear mpls traffic-eng link-management statistics
```

collect-bw-only (MPLS-TE)

To configure only the bandwidth collection without adjusting the bandwidth automatically, use the **collect-bw-only** command in MPLS-TE automatic bandwidth interface configuration mode. To disable this feature, use the **no** form of this command.

collect-bw-only
no collect-bw-only

Syntax Description

This command has no arguments or keywords.

Command Default

Bandwidth collection is either enabled or disabled.

Command Modes

MPLS-TE automatic bandwidth interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If you enable the **collect-bw-only** command while the automatic bandwidth is already running on a tunnel, the bandwidth application is disabled from that moment. Before you enable the actual bandwidth application, you can get the status of the automatic bandwidth behavior.

If you disable the **collect-bw-only** command on a tunnel from which the automatic bandwidth is already running, the actual bandwidth application takes place on the tunnel at the next application period.

It is also possible to manually activate a bandwidth application regardless of the collect bandwidth only flag that is being specified on a tunnel. To activate the bandwidth application, use the mpls traffic-eng auto-bw apply (MPLS-TE), on page 265 command in XR EXEC mode.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable only the bandwidth collection without adjusting the automatic bandwidth:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# auto-bw
RP/0/RP0/CPU0:router(config-if-tunte-autobw)# collect-bw-only
```

destination (MPLS-TE)

To configure the destination address of a TE tunnel, use the **destination** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

destination *ip-address*
no destination *ip-address*

Syntax Description

ip-address	Destination address of the MPLS-TE router ID.

Command Default

No default behavior or values

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Note The tunnel destination address must be a unique MPLS-TE router ID; it cannot be an MPLS-TE link address on a node.

For Point-to-Point (P2P) tunnels, the **destination** command is used as a single-line command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the destination address for tunnel-te1 to 10.10.10.10:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te1
RP/0/RP0/CPU0:router(config-if)# destination 10.10.10.10
```

disable (explicit-path)

To prevent the path from being used by MPLS-TE tunnels while it is configured, use the **disable** command in explicit path configuration mode. To return to the default behavior, use the **no** form of this command.

disable
no disable

Syntax Description

This command has no arguments or keywords.

Command Default

Explicit path is enabled.

Command Modes

Explicit path configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to disable explicit path 200:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# explicit-path identifier 200
RP/0/RP0/CPU0:router(config-expl-path)# disable
```

ds-te bc-model

To enable a specific bandwidth constraint model (Maximum Allocation Model or Russian Doll Model) on the entire label switched router (LSR), use the **ds-te bc-model** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

ds-te bc-model mam
no ds-te bc-model mam

Syntax Description

mam	Enables the Maximum Allocation Model (MAM) bandwidth constraints model.

Command Default

RDM is the default bandwidth constraint model.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You can configure both the MAM and RDM bandwidth values on a single interface before swapping to an alternate global MPLS-TE BC model.

If you configure bandwidth constraints without configuring the corresponding bandwidth constraint values, the router uses default bandwidth constraint values.

MAM is not supported in prestandard DS-TE mode. MAM and RDM are supported in IETF DS-TE mode; RDM is supported in prestandard DS-TE mode.

Note Changing the bandwidth constraints model affects the entire router and may have a major impact on system performance as nonzero-bandwidth tunnels are torn down.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable the MAM bandwidth constraints model:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# ds-te bc-model mam
```

ds-te mode

To configure standard differentiated-service TE mode (DS-TE), use the **ds-te mode** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

ds-te mode ietf
no ds-te mode ietf

Syntax Description

ietf	Enables IETF standard mode.

Command Default

Prestandard DS-TE is the default differentiated service mode.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The following two DS-TE modes are supported:

- Prestandard mode
  - The Cisco proprietary mechanism for IGPs and RSVP signalling are used and DS-TE does not interoperate with third-party vendor equipment.
- IETF mode
  - Standard defined extensions are used for IGPs and RSVP signalling and DS-TE in this mode interoperates with third-party equipment.
  - IETF mode supports two bandwidth constraint models: the Russian Doll Model (RDM) and Maximum Allocation Model (MAM).
  - RDM is the default model.
  - Router advertises variable-length bandwidth constraints, max-reservable- bandwidth, and unreserved bandwidths in TE-classes.
  - tunnels must have valid class-type and priority configured as per TE-class map in use; otherwise, tunnels remain down.
  - TE-class map (a set of tunnel priority and class-type values) is enabled to interpret unreserved bandwidth values advertised in IGP; therefore, TE-class map must be identical on all nodes for TE tunnels to be successfully established

For DS-TE to function properly, DS-TE modes must be configured identically on all MPLS-TE nodes.

If you need to change the DS-TE mode, you must bring down all tunnel interfaces and after the change, you should flood the updated bandwidth values through the network.

Note Changing the DS-TE mode affects the entire LSR and can have a major impact on system performance when tunnels are torn down.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable IETF standard mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# ds-te mode ietf
```

ds-te te-classes

To enter DS-TE te-class map configuration mode, use the **ds-te te-classes** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

ds-te te-classes te-class *te_class_index* {**class-type** *class_type_number* {**priority** *pri_number*} | **unused**}
no ds-te te-classes te-class *te_class_index* {**class-type** *class_type_number* {**priority** *pri_number*} | **unused**}

Syntax Description

te-class	Configures the te-class map.
te_class_index	TE class-map index. Range is 0 to 7.
class-type	Configures the class type.
class_type_number	Class type value in the te-class map. Range is 0 to 1.
priority	Configures the TE tunnel priority.
pri_number	TE tunnel priority value. Range is 0 to 7.
unused	Marks the TE-class as unused.

Command Default

The following default te-class maps are used in IETF DS-TE mode:

te-class index	class-type	priority
0	0	7
1	1	7
2	UNUSED	—
3	UNUSED	—
4	0	0
5	1	0
6	UNUSED	—
7	UNUSED	—

Note The default mapping has 4 TE-classes used with 2 class-types and, 4 TE-classes are unused. TE-class map is not used in prestandard DS-TE mode.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

In IETF DS-TE mode, modified semantic of the unreserved bandwidth TLV is used. Each of the eight available bandwidth values advertised in the IGP corresponds to a TE class. Because IGP advertises only eight bandwidth values, only eight TE-Classes can be supported in a IETF DS-TE network. The TE-Class mapping must be configured the same way on every router in a DS-TE domain. There is, however, no method to automatically detect or enforce this required consistency.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure a TE-class 7 parameter:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# ds-te te-classes te-class 7 class-type 0 priority 4
```

exclude srlg (auto-tunnel backup)

To specify that automatic backup tunnels should avoid Shared Risk Link Groups (SRLGs) of protected interface, use the **exclude srlg** command in auto-tunnel backup configuration mode. To disable this feature, use the **no** form of this command.

exclude srlg [**preferred**]
no exclude srlg [**preferred**]

Syntax Description

preferred	(Optional) Causes the backup tunnel to avoid SRLGs of its protected interface(s); however, the backup tunnel is created if SRLGs are not avoided.

Command Default

Strict SRLG

Command Modes

Auto-tunnel backup configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Strict SRLG configuration of this command means that the path computed for the backup tunnel that is automatically created, must not contain any links that are part of the excluded SRLG groups. If such a path cannot be found, the backup tunnel does not come up.

Configuration of the preferred option allows the automatic backup tunnel to come up even if a path that excludes SRLGs can not be found.

Task ID

Task ID	Operation
mpls-te	read, write

Example

In the following example, automatic backup tunnels must avoid SRLGs of the protected interface.

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#
RP/0/RP0/CPU0:router(config-mpls-te-if)# auto-tunnel backup
RP/0/RP0/CPU0:router(config-mpls-te-if-auto-backup)#  exclude srlg preferred
```

fast-reroute

To enable fast-reroute (FRR) protection for an MPLS-TE tunnel, use the **fast-reroute** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

fast-reroute
no fast-reroute

Syntax Description

This command has no arguments or keywords.

Command Default

FRR is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

When a protected link used by the fast-reroutable label switched path (LSP) fails, the traffic is rerouted to a previously assigned backup tunnel. Configuring FRR on the tunnel informs all the nodes that the LSP is traversing that this LSP desires link/node/bandwidth protection.

You must allow sufficient time after an RSP RP switchover before triggering FRR on standby RSPs RPs to synchronize with the active RSP RP (verified using the **show redundancy** command). All TE tunnels must be in the recovered state and the database must be in the ready state for all ingress and egress line cards. To verify this information, use the **show mpls traffic-eng tunnels** and **show mpls traffic-eng fast-reroute database** commands.

Note Wait approximately 60 seconds before triggering FRR after verifying the database state.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable FRR on an MPLS-TE tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# fast-reroute
```

fast-reroute protect

To enable node and bandwidth protection for an MPLS-TE tunnel, use the **fast-reroute protect** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

fast-reroute protect {**bandwidth** | **node**}
no fast-reroute protect

Syntax Description

bandwidth	Enables bandwidth protection request.
node	Enables node protection request.

Command Default

FRR is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable bandwidth protection for a specified TE tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)#interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# fast-reroute protect bandwidth
```

fast-reroute timers promotion

To configure how often the router considers switching a protected MPLS-TE tunnel to a new backup tunnel if additional backup-bandwidth or a better backup tunnel becomes available, use the **fast-reroute timers promotion** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

fast-reroute timers promotion *interval*
no fast-reroute timers promotion

Syntax Description

interval	Interval, in seconds, between scans to determine if a label switched path (LSP) should use a new, better backup tunnel. Range is 0 to 604800. A value of 0 disables backup tunnel promotions.

Command Default

interval: 300

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Setting the interval to a low value puts more load on the CPU because it has to scan all protected LSPs more frequently. It is not recommended that the timer be configured below the default value of 300 seconds.

Pacing mechanisms have been implemented to distribute the load on the CPU when backup promotion is active. Because of this, when a large number of protected LSPs are promoted, some delay is noticeable in backup promotion. If the promotion timer is configured to a very low value (depending on the number of protected LSPs) some protected LSPs may never get promoted.

To disable the timer, set the value to zero.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to specify that LSPs are scanned every 600 seconds (10 minutes) to determine if they should be promoted to a better backup tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# fast-reroute timers promotion 600
```

flooding thresholds

To set the reserved bandwidth thresholds for a link, use the **flooding thresholds** command in MPLS-TE interface configuration mode. To return to the default behavior, use the **no** form of this command.

flooding thresholds {**down** | **up**} *percent* [*percent1 percent2 percent3 ... percent 15*]
no flooding thresholds {**down** | **up**}

Syntax Description

down	Configures the threshold for decreased resource availability.
up	Configures the threshold for increased resource availability.
percent [percent]	Bandwidth threshold level. Range is 0 to 100 for all 16 levels.

Command Default

down: *100*, *99*, *98*, *97*, *96*, *95*, *90*, *85* , *80*, *75* , *60*, *45*, *30*, *15*

up: *5*, *30*, *45*, *60*, *75*, *80*, *85*, *90*, *95*, *97* , *98*, *99*, *100*

Command Modes

MPLS-TE interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You can configure up to 16 flooding threshold values. The first value is mandatory; the next 15 are optional.

When a threshold is crossed, MPLS-TE link management advertises updated link information. If no thresholds are crossed, changes can be flooded periodically unless periodic flooding was disabled.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the reserved bandwidth threshold for the link for decreased resource availability (down) and for increased resource availability (up) thresholds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigabitEthernet
 0/0/0/3
RP/0/RP0/CPU0:router(config-mpls-te-if)# flooding thresholds down 100 75 25
RP/0/RP0/CPU0:router(config-mpls-te-if)# flooding thresholds up 25 50 100
```

forward-class

To define the forwarding path in the MPLS-TE interface, use the **forward-class** command in MPLS-TE configuration mode. To remove forward-class configuration, use the **no** form of this command.

forward-class *forward-class*
no forward-class

forward-class	Forward class for the tunnel. Range is 1 to 7.

Command Default

No default behavior or values

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to define forwarding path in the MPLS-TE interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)#interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)#forward-class 1
```

forwarding-adjacency

To configure an MPLS-TE forwarding adjacency, use the **forwarding-adjacency** command in interface configuration mode. By configuring forwarding adjacency, the MPLS-TE tunnels are considered to be links by the IGP. If no forwarding adjacency is to be defined, use the **no** form of this command.

forwarding-adjacency [**holdtime** *time*][**include-ipv6**]
no forwarding-adjacency [**holdtime** *time*][**include-ipv6**]

Syntax Description

holdtime *time*	(Optional) Configures the hold time value, in milliseconds, that is associated with each forwarding-adjacency LSP. The hold time is the duration after which the state change of LSP is advertised to IGP. The default value is 0.
include-ipv6	(Optional) Announces the MPLS-TE tunnel as an IPv6 forwarding adjacency.

Command Default

holdtime *time*: 0

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If you do not specify a **holdtime** *time* value, a delay is introduced with the following results:

- When forwarding-adjacency is configured on a tunnel that is up, TE notifies IGP without any additional delay.
- When forwarding-adjacency is configured on a tunnel that is down, TE does not notify IGP.
- When a tunnel on which forwarding-adjacency has been configured comes up, TE holds the notification to IGP for the period of holdtime (assuming non-zero holdtime). When the holdtime elapses, TE notifies IGP if the tunnel is still up.

The paths that traffic is taking to the destination can be manipulated by adjusting the forwarding adjacency link metric. To do that, use the **bandwidth** command. The unit of possible bandwidth values is in kbps.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This example shows how to configure forwarding adjacency with a holdtime value of 60 milliseconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 888
RP/0/RP0/CPU0:router(config-if)# forwarding-adjacency holdtime 60
```

This example shows how to announce MPLS-TE tunnel as an IPv6 forwarding adjacency:

```
RP/0/RP0/CPU0:router#configure
RP/0/RP0/CPU0:router(config)#interface tunnel-te 65534
RP/0/RP0/CPU0:router(config-if)#forwarding-adjacency
RP/0/RP0/CPU0:router(config-if-tunte-fwdadj)#include-ipv6
```

index exclude-address

To exclude an address from a tunnel path entry at a specific index, use the **index exclude-address** command in explicit path configuration mode. To return to the default behavior, use the **no** form of this command.

index *index-id* **exclude-address** { **ipv4 unicast** *IP address* }
no index *index-id*

Syntax Description

index-id	Index number at which the path entry is inserted or modified. Range is 1 to 65535.
ipv4 unicast *IP address*	Excludes the IPv4 unicast address.

Command Default

No default behavior or values

Command Modes

Explicit path configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You cannot include or exclude addresses from an IP explicit path unless explicitly configured using the **exclude-address** keyword.

Use the **exclude-address**keyword only after entering the explicit path configuration mode.

If you use the **exclude-address** keyword and specify the IP address of a link, the constraint-based routine does not consider that link when it sets up MPLS-TE paths. If the excluded address is a flooded MPLS-TE router ID, the constraint-based shortest path first (SPF) routine does not consider that entire node.

Note The person who performs the configuration must know the IDs of the routers, as it may not be apparent if the value refers to the link or to the node.

MPLS-TE accepts IP explicit paths composed of all excluded addresses configured using the **exclude-address** keyword.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to exclude address 192.168.3.2 at index 3 of the explicit path 200:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# explicit-path identifier 200
```

```
RP/0/RP0/CPU0:router(config-expl-path)# index 3 exclude-address ipv4 unicast 192.168.3.2
```

index exclude-srlg

To exclude an address to get SRLGs from a tunnel path entry at a specific index, use the **index exclude-srlg** command in explicit path configuration mode. To return to the default behavior, use the **no** form of this command.

index *index-id* **exclude-srlg ipv4 unicast** *IP address*

no index *index-id*

Syntax Description

index-id	Index number at which the path entry is inserted or modified. Range is 1 to 65535.
exclude-srlg	Specifies an IP address to get SRLG values from for exclusion.
ipv4 unicast *IP address*	Excludes the IPv4 unicast address.

Command Default

No default behavior or values

Command Modes

Explicit path configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to exclude the SRLG values from the IP address 192.168.3.2 at index 1 of the explicit path 100:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# explicit-path identifier 100
RP/0/RP0/CPU0:router(config-expl-path)# index 1 exclude-srlg ipv4 unicast 192.168.3.2
```

index next-address

To include a path entry at a specific index, use the **index next-address** command in explicit path configuration mode. To return to the default behavior, use the **no** form of this command.

index *index-id* **next-address** [**loose** | **strict**] **ipv4 unicast** *IP-address*
no index *index-id*

Syntax Description

index-id	Index number at which the path entry is inserted or modified. Range is 1 to 65535.
ipv4 unicast *IP-address*	Includes the IPv4 unicast address (strict address).
loose ipv4 unicast *IP-address*	(Optional) Specifies the next unicast address in the path as a loose hop.
strict ipv4 unicast *IP-address*	(Optional) Specifies the next unicast address in the path as a strict hop.

Command Default

No default behavior or values

Command Modes

Explicit path configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You cannot include addresses from an IP explicit path unless explicitly configured using the **next-address** keyword.

Use the **next-address** keyword only after entering the explicit path configuration mode.

Note The person who performs the configuration must know the IDs of the routers, as it may not be apparent if the value refers to the link or to the node.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to insert the **next-address** 192.168.3.2 at index 3 of the explicit path 200:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# explicit-path identifier 200
```

```
RP/0/RP0/CPU0:router(config-expl-path)# index 3 next-address ipv4 unicast 192.168.3.2
```

interface (MPLS-TE)

To enable MPLS-TE on an interface and to enter MPLS-TE interface configuration mode, use the **interface** command in XR Config mode. To return to the default behavior, use the **no** form of this command.

interface *type interface-path-id*
no interface *type interface-path-id*

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You must enter MPLS-TE interface mode to configure specific interface parameters on physical interfaces.

Configuring MPLS-TE links or a tunnel TE interface begins the TE-control process on RSP RP.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enter the MPLS-TE interface configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigabitEthernet
 0/0/0/3
```

The following example shows how to remove an interface from the MPLS-TE domain:

```
RP/0/RP0/CPU0:router# configure
```

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# no interface HundredGigabitEthernet 0/0/0/3
```

interface (SRLG)

To enable Shared Risk Link Groups (SRLGs) on an interface and to enter SRLG interface configuration mode, use the **interface** command in SRLG configuration mode. To return to the previous configuration mode, use the **no** form of this command.

interface *type interface-path-id*
no interface *type interface-path-id*

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

SRLG configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to enter SRLG interface configuration mode:

```
RP/0/RP0/CPU0:router(config)# srlg
RP/0/RP0/CPU0:router(config-srlg)# interface HundredGigabitEthernet
 0/0/0/3
RP/0/RP0/CPU0:router(config-srlg-if)# value 10
RP/0/RP0/CPU0:router(config-srlg-if)#value 50
```

interface tunnel-te

To configure an MPLS-TE tunnel interface, use the **interface tunnel-te** command in XR Config mode. To return to the default behavior, use the **no** form of this command.

interface tunnel-te *tunnel-id*
no interface tunnel-te *tunnel-id*

Syntax Description

tunnel-id	Tunnel number. Range is 0 to 65535.

Command Default

Tunnel interfaces are disabled.

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You cannot have two tunnels using the same encapsulation mode with exactly the same source and destination address. The workaround is to create a loopback interface and to use the loopback interface address as the source address of the tunnel.

Configuring MPLS-TE links or Tunnel-TE interface begins the TE-control process on RSP RP.

The **interface tunnel-te** command indicates that the tunnel interface is for an MPLS-TE tunnel and enables the various tunnel MPLS configuration options.

Note You must configure record-route on TE tunnels that are protected by multiple backup tunnels merging at a single node.

Task ID

Task ID	Operations
interface	read, write

Examples

The following example shows how to configure tunnel interface 1:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# ipv4 unnumbered loopback0
```

The following example shows how to set the tunnel-class attribute to map the correct traffic class to the tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# policy-class 1
```

ipv4 unnumbered (MPLS)

To specify the MPLS-TE tunnel Internet Protocol Version 4 (IPv4) address, use the **ipv4 unnumbered** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

ipv4 unnumbered *type interface-path-id*
no ipv4 unnumbered *type interface-path-id*

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (**?**) online help function.

Command Default

No IP address is set.

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Tunnel-te is not signaled until an IP address is configured on the tunnel interface; therefore, the tunnel state stays down without IP address configuration.

Loopback is commonly used as the interface type.

Task ID

Task ID	Operations
network	read, write

Examples

The following example shows how to configure the MPLS-TE tunnel to use the IPv4 address used on loopback interface 0:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# ipv4 unnumbered loopback0
```

ipv4 unnumbered mpls traffic-eng

To specify the Internet Protocol Version 4 (IPv4) address, use the **ipv4 unnumbered mpls traffic-eng** command in XR Config mode. To remove the IPv4 address, use the **no** form of this command.

ipv4 unnumbered mpls traffic-eng *interface-path-id*
no ipv4 unnumbered mpls traffic-eng

Syntax Description

interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router.

Command Default

No default behavior or values.

Command Modes

XR Config mode .

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
network	read, write

Examples

The following example shows how to specify unnumbered IPv4 address for a GigabitEthernet interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)#  ipv4 unnumbered mpls traffic-eng HundredGigabitEthernet
0/0/0/3
```

The following example shows how to specify unnumbered IPv4 address for an MPLS-TE tunnel with tunnel ID 200:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)#  ipv4 unnumbered mpls traffic-eng tunnel-te 200
```

link-management timers bandwidth-hold

To set the length of time that bandwidth is held for a Resource Reservation Protocol (RSVP) Path (setup) message to wait for the corresponding RSVP Resv message to return, use the **link-management timers bandwidth-hold** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

link-management timers bandwidth-hold *holdtime*
no link-management timers bandwidth-hold *holdtime*

Syntax Description

holdtime	Number of seconds that bandwidth can be held. Range is 1 to 300. Default is 15.

Command Default

holdtime: 15

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **link-management timers bandwidth-hold** command determines the time allowed for an RSVP message to return from a neighbor RSVP node.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the bandwidth to be held for 10 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# link-management timers bandwidth-hold 10
```

link-management timers periodic-flooding

To set the length of the interval for periodic flooding, use the **link-management timers periodic-flooding** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

link-management timers periodic-flooding *interval*
no link-management timers periodic-flooding

Syntax Description

interval	Length of the interval, in seconds, for periodic flooding. Range is 0 to 3600. A value of 0 turns off periodic flooding. The minimum value is 30.

Command Default

interval: 180

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **link-management timers periodic-flooding** command advertises the link state information changes that do not trigger immediate action, such as a change to the allocated bandwidth that does not cross a threshold.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the interval length for periodic flooding to 120 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# link-management timers periodic-flooding 120
```

link-management timers preemption-delay

To set the length of the interval for delaying LSP preemption, use the **link-management timers preemption-delay** command in MPLS-TE configuration mode. To disable this behavior, use the **no** form of this command.

link-management timers preemption-delay bundle-capacity *sec*

Syntax Description

bundle-capacity *sec*	Specifies the bundle-capacity preemption timer value in seconds.

Command Default

None

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The value *0* as bundle-capacity value in the **link-management timers preemption-delay** command disables this timer. This means there is no delay before preemption sets in when the bundle capacity goes down.

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to set the interval length for preemption-delay:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# link-management timers preemption-delay bundle-capacity
 180
```

load-share

To determine load-sharing balancing parameters for a specified tunnel interface, use the **load-share** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

load-share *value*
no load-share

Syntax Description

value	Load-share value, equivalent to the bandwidth in kbps (that is, the same value in configuration). Range is 1 to 4294967295. Default is 0.

Command Default

The default load-share for tunnels with no explicit configuration is the configured signalled bandwidth.

The *value* is 0 if no value is assigned.

Command Modes

Interface configuration

Command History

Release	Modification
Release 7.1.1	This command was introduced.

Usage Guidelines

Configuration schemas are supported for load balancing.

To enable the **load-share** command, you must enable unequal load balancing using the **load-share unequal** command in the MPLS-TE configuration mode.

Examples

The following example shows how to configure load-sharing parameters on a specified tunnel interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 100
RP/0/RP0/CPU0:router(config-if)# load-share 100
RP/0/RP0/CPU0:router(config-if)# commit
```

load-share unequal

To configure unequal load-sharing for an MPLS-TE tunnel, use the **load-share unequal** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

load-share unequal
no load-share unequal

Syntax Description

This command has no arguments or keywords.

Command Default

By default, unequal load-balancing is disabled and equal load-balancing occurs.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 7.1.1	This command was introduced.

Usage Guidelines

The **auto-bw** and **load-share unequal** commands should not be used together.

The **load-share unequal** command determines the load-share for a tunnel based on the bandwidth. However, the MPLS-TE automatic bandwidth feature changes the bandwidth around. If you are configuring both the **load-share unequal** command and the MPLS-TE automatic bandwidth feature, we recommend that you specify an explicit load-share value configuration under each MPLS-TE automatic bandwidth tunnel.

Examples

The following example shows how to enable unequal load-sharing:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# load-share unequal
RP/0/RP0/CPU0:router(config-mpls-te)# commit
```

match mpls disposition

To match Tag2IP packets while redirecting MPLS labeled packets to a new destination using PBR policy, use the **match mpls disposition** command in class-map configuration mode. To remove redirection of MPLS labeled packets, use the **no** form of this command.

match mpls disposition access-group {**ipv4** | **ipv6**} *access-list*
no match mpls disposition access-group {**ipv4** | **ipv6**} *access-list*

Syntax Description

access-group	Specifies an access-group.
ipv4 | ipv6	Specifies IPv4 or IPv6 address.
access-list	Specifies an access-list.

Command Default

Match is not set.

Command Modes

Class-map configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Only Tag2IP packets can be redirected.

Task ID

Task ID	Operation
qos	read, write

This example shows how to configure match MPLS disposition sequence for an IPv4 address:

```
RP/0/RP0/CPU0:router#configure
RP/0/RP0/CPU0:router(config)#class-map type traffic class_mpls_src_test
RP/0/RP0/CPU0:router(config-cmap)#match mpls disposition access-group ipv4 ACL_MPLS_SRC
RP/0/RP0/CPU0:router(config-cmap)#end-class-map
```

maxabs (MPLS-TE)

To specify the maximum number of MPLS-TE tunnels that can be configured, use the **maxabs** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

maxabs tunnels *tunnel-limit* **destinations** *dest-limit*
no maxabs tunnels *tunnel-limit* **destinations** *dest-limit*

Syntax Description

tunnels	Configures all tunnels for MPLS-TE.
tunnel-limit	Maximum number of tunnel TE interfaces. Range is 1 to 65536.
destinations	Configures all destinations for MPLS-TE.
dest-limit	Maximum total number of destinations that can be configured. Range is 1 to 65536.

Command Default

tunnel-limit: 4096

dest-limit: 4096

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the tunnel-te configuration limit to 1000:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# maxabs tunnels 1000 destinations 1000
```

mpls traffic-eng

To enter MPLS-TE configuration mode, use the **mpls traffic-eng** command in XR Config mode.

mpls traffic-eng

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enter MPLS-TE configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#
```

mpls traffic-eng anycast-prefer-igp-cost

To allow autoroute announce (AA) with ISIS for anycast prefixes to choose the shortest IGP path and select the tunnel on that shortest path, use the **mpls traffic-eng auto-bw apply** command in XR EXEC mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng anycast-prefer-igp-cost

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.5.4	This command was introduced.

Usage Guidelines

When this command is enabled, AA chooses the shortest IGP path for anycast prefixes only.

Task ID

Task ID	Operations
mpls-te	execute

Examples

The following example enables the AA with ISIS to choose the shortest IGP path for anycast prefixes:

```
Router#configure
Router(config)#router isis 100
Router(config-isis)#is-type level-2-only
Router(config-isis)#net 47.2377.50ea.ffff.988a.2d13.00
Router(config-isis)#address-family ipv4 unicast
Router(config-isis-af)#metric-style wide
Router(config-isis-af)#mpls traffic-eng level-2-only
Router(config-isis-af)#mpls traffic-eng router-id Loopback0
Router(config-isis-af)#mpls traffic-eng tunnel anycast-prefer-igp-cost
```

mpls traffic-eng auto-bw apply (MPLS-TE)

To apply the highest bandwidth collected on a tunnel without waiting for the current application period to end, use the **mpls traffic-eng auto-bw apply** command in XR EXEC mode.

mpls traffic-eng auto-bw apply {**all** | **tunnel-te** *tunnel-number*}

Syntax Description

all	Applies the highest bandwidth collected instantly on all the automatic bandwidth-enabled tunnels.
tunnel-te *tunnel-number*	Applies the highest bandwidth instantly to the specified tunnel. The range is from 0 to 65535.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **mpls traffic-eng auto-bw apply** command can forcefully expire the current application period on a specified tunnel and immediately apply the highest bandwidth recorded so far instead of waiting for the application period to end on its own.



Note The predefined threshold check still applies on the configuration, and if the delta is not significant enough, the automatic bandwidth functionality overrides this command.

The bandwidth application is performed only if at least one output rate sample has been collected for the current application period.

To guarantee the application of a specific signaled bandwidth value when triggering a manual bandwidth application, follow these steps:

1. Configure the minimum and maximum automatic bandwidth to the bandwidth value that you want to apply by using the command.
2. Trigger a manual bandwidth application by using the **mpls traffic-eng auto-bw apply** command.
3. Revert the minimum and maximum automatic bandwidth value back to their original value.

Task ID

Task ID	Operations
mpls-te	execute

Examples

The following example applies the highest bandwidth to a specified tunnel:

```
RP/0/RP0/CPU0:router# mpls traffic-eng auto-bw apply tunnel-te 1
```

mpls traffic-eng event-history (MPLS-TE)

To enable the event history for MPLS-TE tunnels, use the **mpls traffic-eng event-history** command in XR Config mode.

mpls traffic-eng event-history [**tunnel**]

Syntax Description

tunnel	Enables tunnel event history information.

Command Default

By default, tunnel event history is not enabled.

Command Modes

Global ConfigurationXR Config

Command History

Release	Modification
Release 25.4.1	This command was introduced.

Usage Guidelines

You can configure event history only on MPLS-TE headend tunnels.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This example shows how to enable event history on MPLS-TE headend tunnels.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router# mpls traffic-eng event-history tunnel
RP/0/RP0/CPU0:router(config-te-evt-hist-tun)#
```

mpls traffic-eng event-history tunnel (MPLS-TE)

To configure the number of events in the tunnel history for MPLS-TE tunnels, use the **mpls traffic-eng event-history tunnel** command in XR Config mode.

mpls traffic-eng event-history tunnel [**event-count** *value*]

Syntax Description

event-count*value*	Sets the number of events in the tunnel history. Event count ranges between 1 to 1000.

Command Default

By default, tunnel event history is not enabled.

Command Modes

Global ConfigurationXR Config

Command History

Release	Modification
Release 25.4.1	This command was introduced.

Usage Guidelines

You can configure event history only on MPLS-TE headend tunnels.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This example shows how to specify the number of events in the tunnel history.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router# mpls traffic-eng event-history tunnel event-count 25
RP/0/RP0/CPU0:router(config)#
```

mpls traffic-eng fast-reroute promote

To configure the router to assign new or more efficient backup MPLS-TE tunnels to protected MPLS-TE tunnels, use the **mpls traffic-eng fast-reroute promote** command in XR EXEC mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng fast-reroute promote
no mpls traffic-eng fast-reroute promote

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to initiate backup tunnel promote and assignment:

```
RP/0/RP0/CPU0:router# mpls traffic-eng fast-reroute promote
```

mpls traffic-eng level

To configure a router running Intermediate System-to-System (IS-IS) MPLS-TE at IS-IS Level 1 and Level 2, use the **mpls traffic-eng level** command in XR Config mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng level *isis-level*
no mpls traffic-eng level *isis-level*

Syntax Description

isis-level	IS-IS level (1, 2, or both) where MPLS-TE is enabled.

Command Default

No default behavior or values

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **mpls traffic-eng level** command is supported for IS-IS and affects the operation of MPLS-TE only if MPLS-TE is enabled for that routing protocol instance.

Task ID

Task ID	Operations
isis	read, write

Examples

The following example shows how to configure a router running IS-IS MPLS to flood TE for IS-IS level 1:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# router isis 1
RP/0/RP0/CPU0:router(config-isis)# address-family ipv4 unicast
RP/0/RP0/CPU0:router(config-isis-af)# mpls traffic-eng level 1
RP/0/RP0/CPU0:router(config-isis-af)# metric-style wide
```

mpls traffic-eng link-management flood

To enable immediate flooding of all the local MPLS-TE links, use the **mpls traffic-eng link-management flood** command in XR EXEC mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng link-management flood
no mpls traffic-eng link-management flood

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If there is no change in the LSA since last flooding, IGP may dampen the advertisement.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to initiate flooding of the local MPLS-TE links:

```
RP/0/RP0/CPU0:router# mpls traffic-eng link-management flood
```

mpls traffic-eng path-protection switchover tunnel-te

To force a manual switchover for path-protected tunnel, use the **mpls traffic-eng path-protection switchover tunnel-te** command in XR EXEC mode. To disable this feature, use the **no** form of this command.

mpls traffic-eng path-protection switchover tunnel-te *tunnel ID*
no mpls traffic-eng path-protection switchover tunnel-te *tunnel ID*

Syntax Description

tunnel ID	Tunnel identifier of the P2P tunnel for the path protection switchover. Range is from 0 to 65535.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute

Examples

The following example configures the switchover for path-protection for tunnel-te:

```
RP/0/RP0/CPU0:router# mpls traffic-eng path-protection switchover tunnel-te 8
```

mpls traffic-eng pce reoptimize disable

To disable the reoptimization timer for the PCE computed LSPs within MPLS-TE, use the **mpls traffic-eng pce reoptimize disable** command in XR Config mode.

To remove the **mpls traffic-eng pce reoptimize disable** configuration, use the **no** form of this command.

mpls traffic-eng pce reoptimize disable

Syntax Description

This command has no arguments or keywords.

Command Default

This command is disabled by default.

Command Modes

XR Config mode

Command History

Release	Modification
Release 25.1.1	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write, execute

Examples

This example shows how to disable the reoptimization timer for the PCE computed LSPs within MPLS-TE and verifies whether the reoptimization timer is disabled.

```
RP/0/0/CPU0:ios(config)#mpls traffic-eng pce reoptimize disable
RP/0/0/CPU0:rtrA(config)#commit
Fri Nov  1 10:11:18.818 PDT
RP/0/0/CPU0:ios(config)#show running-config mpls traffic-eng pce
Fri Nov  1 10:11:23.788 PDT
mpls traffic-eng
 pce
  reoptimize 60
  reoptimize disable
 !
```

This example shows how to remove the **mpls traffic-eng pce reoptimize disable** configuration.

```
RP/0/0/CPU0:ios(config)#no mpls traffic-eng pce reoptimize disable
RP/0/0/CPU0:ios(config)#commit
```

This example shows how to remove the PCE reoptimize timer configuration. The **no mpls traffic-eng pce reoptimize** <*reoptimize-timer*> command reverts the reoptimization timer for MPLS-TE PCE tunnels to the default 3600 seconds.

```
RP/0/0/CPU0:ios(config)#no mpls traffic-eng pce reoptimize 60
RP/0/0/CPU0:ios(config)#commit
```

mpls traffic-eng reoptimize (EXEC)

To trigger the reoptimization interval of all TE tunnels, use the **mpls traffic-eng reoptimize** command in XR EXEC mode.

mpls traffic-eng reoptimize [*tunnel-id*] [*tunnel-name*] [**all**] [**p2p** {**all** *tunnel-id*}]

Syntax Description

tunnel-id	(Optional) MPLS-TE tunnel identification expressed as a number. Range is from 0 to 65535.
tunnel-name	(Optional) TE tunnel identification expressed as a name.
all	(Optional) Forces an immediate reoptimization for all tunnels.
p2p	(Optional) Forces an immediate reoptimization of all P2P TE tunnels.
all	(Optional) Forces an immediate reoptimization for all P2P tunnels.
tunnel-id	P2P TE tunnel identification to be reoptimized. Range is from 0 to 65535.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute

Examples

The following example shows how to immediately reoptimize all TE tunnels:

```
RP/0/RP0/CPU0:router# mpls traffic-eng reoptimize
```

The following example shows how to immediately reoptimize TE tunnel-te90:

```
RP/0/RP0/CPU0:router# mpls traffic-eng reoptimize tunnel-te90
```

The following example shows how to immediately reoptimize all P2P TE tunnels:

```
RP/0/RP0/CPU0:router# mpls traffic-eng reoptimize p2p all
```

mpls traffic-eng reoptimize events link-up

To turn on automatic reoptimization of Multiprotocol Label Switching (MPLS) traffic engineering when certain events occur, such as, when an interface becomes operational, use the **mpls traffic-eng reoptimize events link-up** command in XR Config mode. To disable automatic reoptimization when link-up event occurs, use the **no** form of this command.

mpls traffic-eng reoptimize events link-up

no mpls traffic-eng reoptimize events link-up

Syntax Description

This command has no arguments or keywords.

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to turn on automatic reoptimization when an interface becomes operational:

```
RP/0/RP0/CPU0:router# mpls traffic-eng reoptimize events link-up
```

mpls traffic-eng router-id (MPLS-TE router)

To specify that the TE router identifier for the node is the IP address associated with a given interface, use the **mpls traffic-eng router-id** command in the appropriate mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng router-id *type interface-path-id*
no mpls traffic-eng router-id *type interface-path-id*

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (**?**) online help function.

Command Default

No default behavior or values

Command Modes

OSPF configuration

IS-IS address family configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

A routers identifier acts as a stable IP address for the TE configuration. This IP address is flooded to all nodes. You must set the destination on the destination node TE router identifier for all affected tunnels. This router ID is the address that the TE topology database at the tunnel head uses for its path calculation.

Note When the **mpls traffic-eng router-id** command is not configured, global router ID is used by MPLS-TE if there is one configured.

We suggest that you configure the **mpls traffic-eng router-id** command explicitly under the IGP; otherwise, TE uses the default algorithm to pick up the TE router-id, which can be the highest IP address of the loopback interfaces or physical interfaces.

A TE router-id configuration is highly recommended to ensure that the tunnel head-end picks up the correct source address, and the configured static RPF address at the tail-end matches the tunnel source which avoids unexpected traffic drops.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following examples show how to specify the TE router identifier as the IP address associated with loopback interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# router ospf CORE_AS
RP/0/RP0/CPU0:router(config-ospf)# mpls traffic-eng router-id 7.7.7.7

RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# router isis 811
RP/0/RP0/CPU0:router(config-isis)# address-family ipv4 unicast
RP/0/RP0/CPU0:router(config-isis-af)# mpls traffic-eng router-id 8.8.8.8
```

mpls traffic-eng repotimize mesh group

To reoptimize all tunnels of a mesh group, use the **mpls traffic-eng repotimize mesh group**command in XR EXEC mode.

mpls traffic-eng reoptimize auto-tunnel mesh group *group_id*

Syntax Description

group_id	Defines auto-tunnel mesh group ID that is to be reoptimized. Range is 0 to 4294967295.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute

Examples

This is sample out from the **mpls traffic-eng reoptimize mesh group** command:

```
RP/0/RP0/CPU0:router mpls traffic-eng reoptimize mesh group 10
```

mpls traffic-eng resetup (EXEC)

To trigger the re-setup of TE tunnels, clearing the LSP states, use the **mpls traffic-eng resetup** command in XR EXEC mode.

mpls traffic-eng resetup {**P2MP** | **P2P** | **name**}

Syntax Description

P2MP	*tunnel-id*	Re-setup a specific P2MP tunnel by tunnel-id. The P2MP tunnel ID range is from 0 to 65535.
P2P	*tunnel-id*	Re-setup a specific P2P tunnel by tunnel-id. The P2MP tunnel ID range is from 0 to 65535.
name	*name*	Re-setup a specific tunnel by the given name.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 5.1.1	This command was introduced.

Task ID

Task ID	Operations
mpls-te	execute

Examples

The following example shows how to re-setup a specific tunnel by the given name (tunnel-te1):

```
RP/0/RP0/CPU0:router#mpls traffic-eng resetup name tunnel-te1
```

The following example shows how to re-setup a specific P2P tunnel based on the specified tunnel-id (tunnel-id 1):

```
RP/0/RP0/CPU0:router#mpls traffic-eng resetup P2P tunnel-id 1
```

The following example shows how to re-setup a P2MP tunnel based on the specified tunnel-id (tunnel-id 2):

```
RP/0/RP0/CPU0:router#mpls traffic-eng resetup P2MP tunnel-id 2
```

mpls traffic-eng srlg

To enter MPLS-TE SRLG configuration mode, use the **mpls traffic-eng srlg** command in XR Config mode. To delete all the SRLG values and mapping configured under traffic engineering, use the **no** form of this command. To enter MPLS-TE SRLG value configuration submode, use the **mpls traffic-eng srlg value** *srlg value* command in the MPLS TE SRLG configuration mode. To delete all the SRLG values configured, use the **no** form of this command. To specify administrative weight associated with an SRLG value, use the **admin-weight** keyword in the MPLS TE SRLG value configuration submode.

mpls traffic-eng srlg {**admin-weight** *weight* | **value** *srlg value*}**ipv4 address** *ip-address* **next-hop ipv4 address** *next-hop-ip-address*

Syntax Description

admin-weight *weight*	Value added to link admin-weight during SRLG-aware path computation. Range is 0 to 4294967295.
value *srlg-value*	SRLG value. Range is 0 to 4294967295.
static	Assign SRLG to topology link based on IP address.
ipv4 address *ip-address* **next-hop ipv4 address** *next-hop-ip-address*	Assign IP address of the local end-point and next-hop address of the link.

Command Default

The default value for **admin-weight** keyword is 1.

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enter MPLS-TE SRLG configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng srlg
RP/0/RP0/CPU0:router(config-mpls-te-srlg)#
```

The following example shows how to enter MPLS-TE SRLG value configuration submode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng srlg value 150
RP/0/RP0/CPU0:router(config-mpls-te-srlg)#
```

The following example shows how to specify admin-weight in the MPLS-TE SRLG value configuration submode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng srlg value 150
RP/0/RP0/CPU0:router(config-mpls-te-srlg)# admin-weight 10
```

mpls traffic-eng teardown (EXEC)

To tear down and reestablish the RSVP-TE tunnels in a router, use the **mpls traffic-eng teardown** command in XR EXEC mode.

mpls traffic-eng teardown { **all** | **head** | **mid** | **tail** }

Syntax Description

all	Tears and set-up all the RSVP-TE tunnels of a network node
head	Tears and sets up all the RSVP-TE tunnels of the configured headend router
mid	Tears and sets up all the RSVP-TE tunnels of the configured midend router
tail	Tears and sets up all the RSVP-TE tunnels of the configured tailend router

Command Default

None

Command Modes

XR EXEC

Command History

Release	Modification
Release 7.11.1	This command was introduced.

Usage Guidelines

You can also use the **mpls traffic-eng resetup** command to reestablish the tunnels only at the headend router.

Task ID

Task ID	Operation
mpls-te	execute

This example shows the tearing down of all the RSVP-TE tunnels in an MPLS network.

```
Router# mpls traffic-eng teardown all
Router# commit
```

mpls traffic-eng topology block-verify-after-rpfo

To block path verification for the specified time after an RP failover when nonstop routing (NSR) is not configured, use the **mpls traffic-eng topology block-verify-after-rpfo** command in Global Configuration mode. To remove the configuration, use the **no** form of the command.

mpls traffic-eng topology block-verify-after-rpfo *time*

Syntax Description

time	Specifies the time in seconds until which the verification is blocked.

Command Default

By default, path verification is not blocked.

Command Modes

Global Configuration

Command History

Release	Modification
Release 6.5.1	This command was introduced.

Usage Guidelines

You should only use this command to prevent the verification failure that causes unprotected LSPs to flap if you have configured nonstop forwarding (NSF) only and performed an RP failover with NSR disabled.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This example shows how to block the path verification for 150 seconds.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# topology block-verify-after-rpfo 150
```

mpls traffic-eng tunnel preferred

By default, IS-IS installs multiple ECMPs for a route in the RIB through MPLS TE tunnels and physical interfaces. To limit IS-IS to use only MPLS TE tunnels for ECMP, use the **mpls traffic-eng tunnel preferred** command in XR Config Mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng tunnel preferred
no mpls traffic-eng tunnel preferred

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR Config Mode

Command History

Release	Modification
Release 7.6.1	This command was introduced.

Usage Guidelines

The **mpls traffic-eng tunnel preferred** command is supported for IS-IS and affects the operation of MPLS-TE only if MPLS-TE is enabled for that routing protocol instance.

Task ID

Task ID	Operations
isis	read, write

Examples

The following example shows how to configure the tunnel preference:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# router isis 1
RP/0/RP0/CPU0:router(config-isis)# address-family ipv4 unicast
RP/0/RP0/CPU0:router(config-isis-af)# mpls traffic-eng tunnel preferred
```

mpls traffic-eng tunnel restricted

To specify an autoroute tunnel as a designated path for the IPv4 unicast address and IPv6 unicast address families, use the **mpls traffic-eng tunnel restricted** command in IS-IS address family mode config mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng tunnel restricted

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

IS-IS address family mode

Command History

Release	Modification
Release 7.6.2	This command was introduced.
Release 25.3.1	The **mpls traffic-eng restricted** configuration is now supported for the IPv6 unicast address.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
isis	read, write

Examples

The following example shows how to specify an autoroute tunnel as designated path:

```
Router# configure
Router(config)# router isis 1
Router(config-isis)# address-family ipv4 unicast
Router(config-isis-af)# mpls traffic-eng tunnel restricted
```

This example shows how to specify an autoroute tunnel as designated path for the IPv6 unicast address.

```
Router# configure
Router(config)# router isis 1
Router(config-isis)# address-family ipv6 unicast
Router(config-isis-af)# mpls traffic-eng tunnel restricted
```

named-tunnels tunnel-te

To name the TE (Traffic Engineering) tunnels in the network with unique tunnel IDs (STRING names), use the **named-tunnels tunnel-te** command in MPLS-TE configuration mode. To delete the named tunnels, use the **no** form of this command.

named-tunnels tunnel-te *tunnel-name* [**self-ping** *max-count*]
no named-tunnels

Syntax Description

tunnel-name	Configures the given name to the TE tunnel. **Note** If the tunnel name contains more than one word, use hyphens to separate the words.
self-ping *max-count*	Configures the maximum number of self-ping probes that are to be sent.

Command Default

None

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.
Release 7.5.3	The **self-ping** keyword was added.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to name a TE tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)#mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#named-tunnels
RP/0/RP0/CPU0:router(config-mpls-te-named-tunnels)#tunnel-te FROM-NY-TO-LA
```

Self-Ping Probe

The following example shows how to configure self-ping probe:

```
/* Self-ping is supported for named-tunnels. This new keyword self-ping enables self-ping
when tunnel-te ABC is being reoptimized. */
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# named-tunnels tunnel-te ABC
RP/0/RP0/CPU0:router(config-te-tun-name)# self-ping
RP/0/RP0/CPU0:router(config-te-tun-name)# commit
```

nhop-only (auto-tunnel backup)

To configure only a next-hop automatic backup tunnel with only link protection, use the **nhop-only** command in MPLS-TE auto-tunnel backup interface configuration mode. To return to the default configuration setting for automatic backup tunnels, use the **no** form of this command.

nhop-only
no nhop-only

Syntax Description

This command has no arguments or keywords.

Command Default

Both NHOP and NNHOP protection are enabled.

Command Modes

Auto-tunnel backup configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If you configure the **nhop-only** command, you destroy any next-next-hop (NNHOP) tunnel created to provide node protection for tunnels running over the specified interface.

If you unconfigure the **nhop-only** command, you trigger a backup assignment on primary tunnels running over that link. The automatic backup tunnel feature attempts to create NNHOP backup tunnnels to provide node protection for the specified tunnels.

Task ID

Task ID	Operation
mpls-te	read, write

Example

In the following example, NNHOP automatic backup tunnels are destroyed and only NHOP tunnels with link protection is configured:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-mpls-te-if)# auto-tunnel backup
RP/0/RP0/CPU0:router(config-mpls-te-if-auto-backup)# nhop-only
```

overflow threshold (MPLS-TE)

To configure the tunnel overflow detection, use the **overflow threshold** command in MPLS-TE automatic bandwidth interface configuration mode. To disable the overflow detection feature, use the **no** form of this command.

overflow threshold *percentage* [**min** *bandwidth*] **limit** *limit*
no overflow threshold

Syntax Description

percentage	Bandwidth change percent to trigger an overflow. The range is from 1 to 100.
min *bandwidth*	(Optional) Configures the bandwidth change value, in kbps, to trigger an overflow. The range is from 10 to 4294967295. The default is 10.
limit *limit*	Configures the number of consecutive collection intervals that exceeds the threshold. The bandwidth overflow triggers an early tunnel bandwidth update. The range is from 1 to 10. The default is none.

Command Default

The default value is disabled.

Command Modes

MPLS-TE automatic bandwidth interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If you modify the **limit** keyword, the consecutive overflows counter for the tunnel is also reset.

If you enable or modify the minimum value, the current consecutive overflows counter for the tunnel is also reset, which effectively restarts the overflow detection from scratch.

Several number of consecutive bandwidth samples are greater than the overflow threshold (bandwidth percentage) and the minimum bandwidth configured, then a bandwidth application is updated immediately instead of waiting for the end of the application period.

Overflow detection applies only to bandwidth increase. For example, an overflow can not be triggered even if bandwidth decreases by more than the configured overflow threshold.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure the tunnel overflow detection for tunnel-te 1:

```
RP/0/RP0/CPU0:router# configure
```

```
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# auto-bw
RP/0/RP0/CPU0:router(config-if-tunte-autobw)# overflow threshold 50 limit 3
```

path-option (MPLS-TE)

To configure a path option for an MPLS-TE tunnel, use the **path-option** command in tunnel-te interface configuration mode. To return to the default behavior, use the **no** form of this command.

path-option *preference-priority* [**protecting** *number*] {**dynamic** | **explicit** {**name** *path-name* | **identifier** *path-number*}[**protected-by** *path-option-level*]} **[attribute-set** *name]* [**isis** *instance-name* **level** *level*] [**lockdown**] [**ospf** *instance-name* **area** {*value address*}] [**verbatim**]
no path-option *preference-priority* {**dynamic** | **explicit** {**name** *path-name* | **identifier** *path-number*}[**protected-by** *path-option-level*]} [**isis** *instance-name* **level** *level*] [**lockdown**] [**ospf** *instance-name* **area** {*value address*}] [**verbatim**]

Syntax Description

preference-priority	Path option number. Range is from 1 to 1000.
protecting *number*	Specifies a path setup option to protect a path. The range is from 1 to 1000.
dynamic	Specifies that label switched paths (LSP) are dynamically calculated.
explicit	Specifies that LSP paths are IP explicit paths.
name *path-name*	Specifies the path name of the IP explicit path.
identifier *path-number*	Specifies a path number of the IP explicit path.
protected-by *path-option-level*	(Optional) Configures path protection for an explicit path that is protected by another explicit path.
isis *instance-name*	(Optional) Limits CSPF to a single IS-IS instance and area.
attribute-set *name*	(Optional) Specifies the attribute set for the LSP.
level *level*	Configures the level for IS-IS. The range is from 1 to 2.
lockdown	(Optional) Specifies that the LSP cannot be reoptimized.
ospf *instance-name*	(Optional) Limits CSPF to a single OSPF instance and area.
area	Configures the area for OSPF.
value	Decimal value for the OSPF area ID.
address	IP address for the OSPF area ID.
verbatim	(Optional) Bypasses the Topology/CSPF check for explicit paths.

Command Default

No default behavior or values

Command Modes

Tunnel-te interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You can configure several path options for a single tunnel. For example, there can be several explicit path options and a dynamic option for one tunnel. The path setup preference is for lower (not higher) numbers, so option 1 is preferred.

When the lower number path option fails, the next path option is used to set up a tunnel automatically (unless using the lockdown option).

The **protecting** keyword specifies that you can configure path-protection for the primary LSP. The **protecting** keyword is available only for tunnel-gte interfaces.

You specify the backup path for the **path-option** command in case of the primary path failure.

CSPF areas are configured on a per-path-option basis.

The **dynamic** keyword is required to configure path-protection.

Any primary explicit path on a path protection enabled tunnel can be configured to be protected by an explicit path option level using **protected-by** keyword. Only one explicit protecting path is supported per path option.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure the tunnel to use a named IPv4 explicit path as verbatim and lockdown options for the tunnel. This tunnel cannot reoptimize when the FRR event goes away, unless you manually reoptimize it:

```
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# path-option 1 explicit name test verbatim lockdown
```

The following example shows how to enable path protection on a tunnel to configure an explicit path:

```
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# path-option 1 explicit name po4
RP/0/RP0/CPU0:router(config-if)# path-option protecting 1 explicit name po6
```

The following example shows how to limit CSPF to a single OSPF instance and area:

```
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# path-option 1 explicit name router1 ospf 3 area 7 verbatim
```

The following example shows how to limit CSPF to a single IS-IS instance and area:

```
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# path-option 1 dynamic isis mtbf level 1 lockdown
```

path-protection (MPLS-TE)

To enable path protection for a tunnel interface , use the **path-protection** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

path-protection
no path-protection

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Although not as fast as a link or node protection, presignaling a secondary Labeled Switch Path (LSP) is faster than configuring a secondary path option or allowing the tunnel's source router to dynamically recalculate a path. The actual recovery time is topology-dependent, and is affected by delay factors such as propagation delay and switch fabric latency.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable path protection for the tunnel-te interface type:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# path-protection
```

path-protection timers reopt-after-switchover

To configure the time to wait after a switchover occurs on a tunnel before a reoptimization is attempted for the tunnel, use the **path-protection timers reopt-after-switchover** command in MPLS-TE configuration mode. To disable this feature, use the **no** form of this command.

path-protection timers reopt-after-switchover *seconds*
no path-protection timers reopt-after-switchover *seconds*

Syntax Description

seconds	Time, in seconds, between path-protection event and tunnel reoptimization. Range is from 0 to 604800.

Command Default

seconds: 180 (3 minutes)

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

This command is used as a triggered reoptimization, which allows a tunnel to reoptimize to a better path than the standby path after the switchover. This option is used as a one time reoptimization.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to adjust the number of seconds between when a path-protection switchover is effected on a tunnel head to when reoptimization is performed on the tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# path-protection timers reopt-after-switchover 180
```

path-selection cost-limit

To set the upper limit on the path aggregate admin-weight when computing paths for MPLS-TE LSPs, use the **path-selection cost-limit** command in an appropriate configuration mode. To remove the upper limit, use the **no** form of this command.

path-selection cost-limit *cost-limit-value*

Syntax Description

cost-limit-value	Configures the path-selection cost-limit value. The range is from 1 to 4294967295.

Command Default

The cost-limit is ignored.

Command Modes

XR Config mode

Interface tunnel TE configuration

MPLS TE path-option attribute set configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Path-selection cost-limit configuration works only on MPLS TE tunnels. The cost-limit configured under path-option attribute-set configuration mode takes priority and will be in effect if the cost-limit is configured under global configuration, interface tunnel TE, and path-option attribute-set configuration modes. The cost-limit is ignored by default.

A LSP is created only if its path aggregate admin-weight is less than the specified path cost limit.

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to set the path-selection cost-limit for under MPLS TE path-option attribute-set *PO3AttrSet*.

```
RP/0/RP0/CPU0:router#configure
RP/0/RP0/CPU0:router(config)#mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#attribute-set path-option PO3AttrSet
RP/0/RP0/CPU0:router(config-te-attribute-set)#path-selection cost-limit 50000
```

path-selection ignore overload (MPLS-TE)

To ignore the Intermediate System-to-Intermediate System (IS-IS) overload bit setting for MPLS-TE, use the **path-selection ignore overload** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

path-selection ignore overload {head | mid | tail}
no path-selection ignore overload {head | mid | tail}

Syntax Description

This command has no arguments or keywords.

Syntax Description

head	The tunnel stays up if **set-overload-bit** is set by ISIS on the head router. Ignores overload node during CSPF for the head node.
mid	The tunnel stays up if **set-overload-bit** is set by ISIS on the mid router. Ignores overload node during CSPF for the mid node.
tail	The tunnel stays up if **set-overload-bit** is set by ISIS on the tail router. Ignores overload node during CSPF for the tail node.

Command Default

None

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **path-selection ignore overload** command to ensure that label switched paths (LSPs) are not broken because of routers that have IS-IS overload bit as enabled.

When the IS-IS overload bit avoidance (OLA) feature is activated, all nodes with the overload bit set, which includes head nodes, mid nodes, and tail nodes, are ignored. This means that they are still available for use with label switched paths (LSPs). This feature allows you to include an overloaded node in constraint-based shortest path first (CSPF).

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This example shows how to use the **path-selection ignore overload head** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# path-selection ignore overload
```

```
RP/0/RP0/CPU0:router(config-mpls-te)# path-selection ignore overload head
```

path-selection loose-expansion affinity (MPLS-TE)

To specify the affinity value to be used to expand a path to the next loose hop for a tunnel on an area border router, use the **path-selection loose-expansion affinity** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

path-selection loose-expansion affinity *affinity-value* **mask** *affinity-mask* [**class-type** *type*]
no path-selection loose-expansion affinity *affinity-value* **mask** *affinity-mask* [**class-type** *type*]

Syntax Description

affinity-value	Attribute values required for links carrying this tunnel. A 32-bit decimal number. Range is 0x0 to 0xFFFFFFFF, representing 32 attributes (bits), where the value of an attribute is 0 or 1.
mask *affinity-mask*	Checks the link attribute, a 32-bit decimal number. Range is 0x0 to 0xFFFFFFFF, representing 32 attributes (bits), where the value of an attribute mask is 0 or 1.
class-type *type*	(Optional) Requests the class-type of the tunnel bandwidth. Range is 0 to 1.

Command Default

affinity-value : 0X00000000

mask-value : 0XFFFFFFFF

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The new affinity scheme (based on names) is not supported for loose-hop expansion. New configuration does not affect the already up tunnels.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure affinity 0x55 with mask 0xFFFFFFFF:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# path-selection loose-expansion affinity 55 mask
FFFFFFFF
```

path-selection loose-expansion metric (MPLS-TE)

To configure a metric type to be used to expand a path to the next loose hop for a tunnel on an area border router, use the **path-selection loose-expansion metric** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

path-selection loose-expansion metric {**igp** | **te**} [**class-type** *type*]
no path-selection loose-expansion metric {**igp** | **te**} [**class-type** *type*]

Syntax Description

igp	Configures an Interior Gateway Protocol (IGP) metric.
te	Configures a TE metric. This is the default.
class-type *type*	(Optional) Requests the class type of the tunnel bandwidth. Range is 0 to 1.

Command Default

The default is TE metric.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

New configurations do not affect tunnels that are already up.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the path-selection metric to use the IGP metric overwriting default:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# path-selection loose-expansion metric igp
```

path-selection metric (MPLS-TE)

To specify the MPLS-TE tunnel path-selection metric, use the **path-selection metric** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

path-selection metric { **igp** | **te** | **delay** }
no path-selection metric

Syntax Description

igp	Configures an Interior Gateway Protocol (IGP) metric.
te	Configures a TE metric.
delay	Configures a delay metric.

Command Default

The default is TE metric.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The metric type to be used for path calculation for a given tunnel is determined as follows:

- If the **path-selection metric** command was entered to specify a metric type for the tunnel, use that metric type.
- Otherwise, use the default (TE) metric.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the path-selection metric to use the IGP metric overwriting default:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# path-selection metric igp
```

path-selection metric (interface)

To configure an MPLS-TE tunnel path-selection metric type, use the **path-selection metric** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

path-selection metric { **igp** | **te** | **delay** }
no path-selection metric

Syntax Description

igp	Configures Interior Gateway Protocol (IGP) metrics.
te	Configures TE metrics. This is the default.
delay	Configures delay metrics.

Command Default

The default is TE metrics.

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The metric type to be used for path calculation for a given tunnel is determined as follows:

- If the **path-selection metric** command was entered to either a metric type for the tunnel or only a metric type, use that metric type.
- Otherwise, use the default (TE) metric.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the path-selection metric to use the IGP metric overwriting default:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# path-selection metric igp
```

pce tcp-ao

To perform MPLS-TE PCE authentication using TCP Authentication Option (TCP-AO), use the **pce tcp-ao** command in MPLS-TE configuration mode.

pce tcp-ao <password> *include-tcp-options*

Syntax Description

pce tcp-ao <password>	Password string.
include-tcp-options	Includes TCP options in the header for MAC calculation.

Command Default

This command is disabled by default.

Command Modes

MPLS-TE interface configuration

Command History

Release	Modification
Release 26.1.1	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write, execute

Examples

This example shows how to configure MPLS-TE PCE authentication using TCP-AO.

```
Router# configure terminal
Router(config)# mpls traffic-eng
Router(config-mpls-te)# pce tcp-ao <password> include-tcp-options
```

policy-class

To configure policy-based tunnel selection (PBTS) to direct traffic into specific TE tunnels, use the **policy-class** command in interface configuration mode. To disable this feature, use the **no** form of this command.

Multiple EXP values can be specified as part of a policy-class, separated by spaces. The EXP values configured to a TE tunnel effectively form a monolithic policy-class, which should not overlap with other policy-classes. Once an EXP value is used in a policy-class configuration, it can only be reused if the subsequent policy-class configurations containing that EXP value are identical. For example, if the configuration **policy-class** *1 2 3* is applied to one or more tunnels, configurations such as **policy-class** *1*, **policy-class** *2 3*, or **policy-class** *3 4 5* become invalid.

policy-class {*1 - 7* | **default**}
no policy-class

Syntax Description

1 - 7	Policy-class attribute to map the correct traffic class to this policy. Multiple EXP values can be specified, separated by spaces.
default	Default tunnel policy class.

Command Default

The lowest class tunnels are assigned to carry default traffic only if no default tunnel is available for forwarding.

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **policy-class** command to enable policy-based tunnel selection (PBTS). See *Cisco IOS XR MPLS Configuration Guide for the Cisco CRS-1 RouterCisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router* for more information on PBTS.

To display the configured PBTS policy-class value, use the **show mpls traffic-eng tunnels** command.

To display information about PBTS configuration, use the **show cef** and **show cef hardware** commands in *Cisco IOS XR IP Addresses and Services Command Reference for the Cisco XR 12000 Series Router Cisco IOS XR IP Addresses and Services Command Reference for the Cisco CRS-1 Router*.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure a policy class:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
```

```
RP/0/RP0/CPU0:router(config-if)# policy-class 7
```

The following example shows how to configure a policy-class that maps to multiple traffic classes:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# policy-class 1 2 3
```

The following example shows how to configure a default policy-class tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# policy-class default
RP/0/RP0/CPU0:router(config-if)# commit
```

priority (MPLS-TE)

To configure the setup and reservation priority for an MPLS-TE tunnel, use the **priority** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

priority *setup-priority hold-priority*
no priority *setup-priority hold-priority*

Syntax Description

setup-priority	Priority used when signaling a label switched path (LSP) for this tunnel to determine which existing tunnels can be preempted. Range is 0 to 7 (in which a lower number indicates a higher priority). Therefore, an LSP with a setup priority of 0 can preempt any LSP with a non-0 priority.
hold-priority	Priority associated with an LSP for this tunnel to determine if it should be preempted by other LSPs that are being signaled. Range is 0 to 7 (in which a lower number indicates a higher priority).

Command Default

setup-priority: 7

hold-priority: 7

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

When an LSP is signaled and an interface does not currently have enough bandwidth available for that LSP, the call admission software (if necessary) preempts lower-priority LSPs to admit the new LSP. Accordingly, the new LSP priority is the setup priority and the existing LSP priority is the hold priority. The two priorities make it possible to signal an LSP with a low setup priority (so that the LSP does not preempt other LSPs on setup) and a high hold priority (so that the LSP is not preempted after it is established). Setup priority and hold priority are typically configured to be equal, and setup priority cannot be numerically smaller than the hold priority.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure a tunnel with a setup and hold priority of 1:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# priority 1 1
```

record-route

To record the route used by a tunnel, use the **record-route** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

record-route
no record-route

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You must configure record-route on TE tunnels that are protected by multiple backup tunnels merging at a single node.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable record-route on the TE tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# record-route
```

redirect default-route nexthop

To configure multi nexthop tracking on default-route on a VRF for IPv4 or IPv6 address family, use the **redirect default-route nexthop** command in policy-map class type configuration mode.

redirect {**ipv4** | **ipv6**} **default-route nexthop**
[**vrf** *vrf-name*] [*v4v6*] **nexthop** [**vrf** *vrf-name*] [*v4v6*] **nexthop** [**vrf** *vrf-name*] [*v4v6*]

Syntax Description

ipv4 | ipv6	Specifies IPv4 or IPv6 address family.
vrf *vrf-name*	Specifies the VRF name for nexthop.
v4	Specifies IPv4 nexthop address in A.B.C.D format.
v6	Specifies IPv6 nexthop address in X:X::X%zone format.

Command Default

No default behavior or values

Command Modes

Policy-map class type configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
qos	read, write

Example

The following example shows how to configure multi nexthop tracking on default-route on a VRF for IPv4:

```
RP/0/RSP0/CPU0:Router# config
RP/0/RSP0/CPU0:Router(config)# policy-map type pbr kmd
RP/0/RSP0/CPU0:Router(config-pmap)# class type traffic acl
RP/0/RSP0/CPU0:Router(config-pmap-c)# redirect ipv4 default-route nexthop vrf vpn1 3.2.1.2
 nexthop vrf vpn2 3.2.3.2 nexthop vrf vpn3 3.2.4.2
```

redirect nexthop

To configure multi nexthop tracking on a VRF for IPv4 or IPv6 address family, use the **redirect nexthop** command in policy-map class type configuration mode.

redirect {**ipv4** | **ipv6**} **nexthop**
[**vrf** *vrf-name*] [*v4 v6*] **nexthop** [**vrf** *vrf-name*] [*v4 v6*] **nexthop** [**vrf** *vrf-name*] [*v4 v6*]

Syntax Description

ipv4 | ipv6	Specifies IPv4 or IPv6 address family.
vrf *vrf-name*	Specifies the VRF name for nexthop.
v4	Specifies IPv4 nexthop address in A.B.C.D format.
v6	Specifies IPv6 nexthop address in X:X::X%zone format.

Command Default

No default behavior or values

Command Modes

Policy-map class type configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

A maximum number of three nexthops can be configured. The first nexthop configured has the highest priority as compared to the last nexthop, which has the least priority. The nexthops configured must be either IPv4 or IPv6. Either a VRF name or an IPv4/IPv6 address, or both can be configured for a given nexthop. When VRF is not configured, it is presumed to be ingress interface VRF.

Task ID

Task ID	Operation
qos	read, write

Example

The following example shows how to configure multi nexthop tracking on a VRF for IPv4:

```
RP/0/RSP0/CPU0:Router# config
RP/0/RSP0/CPU0:Router(config)# policy-map type pbr kmd
RP/0/RSP0/CPU0:Router(config-pmap)# class type traffic acl
RP/0/RSP0/CPU0:Router(config-pmap-c)# redirect ipv4 nexthop vrf vpn1 3.2.1.2 nexthop vrf
vpn2 3.2.3.2 nexthop vrf vpn3 3.2.4.2
```

reoptimize (MPLS-TE)

To force the reoptimization interval for all TE tunnels, use the **reoptimize** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

reoptimize *frequency*
no reoptimize *frequency*

Syntax Description

frequency Timer frequency range, in seconds. Range is from 0 to 604800.

Note:

- A value of 0 disables periodic reoptimization.
- Any value in the range from 1 to 60 results in periodic reoptimization that occurs every 60 seconds.

Command Default

frequency: 3600

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to force the reoptimization interval to 60 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# reoptimize 60
```

reoptimize timers delay (MPLS-TE)

To delay removal or relabeling of the old label switched paths (LSPs) (reoptimized LSP from the forwarding plane) after tunnel reoptimization, use the **reoptimize timers delay** command in MPLS-TE configuration mode. To restore the default value, use the **no** form of this command.

reoptimize timers delay {**after-frr** *seconds* | **cleanup** *delay-time* | **installation** *delay-time* | **path-protection** *seconds*}
no reoptimize timers delay {**after-frr** *seconds* | **cleanup** *delay-time* | **installation** *delay-time* | **path-protection** *seconds*}

Syntax Description

after-frr	Delays the LSP reoptimization in the event of the FRR.
seconds	Reoptimization initiation delay time of the tunnel, in seconds, after an FRR event. Range is from 0 to 120.
cleanup	Delays removal of the old LSPs after tunnel reoptimization.
delay-time	Reoptimization delay time, in seconds. A value of 0 disables delay. The valid range is from 0 to 300 for cleanup time.
installation	Delays installation of a new label after tunnel reoptimization.
delay-time	Reoptimization delay time, in seconds. A value of 0 disables delay. The valid range is 0 to 3600 for installation time.
path-protection	Delays the time between path protection switchover event and tunnel reoptimization.
seconds	Time, in seconds, between path protection switchover event and tunnel reoptimization. A value of 0 disables delay. Range is from 0 to 604800.

Command Default

after-frr *delay*: 0

cleanup *delay*: 20

delay-time: 20

installation *delay*: 20

path-protection: 180

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

A device with Multiprotocol Label Switching traffic engineering (MPLS-TE) tunnels periodically examines tunnels with established LSPs to discover whether more efficient LSPs (paths) are available. If a better LSP is available, the device signals the more efficient LSP; if the signaling is successful, the device replaces the older LSP with the new, more efficient LSP.

Sometimes the slower router-point nodes may not yet utilize the new label's forwarding plane. In this case, if the headend node replaces the labels quickly, it can result in brief packet loss. By delaying the cleanup of the old LSP using the **reoptimize timers delay cleanup** command, packet loss is avoided.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the reoptimization cleanup delay time to 1 minute:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# reoptimize timers delay cleanup 60
```

The following example shows how to set the reoptimization installation delay time to 40 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# reoptimize timers delay installation 40
```

The following example shows how to set the reoptimization delay time after the event of the FRR to 50 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# reoptimize timers delay after-frr 50
```

The following example shows how to set the reoptimization delay time between path protection switchover event and tunnel reoptimization to 80:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# reoptimize timers delay path-protection 80
```

route-priority

To enable users to adjust the route-priority given to TE labels into the data plane, compared to labels and route updates from other protocols, use the **route-priority** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

route-priority role {**middle** | **head** {**primary** | **backup**}} **queue** *queue*
no route-priority role {**middle** | **head** {**primary** | **backup**}}

Syntax Description

role	Defines the role of the tunnel to which the label belongs.
middle	A tunnel mid-point.
head backup	A tunnel head which is assigned as a FRR backup to an interface.
head primary	All other tunnel heads.
queue	Defines the queue number. Range is from 0 to 12 inclusive; lower values represent higher priority queues.

Command Default

head backup: 9

head primary: 10

middle: 10

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use this command to change the priority given to TE labels when updates to the forwarding plane are made from the control plane.

The priority values used by other applications are:

- 0 - Unused
- 1 - Unused
- 2 - RIB/LDP (Critical)
- 3 - Unused
- 4 - Unused
- 5 - RIB/LDP (High)

- 6 - Unused
- 7 - Unused
- 8 - RIB/LDP (Medium)
- 9 - TE backup tunnel head
- 10 - Other TE tunnels
- 11 - Unused (future TE use)
- 12 - Unused (future TE use)



Caution The default prioritization of label updates from the control plane to the forwarding plane has been carefully chosen to avoid traffic loss under both normal operation and high system load, and to balance the needs of the various features that employ label switching. Changing these defaults may cause unpredictable behavior including traffic loss, especially when the router is experiencing high load. Use of this command is not recommended without proper understanding of its effects and possible side-effects.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable route-priority:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# route-priority role middle queue 7
```

router-id secondary (MPLS-TE)

To configure a secondary TE router identifier in MPLS-TE to be used locally (not advertised through IGP), use the **router-id secondary** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

router-id secondary *IP address*
no router-id secondary *IP address*

Syntax Description

IP address	IPv4 address to be used as secondary TE router ID.

Command Default

No default behavior or values

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **router-id secondary** command on tail end nodes to terminate verbatim tunnels to secondary TE RIDs as destinations.

You can configure up to 32 IPv4 addresses as TE secondary router IDs.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure a secondary TE router identifier in MPLS-TE:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# router-id secondary 10.0.0.1
RP/0/RP0/CPU0:router(config-mpls-te)# router-id secondary 172.16.0.1
```

set destination-address

To set destination address while redirecting Tag2IP MPLS labeled packets using PBR policy, use the **set destination-address** command in policy map class type configuration mode. To remove this configuration, use the **no** form of this command.

set destination-address {**ipv4** | **ipv6**} *ip-address*
no set destination-address {**ipv4** | **ipv6**} *ip-address*

Syntax Description

ipv4 | ipv6	Specifies IPv4 or IPv6 address format.
ip-address	Specifies the IPv4 or IPv6 address.

Command Default

Destination IP address is not set.

Command Modes

Policy-map class type Configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Only Tag2IP packets redirection is supported.

Task ID

Task ID	Operation
qos	read, write

This example shows how to set an IPv4 address as the redirect destination address:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#policy-map type pbr pbr_prec_exp
RP/0/0/CPU0:ios(config-pmap)#class type traffic class_prec_exp
RP/0/0/CPU0:ios(config-pmap-c)#set destination-address ipv4 192.168.0.1
```

set ipv4 df

To set or clear the do not fragment (df) bit policy before forwarding the packet in IPv4 traffic, use the set ipv4 df command in Policy-map configuration mode. To disable setting or clearing the df bit, use the no form of this command.

set ipv4 df *df-value*

Syntax Description

df-value	Specifies the df bit value. Range is from 1 to 7.

Command Default

Set df bit policy is disabled.

Command Modes

Policy-map configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
qos	read, write

This example shows how to set the IPv4 df bit policy value as *1*:

```
RP/0/RP0/CPU0:router(config-pmap-c)#set ipv4 df 1
```

set source-address

To set source address while redirecting Tag2IP MPLS labeled packets using PBR policy, use the **set source-address** command in policy map class type configuration mode. To remove this configuration, use the **no** form of this command.

set source-address {**ipv4** | **ipv6**} *ip-address*

Syntax Description

ipv4 | ipv6	Specifies IPv4 or IPv6 address format.
ip-address	Specifies the IPv4 or IPv6 address.

Command Default

No default behavior or values

Command Modes

Policy-map class type Configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
qos	read, write

Example

This example shows how to set an IPv4 address as the source address:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#policy-map type pbr pbr_prec_exp
RP/0/0/CPU0:ios(config-pmap)#class type traffic class_prec_exp
RP/0/0/CPU0:ios(config-pmap-c)#set source-address ipv4 10.0.0.1
```

show explicit-paths

To display the configured IP explicit paths, use the **show explicit-paths** command in XR EXEC mode.

show explicit-paths [**name** *path-name* | **identifier** *number*]

Syntax Description

name *path-name*	(Optional) Displays the name of the explicit path.
identifier *number*	(Optional) Displays the number of the explicit path. Range is 1 to 65535.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

An IP explicit path is a list of IP addresses that represent a node or link in the explicit path.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show explicit-paths** command:

```
RP/0/RP0/CPU0:router# show explicit-paths

  Path ToR2    status enabled
         0x1: next-address 192.168.1.2
         0x2: next-address 10.20.20.20
  Path ToR3    status enabled
         0x1: next-address 192.168.1.2
         0x2: next-address 192.168.2.2
         0x3: next-address 10.30.30.30
  Path 100    status enabled
         0x1: next-address 192.168.1.2
         0x2: next-address 10.20.20.20
  Path 200    status enabled
         0x1: next-address 192.168.1.2
         0x2: next-address 192.168.2.2
         0x3: next-address 10.30.30.30
```

This table describes the significant fields shown in the display.

Table 28: show explicit-paths Command Field Descriptions

Field	Description
Path	Pathname or number, followed by the path status.
1: next-address	First IP address in the path.
2: next-address	Second IP address in the path.

The following shows a sample output from the **show explicit-paths** command using a specific path name:

```
RP/0/RP0/CPU0:router# show explicit-paths name ToR3

  Path ToR3    status enabled
          0x1:  next-address 192.168.1.2
          0x2:  next-address 192.168.2.2
          0x3:  next-address 10.30.30.30
```

The following shows a sample output from the **show explicit-paths** command using a specific path number:

```
RP/0/RP0/CPU0:router# show explicit-paths identifier 200

  Path 200    status enabled
          0x1:  next-address 192.168.1.2
          0x2:  next-address 192.168.2.2
          0x3:  next-address 10.30.30.30
```

show interfaces tunnel-te accounting

To display IPv4 and IPv6 statistics for MPLS traffic engineering (TE) tunnels, use the **show interfaces tunnel-te accounting** command in XR EXEC mode.

show interfaces tunnel-te *tunnel-number* **accounting** [**location** *location-id* | **rates**]

Syntax Description

tunnel-number	Specifies TE tunnel number. Range is from 0 to 6553.
location *location-id*	Specifies fully qualified location of the TE tunnel.
rates	Displays interface accounting rates.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read

This example displays accounting information from tunnel-te interface *1*:

```
RP/0/RP0/CPU0:router#show interface tunnel-te 1 accounting

tunnel-te1
  Protocol              Pkts In         Chars In     Pkts Out        Chars Out
  IPV4_UNICAST                0                0            5              520
  IPV6_UNICAST                0                0           15             1560
```

show mpls traffic-eng affinity-map

To display the color name-to-value mappings configured on the router, use the **show mpls traffic-eng affinity-map** command in XR EXEC mode.

show mpls traffic-eng affinity-map

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If the affinity value of an affinity associated with an affinity constraint is unknown, the **show mpls traffic-eng affinity-map** command output displays: "(refers to undefined affinity name)"

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng affinity-map** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng affinity-map

  Affinity Name                          Bit-position     Affinity Value
    ---------------------------------   --------------   ----------------
     bcdefghabcdefghabcdefghabcdefgha                0                1
                                 red1                1                2
                                 red2                2                4
                                 red3                3                8
                                 red4                4               10
                                 red5                5               20
                                 red6                6               40
                                 red7                7               80
                                 red8                8              100
                                 red9                9              200
                                red10               10              400
                                red11               11              800
                                red12               12             1000
                                red13               13             2000
                                red14               14             4000
                                red15               15             8000
                                red16               16            10000
     cdefghabcdefghabcdefghabcdefghab               17            20000
                                red18               18            40000
                                red19               19            80000
```

```
                                    red20                20              100000
                                    red21                21              200000
                                    red22                22              400000
                                    red23                23              800000
                                    red24                24             1000000
                                    red25                25             2000000
                                    red26                26             4000000
                                    red27                27             8000000
                                 orange28                28            10000000
                                    red28                29            20000000
                                    red30                30            40000000
abcdefghabcdefghabcdefghabcdefgh        31            80000000
```

Table 29: show mpls traffic-eng affinity-map Field Descriptions, on page 323 describes the significant fields shown in the display.

Table 29: show mpls traffic-eng affinity-map Field Descriptions

Field	Description
Affinity Name	Affinity name associated with the tunnel affinity constraints.
Bit-position	Bit position set in the 32-bit affinity value
Affinity Value	Affinity value associated with the affinity name.

show mpls traffic-eng attribute-set

To display the attribute set for MPLS-TE, use the **show mpls traffic-eng attribute-set** command in XR EXEC mode.

show mpls traffic-eng attribute-set [**auto-backup** | **auto-mesh** | **path-option** | **xro**[*attribute-set-name*]]

Syntax Description

auto-backup	Displays information for the auto-backup attribute type.
auto-mesh	Displays information for the auto-mesh attribute type.
path-option	Displays information for the path-option attribute type.
xro	Displays information for the XRO attribute type.
attribute-set-name	Specifies the name of the attribute set to be displayed.

Command Default

Displays information about all types of attribute sets.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

To use this command, first enable the MPLS-TE application.

Task ID

Task ID	Operation
mpls-te	read

Example

The following command shows the attribute set for auto-backup attribute type.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng attribute-set auto-backup auto1

Attribute Set Name: auto1 (Type: auto-backup)
  Affinity: 0x0/0xffff  (Default)
  Priority: 7 7 (Default)
  Record-route: Enabled
  Policy-class: 0 (Not configured)
  Logging: None
  List of protected interfaces (count 0)
  List of tunnel IDs (count 0)
```

The following command shows the attribute set for auto-mesh attribute type.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng attribute-set auto-mesh mesh1

Attribute Set Name: mesh1 (Type: auto-mesh)
  Bandwidth: 0 kbps (CT0) (Default)
  Affinity: 0x0/0xffff  (Default)
  Priority: 7 7 (Default)
  Interface Bandwidth: 0 kbps (Default)
  AutoRoute Announce: Disabled
  Auto-bw: Disabled
  Soft Preemption: Disabled
  Fast Reroute: Disabled, Protection Desired: None
  Record-route: Disabled
  Policy-class: 0 (Not configured)
  Logging: None
  List of Mesh Groups (count 0)
```

The following command shows the attribute set for path-option attribute type.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng attribute-set path-option path1

Attribute Set Name: path1 (Type: path option)
  Bandwidth: 0 kbps (CT0) (Default)
  Affinity: 0x0/0xffff  (Default)
  List of tunnel IDs (count 0)
```

The following command shows the attribute set for xro.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng attribute-set xro

Attribute Set Name: foo (Type: XRO)
  Number of XRO constraints : 2
    LSP, best-effort, LSP-id used
      Specified by FEC: tunnel-id 55, LSP-id 88, ext. id 10.10.10.10
                        source 10.10.10.10, destination 20.20.20.20
    LSP, strict, LSP-id ignored
      Specified by FEC: tunnel-id 3, LSP-id 0, ext. id 10.0.0.1
                        source 10.0.0.1, destination 172.16.0.1
```

show mpls traffic-eng autoroute

To display tunnels that are announced to the Interior Gateway Protocol (IGP), including information about next hop and destinations, use the **show mpls traffic-eng autoroute** command in XR EXEC mode.

show mpls traffic-eng autoroute [**name** *tunnel-name*][*IP-address*]

Syntax Description

IP-address	(Optional) Tunnel leading to this address.
name *tunnel-name*	Specifies a tunnel by name.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The traffic-engineering tunnels are taken into account for the enhanced shortest path first (SPF) calculation of the IGP. The **show mpls traffic-eng autoroute** command displays those tunnels that IGP is currently using in its enhanced SPF calculation (that is, those tunnels that are up and have autoroute configured).

Tunnels are organized by destination. All tunnels to a destination carry a share of the traffic tunneled to that destination.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng autoroute** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng autoroute

  Destination 103.0.0.3 has 2 tunnels in OSPF 0 area 0
  tunnel-te1 (traffic share 1, nexthop 103.0.0.3)
  tunnel-te2 (traffic share 1, nexthop 103.0.0.3)
```

This table describes the significant fields shown in the display.

Table 30: show mpls traffic-eng autoroute Command Field Descriptions

Field	Description
Destination	Multiprotocol Label Switching (MPLS) TE tail-end router ID.

Field	Description
traffic share	A factor, based on bandwidth, indicating how much traffic this tunnel should carry, relative to other tunnels, to the same destination. If two tunnels go to a single destination, one with a traffic share of 200 and the other with a traffic share of 100, the first tunnel carries two-thirds of the traffic.
Nexthop	Next-hop router ID of the MPLS-TE tunnel.
absolute metric	Metric with mode absolute for the MPLS-TE tunnel.
relative metric	Metric with mode relative for the MPLS-TE tunnel.

This sample output displays *Signalled-Name* information:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng autoroute
Destination 192.168.0.4 has 1 tunnels in OSPF ring area 0
    tunnel-te1 (traffic share 0, nexthop 192.168.0.4)
    Signalled-Name: rtrA_t1
```

This sample output displays IS-IS autoroute information:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng autoroute
Destination 192.168.0.1 has 1 tunnels in IS-IS ring level 1
    tunnel-te1 (traffic share 0, nexthop 192.168.0.1)
       (IS-IS ring level-1, IPV4 Unicast)
       (IS-IS ring level-1, IPV6 Unicast)
```

show mpls traffic-eng auto-tunnel backup

To display information about automatically build MPLS-TE backup tunnels, use the **show mpls traffic-eng auto-tunnel backup** command in XR EXEC mode.

show mpls traffic-eng auto-tunnel {**backup** [**private** | **summary** | **unused**]}

Syntax Description

backup	Displays information about auto-tunnel backup.
private	(Optional) Displays private information about the automatically build MPLS-TE backup tunnels.
summary	(Optional) Displays the automatically build MPLS-TE backup tunnels summary information.
unused	(Optional) Displays only unused MPLS-TE backup tunnels.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read

Example

This is sample output from the **show mpls traffic-eng auto-tunnel backup** command:

```
AutoTunnel Backup Configuration:
    Interfaces count: 4
    Unused removal timeout: 1h 0m 0s
    Configured tunnel number range: 2000-2500

AutoTunnel Backup Summary:
    AutoTunnel Backups:
             1 created, 1 up, 0 down, 0 unused
             1 NHOP, 0 NNHOP, 0 SRLG strict, 0 SRLG preferred
    Protected LSPs:
             1 NHOP, 0 NHOP+SRLG
             0 NNHOP, 0 NNHOP+SRLG
    Protected S2L Sharing Families:
```

```
             0 NHOP, 0 NHOP+SRLG
             0 NNHOP, 0 NNHOP+SRLG
    Protected S2Ls:
             0 NHOP, 0 NHOP+SRLG
             0 NNHOP, 0 NNHOP+SRLG

Cumulative Counters (last cleared 05:17:19 ago):
                        Total   NHOP  NNHOP
    Created:                1      1      0
    Connected:              1      1      0
    Removed (down):         0      0      0
    Removed (unused):       0      0      0
    Removed (in use):       0      0      0
    Range exceeded:         0      0      0

AutoTunnel Backups:
        Tunnel   State   Protection   Prot.       Protected   Protected
          Name             Offered  Flows*       Interface    Node
-------------- ------- ------------ ------- --------------- ---------------
 tunnel-te2000      up NHOP               1       Gi0/2/0/2     N/A

*Prot. Flows = Total Protected LSPs, S2Ls and S2L Sharing Families
```

This is sample output from the **show mpls traffic-eng auto-tunnel mesh** command:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng auto-tunnel mesh

Auto-tunnel Mesh Global Configuration:
  Unused removal timeout: 2h
  Configured tunnel number range: 10000-12000

Auto-tunnel Mesh Groups Summary:
  Mesh Groups count: 5
Mesh Groups Destinations count: 50

Mesh Group 40 (2 Destinations, 1 Up, 1 Down):
  Destination-list: dl-40
  Attribute-set: ta_name
  Destination: 40.40.40.40, tunnel-id: 10000, State: Up
  Destination: 10.10.10.10, tunnel-id: 10001, State: Down
Mesh Group 41 (3 Destinations, 2 Up, 1 Down):
  Destination-list: dl-40
  Attribute-set: ta_name
  Destination: 203.0.113.1, tunnel-id: 10005, State: Up
  Destination: 209.165.201.1, tunnel-id: 10006, State: Up
  Destination: 10.0.0.1, tunnel-id: 10007, State: Down
Mesh Group 51 (0 Destinations, 0 Up, 0 Down):
  Destination-list: Not configured
  Attribute-set: Not configured
Mesh Group 52 (0 Destinations, 0 Up, 0 Down):
  Destination-list: NAME1 (Not defined)
  Attribute-set: NAME2 (Not defined)
Mesh Group 53 (2 Destinations, 1 Up, 1 Down):
  Destination-list: dl-53
  Attribute-set: Not configured
  Destination: 40.40.40.40, tunnel-id: 10000, State: Up
  Destination: 10.10.10.10, tunnel-id: 10001, State: Down


Cumulative Counters (last cleared 7h ago):
                    Total
  Created:            100
  Connected:           50
  Removed (unused):    50
```

```
  Removed (in use):     0
  Range exceeded:       0
```

This is sample output from the **show mpls traffic-eng auto-tunnel private** command:

```
Auto-tunnel Mesh Private Information:
  ID allocator overall maximum ID: 4096
  ID allocator last allocated ID: 50999
  ID allocator number IDs allocated: 1000
```

show mpls traffic-eng auto-tunnel mesh

To display information about automatically built MPLS-TE mesh tunnels, use the **show mpls traffic-eng auto-tunnel mesh** command in XR EXEC mode.

show mpls traffic-eng auto-tunnel mesh {*mesh-value* | **unused** | **summary** | **attribute-set** *name* | **destination** *address* | **destination-list** *name* | **down** | **up** | **tunnel** {**created** | **not-created**} | **onehop**}

Syntax Description

mesh *mesh-value*	Displays the tunnels that belong to the specified auto-tunnel mesh group. The range of mesh group ID is from 0 to 4294967295.
attribute-set *name*	Displays mesh-groups configured with a specific attribute set.
destination *address*	Displays only the destinations with a specified address.
destination-list *name*	Displays mesh-groups configured with a specified prefix-list.
down	Displays only those tunnels that are down.
up	Displays only those tunnels that are up.
summary	Displays auto-tunnel mesh summary information.
unused	Displays only the down tunnels with no destination in the topology.
tunnel created | not-created	Specifies either created destinations with tunnels, or not-created destinations without tunnels.
onehop	Displays onehop enabled mesh groups.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
MPLS-TE	read

This is sample output from the **show mpls traffic-eng auto-tunnel mesh** command:

```
RP/0/RP0/CPU0:router show mpls traffic-eng auto-tunnel mesh

Auto-tunnel Mesh Global Configuration:
  Unused removal timeout: 1h 0m 0s
```

```
  Configured tunnel number range: 1000-1200

Auto-tunnel Mesh Groups Summary:
  Mesh Groups count: 1
  Mesh Groups Destinations count: 3
  Mesh Groups Tunnels count:
    3 created, 0 up, 3 down, 0 FRR enabled

Mesh Group: 65 (3 Destinations)
  Status: Enabled
  Attribute-set: am-65
  Destination-list: dl-65 (Not a prefix-list)
  Recreate timer: Not running
       Destination    Tunnel ID    State  Unused timer
  ----------------  -----------  -------  ------------
       192.168.0.2         1000     up   Not running
       192.168.0.3         1001     up   Not running
       192.168.0.4         1002     up   Not running
  Displayed 3 tunnels, 0 up, 3 down, 0 FRR enabled

Auto-mesh Cumulative Counters:
  Last cleared: Wed Nov  9 12:56:37 2011 (02:39:07 ago)
                      Total
  Created:                3
  Connected:              0
  Removed (unused):       0
  Removed (in use):       0
  Range exceeded:         0
```

This shows how to configure the **auto-tunnel mesh** command with **destination-list** and **attribute-set** keywords:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# auto-tunnel mesh
RP/0/RP0/CPU0:router(config-te-auto-mesh)# group 65
RP/0/RP0/CPU0:router(config-te-mesh-group)# disable
RP/0/RP0/CPU0:router(config-te-mesh-group)# destination-list dl-65
RP/0/RP0/CPU0:router(config-te-mesh-group)# attribute-set am-65
```

Note This **attribute-set** is an optional configuration. Without this configuration, all tunnels use default tunnel attribute values. If you configure an non-existent attribute-set, this mesh group does not create any tunnel.

Note This **destination-list** configuration is mandatory. If there is no IPv4 prefix-list by th router, this mesh group create tunnels with all routers in the network.

This sample output displays information about one-hop tunnels:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng auto-tunnel mesh onehop

Auto-tunnel Mesh Onehop Groups Summary:
  Mesh Groups count: 1
  Mesh Groups Destinations count: 2
  Mesh Groups Tunnels count:
    2 created, 2 up, 0 down, 0 FRR enabled

Mesh Group: 25 (2 Destinations) Onehop
  Status: Enabled
  Attribute-set: Not configured
  Destination-list: dest_list (Not a prefix-list)
  Recreate timer: Not running
       Destination    Tunnel ID    State  Unused timer
  ----------------  -----------  -------  ------------
       10.10.10.2         3500       up   Not running
       11.11.11.2         3501       up   Not running
  Displayed 2 tunnels, 2 up, 0 down, 0 FRR enabled

Auto-mesh Onehop Cumulative Counters:
  Last cleared: Thu Sep 12 13:39:38 2013 (03:47:21 ago)
                       Total
  Created:                 2
  Connected:               2
  Removed (unused):        0
  Removed (in use):        0
  Range exceeded:          0
```

show mpls traffic-eng chunks

To display the usage of memory chunks for MPLS-TE tunnels, use the **show mpls traffic-eng chunks** command in XR EXEC mode.

show mpls traffic-eng chunks **standby**

Syntax Description

detail	Displays detailed information about the memory usage by MPLS-TE tunnels.
standby	Displays memory information for the standby node.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 25.4.1	The output includes the memory usage information by MPLS-TE event history.
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

This example displays the memory utilized using the **show mpls traffic-eng chunks** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng chunks

  Tue Dec  9 06:30:40.055 UTC
Pool name            InUse     Free      Allocs    Deallocs  Sib creat Sib trimm
-------------------- --------- --------- --------- --------- --------- ---------
mpls wavl Chunks             0     32000         0         0         0         0
mpls wavl Chunks            28      7972        28         0         0         0
mpls wavl Chunks           101      3899       101         0         0         0
mpls wavl Chunks            59      1941        59         0         0         0
mpls wavl Chunks            27       973        27         0         0         0
mpls wavl Chunks             9       491         9         0         0         0
mpls wavl Chunks             0       240         0         0         0         0
mpls wavl Chunks             0       120         0         0         0         0
TE S2L chunk                 0       200         0         0         0         0
TE S2L stats chunk           0      1024         0         0         0         0
TE LSP chunk                 0       200         0         0         0         0
TE collab chunk             15        25        15         0         0         0
TE FSM Q chunk               0       128         0         0         0         0
```

```
TE NextHop Route Po          0       128         0         0         0         0
TE Binding Sid Cont          0       128         0         0         0         0
TE CHKPT Q Elements          0       600        10        10         0         0
RSVP CHKPT LIST Chu          0      8192         0         0         0         0
TE Tunnel Service R          0       128         0         0         0         0
TE Tunnel Service R          0       128         0         0         0         0
RSVP API CTX                 0       156         0         0         0         0
RSVP API CTX stats           0        48         0         0         0         0
RSVP API CTX event           0      1248         0         0         0         0
RSVP API CTX event           0      1248         0         0         0         0
RSVP API CTX Histor          0      1248         0         0         0         0
TE S2L RW chunk              0       124         0         0         0         0
TE S2L RW chunk              0       128         0         0         0         0
TE Event History             0       200         0         0         0         0
VIF Pulse Context c          0      1024       668       668         0         0
```

show mpls traffic-eng collaborator-timers

To display the current status of the MPLS-TE collaborator timers, use the **show mpls traffic-eng collaborator-timers** command in XR EXEC mode.

show mpls traffic-eng collaborator-timers

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The MPLS-TE process maintains the timers for all of the collaborators such as RSVP, LSD, and so forth. The **show mpls traffic-eng collaborator-timers** command shows the status of these timers.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following sample output shows the current status of the collaborator timers:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng collaborator-timers

Collaborator Timers
-------------------
Timer Name: [LMRIB Restart] Index:[0]
    Duration: [60] Is running: NO
    Last start time:  02/09/2009 11:57:59
    Last stop time:   02/09/2009 11:58:00
    Last expiry time: Never expired
Timer Name: [LMRIB Recovery] Index:[1]
    Duration: [60] Is running: YES
    Last start time:  02/09/2009 11:58:00
    Last stop time:   Never Stopped
    Last expiry time: 19/08/2009 17:45:24
Timer Name: [RSVP Restart] Index:[2]
    Duration: [180] Is running: NO
    Last start time:  26/08/2009 18:59:18
    Last stop time:   26/08/2009 18:59:20
    Last expiry time: Never expired
Timer Name: [RSVP Recovery] Index:[3]
    Duration: [1800] Is running: NO
    Last start time:  26/08/2009 18:59:20
    Last stop time:   26/08/2009 19:03:19
    Last expiry time: 19/08/2009 18:12:39
```

```
Timer Name: [LSD Restart] Index:[4]
    Duration: [60] Is running: NO
    Last start time:  19/08/2009 17:44:26
    Last stop time:   19/08/2009 17:44:26
    Last expiry time: Never expired
Timer Name: [LSD Recovery] Index:[5]
    Duration: [600] Is running: NO
    Last start time:  19/08/2009 17:44:26
    Last stop time:   Never Stopped
    Last expiry time: 19/08/2009 17:53:44
Timer Name: [Clearing in progress BW for the whole topology] Index:[6]
    Duration: [60] Is running: YES
    Last start time:  02/09/2009 11:57:50
    Last stop time:   Never Stopped
    Last expiry time: 02/09/2009 11:57:50
```

This table describes the significant fields shown in the display.

Table 31: show mpls traffic-eng collaborator-timers Command Field Descriptions

Field	Description
Timer Name	Timer name that is associated to a collaborator.
Index	Identification number of the timer.
Duration	Expiry delay of the timer, in seconds. For example, the duration indicates the timer interval.
Is running	Timer is running low or not.
Last start time	Last time that the collaborator process for MPLS LSD was restarted.
Last stop time	Time TE was able to reconnect to the MPLS LSD process.
Last expiry time	Time that timer expired.

show mpls traffic-eng counters global

To display global statistics for MPLS-TE tunnels, use the **show mpls traffic-eng counters global** command in XR EXEC mode.

show mpls traffic-eng counters global standby

Syntax Description		
	standby	Displays information about standby node.

Command Default None

Command Modes XR EXEC mode

Command History

Release	Modification
Release 25.4.1	The output includes the event history information.
Release 7.0.12	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples This example displays the output using the **show mpls traffic-eng counters global** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng counters global

Tue Dec  9 05:28:18.911 UTC
Global Statistics:
  Number of VIF                           : 0
  Number of LSP                           : 0
  Number of S2L                           : 0
  Checkpoint request queue high watermark    : 1
  Checkpoint response queue high watermark   : 1
  Checkpoint reschedules                  : 7
  Checkpoint enqueues (request queue)        : 5
  Checkpoint dequeues (request queue)        : 5
  Checkpoint enqueues (response queue)       : 5
  Checkpoint dequeues (response queue)       : 5
  Checkpoint write (VIF)                  : 0
  Checkpoint read (VIF)                   : 0
  Checkpoint write (DST)                  : 0
  Checkpoint read (DST)                   : 0
  Checkpoint write (S2L)                  : 0
  Checkpoint read (S2L)                   : 0
  Checkpoint write (Autobackup)           : 0
  Checkpoint read (Autobackup)            : 0
```

```
Checkpoint write (PI backup)              : 0
Checkpoint read (PI backup)               : 0
Number of RSVP connection                 : 0
Number of RSVP disconnection              : 0
Number of RSVP restart time change        : 0
Number of LSD connection                  : 1
Number of LSD disconnection               : 0
Number of LSD replay                      : 1
Number of LMRIB connection                : 1
Number of LMRIB disconnection             : 0
Number of LMRIB restart time change       : 1
Number of LMRIB restart failed            : 0
Number of LMRIB restart passed            : 1
Number of LMRIB recovery failed           : 0
Number of LMRIB recovery passed           : 1
Number of RSI connection                  : 1
Number of RSI disconnection               : 0
Event-history size (bytes)
 Tunnels (excluding chunks)               : 16444912
```

show mpls traffic-eng counters signaling

To display tunnel signaling statistics, use the **show mpls traffic-eng counters signaling** command in XR EXEC mode.

show mpls traffic-eng counters {**signaling** | **soft-preemption**} {*tunnel -number* | **all** | [**heads** | **mids** | **tails**] | **name** *tunnel-name* | **summary**}

Syntax Description

signaling	Displays signaling counters.
soft-preemption	Displays the statistics for the soft-preemption.
tunnel-number	Statistics for the input tunnel number. The range is from 0 to 65535.
all	Displays statistics for all tunnels.
heads	(Optional) Displays statistics for all tunnel heads.
mids	(Optional) Displays statistics for all tunnel midpoints.
tails	(Optional) Displays statistics for all tunnel tails.
name	Displays statistics for a specified tunnel.
tunnel-name	Name of the specified tunnel.
summary	Displays a summary of signaling statistics.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

This is a sample output from the **show mpls traffic-eng counters signaling** command, using the **all** keyword, which displays tunnel signaling statistics for all tunnels:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng counters signaling all


  Tunnel Head: tunnel-te100
  Cumulative Tunnel Counters:
    Signalling Events      Recv     Xmit                          Recv     Xmit
       PathCreate             1        1      ResvCreate             1        0
       PathChange             0        0      ResvChange             0        0
       PathError              0        0      ResvError              0        0
       PathTear               0       18      ResvTear               0        0
       BackupAssign           0        1      BackupError            0        0
       PathQuery              0        0      Unknown                0        0

    Destination 100.0.0.4
    Cumulative counters
      Signalling Events      Recv     Xmit                          Recv     Xmit
         PathCreate             1        1      ResvCreate             1        0
         PathChange             0        0      ResvChange             0        0
         PathError              0        0      ResvError              0        0
         PathTear               0       18      ResvTear               0        0
         BackupAssign           0        1      BackupError            0        0
         PathQuery              0        0      Unknown                0        0
      S2L LSP ID: 2 Sub-Grp ID: 0 Destination: 100.0.0.4
        Signalling Events      Recv     Xmit                          Recv     Xmit
           PathCreate             1        1      ResvCreate             1        0
           PathChange             0        0      ResvChange             0        0
           PathError              0        0      ResvError              0        0
           PathTear               0        0      ResvTear               0        0
           BackupAssign           0        1      BackupError            0        0
           PathQuery              0        0      Unknown                0        0

  Signaling Counter Summary:
    Signalling Events      Recv     Xmit                          Recv     Xmit
       PathCreate            11        7      ResvCreate            11        4
       PathChange             0        0      ResvChange             0        0
       PathError              0        0      ResvError              0        0
       PathTear               0       38      ResvTear               0        0
       BackupAssign           0        3      BackupError            0        0
       PathQuery              0        0      Unknown                0        0
```

This is a sample output from the **show mpls traffic-eng counters signaling** command using the *tunnel number* argument, which displays statistics for the input tunnel number:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng counters signaling 200

Tunnel Head: tunnel-te200
Cumulative Tunnel Counters:
  Signalling Events  Recv     Xmit                      Recv     Xmit
     PathCreate        4        4      ResvCreate        4        0
     PathChange        0        0      ResvChange        0        0
     PathError         0        0      ResvError         0        0
```

```
    PathTear          0       1      ResvTear          0       0
    BackupAssign      0       4      BackupError       0       0
    PathQuery         0       0      Unknown           0       0

Destination 192.168.0.1
Cumulative counters
  Signalling Events Recv     Xmit                    Recv    Xmit
     PathCreate      4        4      ResvCreate       4       0
     PathChange      0        0      ResvChange       0       0
     PathError       0        0      ResvError        0       0
     PathTear        0        1      ResvTear         0       0
     BackupAssign    0        4      BackupError      0       0
     PathQuery       0        0      Unknown          0       0
S2L LSP ID: 3 Sub-Grp ID: 0 Destination: 192.168.0.1
  Signalling Events Recv     Xmit                    Recv    Xmit
     PathCreate       3       3      ResvCreate       3       0
     PathChange       0       0      ResvChange       0       0
     PathError        0       0      ResvError        0       0
     PathTear         0       0      ResvTear         0       0
     BackupAssign     0       3      BackupError      0       0
     PathQuery        0       0      Unknown          0       0
```

This table describes the significant fields shown in the display.

Table 32: show mpls traffic-eng counters signaling Command Field Descriptions

Field	Description
Tunnel Head	Tunnel head identifier.
Match Resv Create	Number of RSVP Reservation create messages received.
Sender Create	Number of Sender Create messages sent by TE to RSVP.
Path Error	Number of RSVP Path Error messages received.
Match Resv Change	Number of RSVP Reservation change messages received.
Sender Modify	Number of Sender Modify messages sent by TE to RSVP.
Path Change	Number of RSVP Path Change messages received.
Match Resv Delete	Number of RSVP Reservation delete messages received.
Sender Delete	Number of Sender Delete messages sent by TE to RSVP.
Path Delete	Number of RSVP Path Delete messages received.
Total	Total signaling messages received from RSVP.
Unknown	Unknown messages include fast reroute events and internal messages related to process restart.

This is sample output from the **show mpls traffic-eng counters soft-preemption** command, which displays statistics for the soft preempted LSPs:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng counters soft-preemption
```

```
Soft Preemption Global Counters:
 Last Cleared: Never
 Preemption Node Stats:
   Number of soft preemption events: 1
   Number of soft preempted LSPs: 1
   Number of soft preempted LSPs that timed out: 0
   Number of soft preempted LSPs that were torn down: 0
   Number of soft preempted LSPs that were fast rerouted: 0
   Minimum Time in Soft Preemption Pending State (sec): 0
   Maximum Time in Soft Preemption Pending State (sec): 0
   Average Time in Soft Preemption Pending State (sec): 0
 Headend Stats:
   Number of soft preempted LSPs: 1
   Number of reoptimized soft preempted headend-LSPs: 0
   Number of path protected switchover soft preempted headend-LSPs: 0
   Number of torn down soft preempted headend-LSPs: 0
```

This is sample output from the **show mpls traffic-eng counters signaling all** command that displays the *Signalled-Name* information:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng counters signaling all
Tunnel Head: tunnel-te1
Signalled-Name: rtrA_t1
Cumulative Tunnel Counters:
  Signalling Events      Recv     Xmit  Signalling Events      Recv     Xmit
     PathCreate             2        2     ResvCreate             2        0
```

show mpls traffic-eng ds-te te-class

To display the Diff-Serv TE-class map in use, use the **show mpls traffic-eng ds-te te-class** command in XR EXEC mode.

show show mpls traffic-eng ds-te te-class

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

TE-class is used only in IETF DS-TE mode.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following shows a sample output from the **show mpls traffic-eng ds-te te-class** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng ds-te te-class

  te-class 0: class-type 0 priority 7 status default
  te-class 1: class-type 1 priority 7 status default
  te-class 2: unused
  te-class 3: unused
  te-class 4: class-type 0 priority 0 status default
  te-class 5: class-type 1 priority 0 status default
  te-class 6: unused
  te-class 7: unused
```

This table describes the significant fields shown in the display.

Table 33: show mpls traffic-eng ds-te te-class Command Field Descriptions

Field	Description
te-class	TE-class map, pair of class-type, and priority.
class-type	class-type of the tunnel.
status	Source of the TE-class map, either default or user configured.

show mpls traffic-eng event-history tunnels

To display the event history for MPLS-TE tunnels, use the **show mpls traffic-eng event-history tunnels** command in XR EXEC mode.

show mpls traffic-eng event-history tunnels { **all** | **name** *tunnel-name* }

Syntax Description

all	Displays the event history for all MPLS-TE headend tunnels.
name*tunnel-name*	Displays the event history for the specified MPLS-TE headend tunnel.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 25.4.1	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute

Examples

This example displays the event history for all MPLS-TE headend tunnels:

```
Router# show mpls traffic-eng event-history tunnel all
Wed Dec 3 14:08:59.529 UTC

Name: tunnel-te1
Event history (oldest first):
ID                  Time               LSP  Event-Type  Rep  Event-Message
01764770758196406124 Dec 3 14:06:05.309   2  Path          0  BW:300 kbps ERO: 10.1.3.103
10.3.5.105 10.5.6.106 20.1.0.106
01764770758196406128 Dec 3 14:06:05.346   2  Path Err      0  (24,0), Error: routing (24),
 Suberror: none (0), error-node: 10.1.3.103
01764770758196406129 Dec 3 14:06:05.346   2  Path Tear     0
01764770758196406131 Dec 3 14:06:08.349   3  Path          0   BW:300 kbps ERO: 10.1.3.103
 10.3.5.105 10.5.6.106 20.1.0.106
01764770758196406132 Dec 3 14:06:08.449   3  Resv          0   BW:300 kbps RRO:
01764770758196406134 Dec 3 14:06:08.449   3  Oper State    0   New tunnel state: UP

Name: T10
Event history (oldest first):
ID                  Time               LSP  Event-Type  Rep  Event-Message
01764770758196406125 Dec 3 14:06:05.309   2  Path          0  BW:300 kbps ERO: 10.1.2.102
10.2.4.104 10.4.6.106 20.1.0.106
01764770758196406126 Dec 3 14:06:05.346   2  Path Err      0  (24,0), Error: routing (24),
 Suberror: none (0), error-node: 10.1.2.102
01764770758196406127 Dec 3 14:06:05.346   2  Path Tear     0
```

```
01764770758196406130 Dec 3 14:06:08.346   3  Path          0  BW:300 kbps ERO: 10.1.2.102
10.2.4.104 10.4.6.106 20.1.0.106
01764770758196406133 Dec 3 14:06:08.449   3  Resv          0  BW:300 kbps RRO:
01764770758196406135 Dec 3 14:06:08.496   3  Oper State    0  New tunnel state: UP

Name: SELFPING-101
 Event history (oldest first):
 ID                   Time                  LSP  Event-Type  Rep  Event-Message
 01769076278173248001  Jan 22 05:30:13.487    2  Path         0  BW:0 kbps ERO: 10.10.10.2
 17.17.17.2 17.17.17.3 22.22.22.3 22.22.22.4 192.168.0.4
 01769076278173248002  Jan 22 05:30:13.546    2  Resv         0  BW:0 kbps RRO:
 01769076278173248003  Jan 22 05:30:23.551    2  Self-Ping    0  Timed-out (started at
Jan 22 05:01:30.769)
 01769076278173248004  Jan 22 05:30:23.554    2  Oper State   0  New tunnel state: UP

Name: SELFPING-103
 Event history (oldest first):
 ID                   Time                  LSP  Event-Type  Rep  Event-Message
 01769076278173248011  Jan 22 05:31:54.518    2  Path         0  BW:0 kbps ERO: 10.10.10.2
 17.17.17.2 17.17.17.3 22.22.22.3 22.22.22.4 192.168.0.4
 01769076278173248012  Jan 22 05:31:54.581    2  Resv         0  BW:0 kbps RRO:
 01769076278173248013  Jan 22 05:32:02.917    2  Self-Ping    0  Aborted (started at Jan
 22 05:01:30.769)
 01769076278173248014  Jan 22 05:32:02.925    2  Path Tear    0
 01769076278173248015  Jan 22 05:32:02.936    3  Path         0  BW:0 kbps ERO: 11.11.11.2
 17.17.17.2 17.17.17.3 22.22.22.3 22.22.22.4 192.168.0.4
 01769076278173248016  Jan 22 05:32:02.987    3  Resv         0  BW:0 kbps RRO:
 01769076278173248017  Jan 22 05:32:06.994    3  Self-Ping    0  Succeeded (started at
Jan 22 05:01:30.769)
 01769076278173248018  Jan 22 05:32:06.995    3  Oper State   0  New tunnel state: UP
```

This example displays the event history for the specified MPLS-TE headend tunnel:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng event-history tunnels name tunnel-T10

Thu Dec 18 07:30:57.167 UTC
Name: tunnel-T10
 Event history (oldest first):
 ID                   Time                  LSP  Event-Type  Rep  Event-Message
 01765952238563713933  Jan 1 07:15:28.220    5  Path Tear    0
 01765952238563713934  Jan 1 07:15:32.660    8  Path         0  BW:300 kbps ERO: 10.1.2.102
 10.2.4.104
 01765952238563713935  Jan 1 07:15:32.763    8  Resv         0  BW:300 kbps RRO:
 01765952238563713936  Jan 1 07:15:32.803    6  Path Tear    0
 01765952238563713937  Jan 1 07:15:37.387    9  Path         0  BW:300 kbps ERO: 10.1.2.102
 10.2.4.104
 01765952238563713938  Jan 1 07:15:37.480    9  Resv         0  BW:300 kbps RRO:
 01765952238563713939  Jan 1 07:15:37.517    7  Path Tear    0
 01765952238563713940  Jan 1 07:15:47.193   10  Path         0  BW:300 kbps ERO: 10.1.2.102
 10.2.4.104
 01765952238563713941  Jan 1 07:15:47.283   10  Resv         0  BW:300 kbps RRO:
 01765952238563713942  Jan 1 07:15:47.320    8  Path Tear    0
 01765952238563713943  Jan 1 07:16:07.420    9  Path Tear    0
 01765952238563713944  Jan 1 07:16:15.573   11  Path         0  BW:300 kbps ERO: 10.1.2.102
 10.2.4.104
 01765952238563713945  Jan 1 07:16:15.670   11  Resv         0  BW:300 kbps RRO:
 01765952238563713946  Jan 1 12:23:05.711   10  Self-Ping    0  Succeeded (started at Jan
  1 12:23:05.709)
 01765952238563713947  Jan 1 07:16:35.810   10  Path Tear    0
 01765952238563713948  Jan 1 07:22:49.863   12  Path         0  BW:300 kbps ERO: 10.1.2.102
 10.2.4.104
 01765952238563713949  Jan 1 07:22:49.963   12  Resv         0  BW:300 kbps RRO:
 01765952238563713950  Jan 1 07:23:10.103   11  Path Tear    0
 01765952238563713951  Jan 1 07:23:49.240   13  Path         0  BW:300 kbps ERO: 10.1.2.102
```

```
10.2.4.104
01765952238563713952  Jan 1 07:23:49.340    13  Resv          0  BW:300 kbps RRO:
01765952238563713953  Jan 1 07:24:09.480    12  Path Tear     0
01765952238563713954  Jan 1 12:45:45.473    11  Self-Ping     0  Succeeded (started at Jan
 1 12:45:45.472)
```

show mpls traffic-eng forwarding

To display forwarding information on tunnels that were admitted locally, use the **show mpls traffic-eng forwarding** command in XR EXEC mode.

show mpls traffic-eng forwarding [**backup-name** *tunnel-name*] [**source** *source-address*][**tunnel-id** *tunnel-id*] [**interface** {**in** | **inout** | **out**} *type interface-path-id*][**p2p**] {**p2p**} [**detail**]

Syntax Description

backup-name *tunnel-name*	(Optional) Restricts tunnels with this backup tunnel name.
source *source-address*	(Optional) Restricts tunnels for this specified tunnel source IPv4 address.
tunnel-id *tunnel-id*	(Optional) Restricts tunnels for this tunnel identifier. Range for the *tunnel-id* argument is from 0 to 65535.
interface	(Optional) Displays information on the specified interface.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
in	Displays information for the input interface.
inout	Displays information for either the input or output interface.
out	Displays information for the output interface.
p2p	(Optional) Displays only Point-to-Point (P2P) information.
detail	(Optional) Displays detailed forwarding information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng forwarding** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng forwarding

Tue Sep 15 14:22:39.609 UTC P2P tunnels

Tunnel ID              Ingress IF                    Egress IF             In lbl   Out lbl
  Backup tunnel
---------------------- ------------                  ------------          -------- --------
 -------------
172.16.0.1 2_2           HundredGigE0/0/0/3           HundredGigE0/0/0/4    16004    16020
    unknown
198.51.100.1 1_23          -                              HundredGigE0/0/0/3    16000    3
        tt1300
198.51.100.1 1100_9        -                              HundredGigE0/0/0/3    16002
16001    unknown
198.51.100.1 1200_9        -                              HundredGigE0/0/0/3    16001
16000    unknown
198.51.100.1 1300_2        -                              HundredGigE0/0/0/4    16005
16021    unknown
198.51.100.1 1400_9        -                              HundredGigE0/0/0/3    16003
16002    unknown
```

This table describes the significant fields shown in the display.

Table 34: show mpls traffic-eng forwarding Field Descriptions

Field	Description
TUNNEL ID	Tunnel identification.
Ingress IF	Ingress interface of the tunnel.
Egress IF	Egress interface of the tunnel.
In lbl	Incoming label associated with the tunnel.
Out lbl	Outgoing label associated with the tunnel.
Backup tunnel	Fast Reroute backup tunnel

show mpls traffic-eng forwarding-adjacency

To display forwarding-adjacency information for an IPv4 address, use the **show mpls traffic-eng forwarding-adjacency** command in XR EXEC mode.

show mpls traffic-eng forwarding-adjacency [*IP-address*]

Syntax Description

IP-address	(Optional) Destination IPv4 address for forwarding adjacency.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

This is a sample output from the **show mpls traffic-eng forwarding-adjacency** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng forwarding-adjacency

destination 192.168.0.1 has 1 tunnels
tunnel-te1    (traffic share 0, next-hop 192.168.0.1)
(Adjacency Announced: yes, holdtime 0)
```

This sample output displays information on IPv6 autoroute forwarding adjacency information for IS-IS IGP:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng forwarding-adjacency

 destination 192.168.0.1 has 1 tunnels

              tunnel-te10    (traffic share 0, next-hop 192.168.0.1)
                             (Adjacency Announced: yes, holdtime 0)
                             (IS-IS 100, IPv4 unicast)
                             (IS-IS 100, IPv6 unicast)
```

show mpls traffic-eng igp-areas

To display MPLS-TE internal area storage, use the **show mpls traffic-eng igp-areas** command in XR EXEC mode.

show mpls traffic-eng igp-areas [**detail**]

Syntax Description

detail	(Optional) Displays detailed information about the configured MPLS-TE igp-areas and communication statistics with IGPs.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng igp-areas** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng igp-areas

  MPLS-TE IGP Areas

  Global router-id:         10.144.144.144
  Global optical router-id: Not available

  IS-IS 100

      IGP ID:                      0000.0000.0044
      TE router ID configured:     10.144.144.144
                  in use:          10.144.144.144
      Link connection:             up
      Topology/tunnel connection:  up

      level 2
          TE index: 1
          IGP config for TE: complete
          Local links flooded in this IGP level: 1
          Flooding beacon sent and received
          P2P tunnel heads running over this IGP level: 1
              1 AA, 0 FA
```

```
        Tunnel loose-hops expanded over this IGP level: 0


  OSPF 100

      IGP ID:                      10.144.144.144
      TE router ID configured:     10.144.144.144
                  in use:          10.144.144.144
      Link connection:             up
      Topology/tunnel connection:  up

      area 0
          TE index: 0
          IGP config for TE: complete
          Local links flooded in this IGP area: 2
          Flooding beacon sent and received
          P2P tunnel heads running over this IGP area: 3
              1 AA, 0 FA
          Tunnel loose-hops expanded over this IGP area: 0
```

The following shows a sample output from the **show mpls traffic-eng igp-areas** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng igp-areas

  MPLS-TE IGP Areas
  Global router-id:         0.0.0.0
  Global optical router-id: Not available
  OSPF 0
      IGP ID:                      101.0.0.1
      TE router ID configured:     101.0.0.1
                  in use:          101.0.0.1
      Link connection:             up
      Topology/tunnel connection:  up
      area 4
          TE index: 0
          IGP config for TE: complete
          Number of links in this IGP area: 1
          Number of tunnel heads running over this IGP area: 0
          Number of tunnel loose-hops expanded over this IGP area: 0
      area 3
          TE index: 1
          IGP config for TE: complete
          Number of links in this IGP area: 1
          Number of tunnel heads running over this IGP area: 0
          Number of tunnel loose-hops expanded over this IGP area: 0
      area 2
          TE index: 2
          IGP config for TE: complete
          Number of links in this IGP area: 1
          Number of tunnel heads running over this IGP area: 0
          Number of tunnel loose-hops expanded over this IGP area: 0
      area 1
          TE index: 3
          IGP config for TE: complete
          Number of links in this IGP area: 1
          Number of tunnel heads running over this IGP area: 0
          Number of tunnel loose-hops expanded over this IGP area: 0
      area 0
          TE index: 4
          IGP config for TE: complete
          Number of links in this IGP area: 2
          Number of tunnel heads running over this IGP area: 1
          Number of tunnel loose-hops expanded over this IGP area: 0
```

This table describes the significant fields shown in the display.

Table 35: show mpls traffic-eng igp-areas Command Field Descriptions

Field	Description
Global router-id	Global router ID on this node.
IGP ID	IGP System ID.
area	IGP area.
TE index	Internal index in the IGP area table.
IGP config for TE	Whether the IGP configuration is complete or missing.

show mpls traffic-eng link-management admission-control

To display which tunnels were admitted locally and their parameters, use the **show mpls traffic-eng link-management admission-control** command in XR EXEC mode.

show mpls traffic-eng link-management admission-control [**interface** *type interface-path-id*]

Syntax Description

interface	(Optional) Displays information on the specified interface.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng link-management admission-control** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management admission-control

  S System Information:
        Tunnels Count     : 2
        Tunnels Selected  : 2
    Bandwidth descriptor legend:
      B0 = bw from pool 0, B1 = bw from pool 1, R = bw locked, H = bw held

  TUNNEL ID                UP IF      DOWN IF             PRI STATE         BW (kbits/sec)
```

```
  ---------------------- ---------- ----------          --- ------------- ---------------

  10.10.10.10 1_34         -          HundredGigE0/0/0/3  7/7 Resv Admitted 100         RB0

  10.10.10.10 15_2         -          HundredGigE0/0/0/3  7/7 Resv Admitted 0
B0
```

This table describes the significant fields shown in the display.

Table 36: show mpls traffic-eng link-management admission-control Command Field Descriptions

Field	Description
Tunnels Count	Total number of tunnels admitted.
Tunnels Selected	Number of tunnels displayed.
Bandwidth descriptor legend	BW pool type and status displayed with the tunnel entry. Shown as RG (Locked BW in global pool) in the preceding sample output.
TUNNEL ID	Tunnel identification.
UP IF	Upstream interface used by the tunnel.
DOWN IF	Downstream interface used by the tunnel.
PRI	Tunnel setup priority and hold priority.
STATE	Tunnel admission status.
BW (kbps)	Tunnel bandwidth in kilobits per second. If an R follows the bandwidth number, the bandwidth is reserved. If an H follows the bandwidth number, the bandwidth is temporarily being held for a Path message. If a G follows the bandwidth number, the bandwidth is from the global pool. If an S follows the bandwidth number the bandwidth is from the sub-pool.

The following shows a sample output from the **show mpls traffic-eng link-management interface** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management interface HundredGigE 0/0/0/3

    System Information::
        Links Count         : 1

    Link ID:: HundredGigE 0/0/0/3 (35.0.0.5)
      Local Intf ID: 7
      Link Status:

        Link Label Type          : PSC (inactive)
        Physical BW                : 155520 kbits/sec
        BCID                           : RDM
        Max Reservable BW    : 0 kbits/sec (reserved: 100% in, 100% out)
        BC0 (Res. Global BW): 0 kbits/sec (reserved: 100% in, 100% out)
        BC1 (Res. Sub BW)     : 0 kbits/sec (reserved: 100% in, 100% out)
        MPLS-TE Link State    : MPLS-TE on, RSVP on
        Inbound Admission      : allow-all
        Outbound Admission    : allow-if-room
```

```
IGP Neighbor Count      : 0
Max Res BW (RDM)    : 0 kbits/sec
BC0 (RDM)                   : 0 kbits/sec
BC1 (RDM)                   : 0 kbits/sec
Max Res BW (MAM)    : 0 kbits/sec
BC0 (MAM)                  : 0 kbits/sec
BC1 (MAM)                  : 0 kbits/sec
Admin Weight               : 1 (OSPF), 10 (ISIS)
Attributes                     : 0x5 (name-based)
Flooding Status: (1 area)
  IGP Area[1]: ospf 100 area 0, not flooded
              (Reason: Interface has been administratively disabled)
```

This table describes the significant fields shown in the display.

Table 37: show mpls traffic-eng link-management interface Command Field Descriptions

Field	Description
Links Count	Number of links configured for MPLS-TE.
Link ID	Index of the link described.
Local Intf ID	Local interface ID.
Link Label Type	Label type of the link, for instance: PSC[11], TDM[12], FSC[13].
Physical BW	Link bandwidth capacity (in kilobits per second).
BCID	Bandwidth constraint model ID (RDM or MAM).
Max Reservable BW	Maximum reservable bandwidth on this link.
BC0 (Res. Global BW)	Bandwidth constraint value for class-type 0.
BC1 (Res. Sub BW)	Bandwidth constraint value for class-type 1.
MPLS-TE Link State	Status of the link MPLS-TE-related functions.
Inbound Admission	Link admission policy for incoming tunnels.
Outbound Admission	Link admission policy for outgoing tunnels.
IGP Neighbor Count	IGP neighbors directly reachable over this link.
Max Res BW (RDM)	Maximum reservable bandwidth on this link for RDM.
BC0 (RDM)	Bandwidth constraint value for RDM.
BC1 (RDM)	Bandwidth constraint value for RDM.
Admin Weight	Administrative weight associated with this link.
Attributes	Interface attributes referring to one or more affinity names.
IGP Area[1]	IGP type and area and level used for TE flooding.

[11] PSC = Packet switch capable.

[12] TDM = Time-division multiplexing.
[13] FSC = Fiber switch capable.

show mpls traffic-eng link-management advertisements

To display local link information that MPLS-TE link management is currently flooding into the global TE topology, use the **show mpls traffic-eng link-management advertisements** command in XR EXEC mode.

show mpls traffic-eng link-management advertisements

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls traffic-eng link-management advertisements** command has two output formats depending on the Diff-Serv TE Mode: one for prestandard mode and one for IETF mode.

The SRLG values are advertised for the link.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng link-management advertisements** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management advertisements

Link ID:: 0 (GigabitEthernet0/2/0/1)
          Link IP Address      : 12.9.0.1
          O/G Intf ID          : 28
          Designated Router    : 12.9.0.2
          TE Metric            : 1
          IGP Metric           : 1
          Physical BW          : 1000000 kbits/sec
          BCID                 : RDM
          Max Reservable BW    : 10000 kbits/sec
          Res Global BW        : 10000 kbits/sec
          Res Sub BW           : 0 kbits/sec
          SRLGs                : 10, 20

          Downstream::
                               Global Pool   Sub Pool
                               -----------   -----------
            Reservable BW[0]:         10000             0  kbits/sec
            Reservable BW[1]:         10000             0  kbits/sec
            Reservable BW[2]:          9800             0  kbits/sec
```

```
    Reservable BW[3]:          9800             0  kbits/sec
    Reservable BW[4]:          9800             0  kbits/sec
    Reservable BW[5]:          9800             0  kbits/sec
    Reservable BW[6]:          9800             0  kbits/sec
    Reservable BW[7]:          9800             0  kbits/sec

  Attribute Flags: 0x00000004
  Attribute Names: red2

Link ID:: 1 (GigabitEthernet0/2/0/2)
    Link IP Address      : 14.9.0.1
    O/G Intf ID          : 29
    Designated Router    : 14.9.0.4
    TE Metric            : 1
    IGP Metric           : 1
    Physical BW          : 1000000 kbits/sec
    BCID                 : RDM
    Max Reservable BW    : 750000 kbits/sec
    Res Global BW        : 750000 kbits/sec
    Res Sub BW           : 0 kbits/sec

    Downstream::
                          Global Pool   Sub Pool
                          -----------   -----------
      Reservable BW[0]:        750000             0  kbits/sec
      Reservable BW[1]:        750000             0  kbits/sec
      Reservable BW[2]:        750000             0  kbits/sec
      Reservable BW[3]:        750000             0  kbits/sec
      Reservable BW[4]:        750000             0  kbits/sec
      Reservable BW[5]:        750000             0  kbits/sec
      Reservable BW[6]:        750000             0  kbits/sec
      Reservable BW[7]:        750000             0  kbits/sec

    Attribute Flags: 0x00000000
    Attribute Names:
```

This table describes the significant fields shown in the display.

Table 38: show mpls traffic-eng link-management advertisements Command Field Descriptions

Field	Description
Link ID	Index of the link described.
Link IP Address	Local IP address of the link.
TE Metric	Metric value for the TE link configured under MPLS-TE.
IGP Metric	Metric value for the TE link configured under IGP.
Physical BW	Link bandwidth capacity (in kilobits per second).
BCID	Bandwidth constraint model ID (RDM or MAM).
Max Reservable BW	Maximum reservable bandwidth on this link.
Res Global BW	Maximum reservable of global pool/BC0 bandwidth on this link.
Res Sub BW	Reservable sub-bandwidth for sub-pool /BC1 bandwidth on this link.

Field	Description
SRLGs[14]	Links that share a common fiber or a common physical attribute. If one link fails, other links in the group may also fail. Links in the group have a shared risk.
Downstream	Direction of the LSP path message.
Reservable BW[x]	Bandwidth available for reservations in the global TE topology and subpools.
Attribute Flags	Link attribute flags being flooded.
Attribute Names	Name of the affinity attribute of a link.
BC0	Bandwidth constraint value for class-type 0
BC1	Bandwidth constraint value for class-type 1
TE-class [index]	TE-class configured on this router at given index (mapping of class-type and priority), shows available bandwidth in that class.

[14] SRLGs = Shared Risk Link Groups.

show mpls traffic-eng link-management bandwidth-allocation

To display current local link information, use the **show mpls traffic-eng link-management bandwidth-allocation** command in XR EXEC mode.

show mpls traffic-eng link-management bandwidth-allocation [**interface** *type* *interface-path-id*]

Syntax Description

interface	(Optional) Displays information on the specified interface.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Advertised and current information may differ depending on how flooding is configured.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng link-management bandwidth-allocation** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link bandwidth-allocation interface HundredGigE
 0/0/0/3

System Information::
        Links Count         : 4
        Bandwidth Hold time : 15 seconds

    Link ID: HundredGigE0/0/0/3 (7.2.2.1)
      Local Intf ID: 4
```

```
    Link Status:
      Link Label Type     : PSC
      Physical BW         : 155520 kbits/sec
      BCID                : MAM
      Max Reservable BW   : 1000 kbits/sec (reserved: 0% in, 0% out)
      BC0                 : 600 kbits/sec (reserved: 2% in, 2% out)
      BC1                 : 400 kbits/sec (reserved: 0% in, 0% out)
      MPLS-TE Link State  : MPLS-TE on, RSVP on, admin-up, flooded
      Inbound Admission   : allow-all
      Outbound Admission  : allow-if-room
      IGP Neighbor Count  : 2
      BW Descriptors      : 1 (including 0 BC1 descriptors)
      Admin Weight        : 1 (OSPF), 10 (ISIS)
Up Thresholds       : 15 30 45 60 75 80 85 90 95 96 97 98 99 100 (default)
Down Thresholds     : 100 99 98 97 96 95 90 85 80 75 60 45 30 15 (default)

      Bandwidth Information::

        Downstream BC0 (kbits/sec):

        KEEP PRIORITY BW HELD    BW TOTAL HELD BW LOCKED  BW TOTAL LOCKED
        ------------- ---------- ------------- ---------- ---------------
                    0          0             0          0               0
                    1          0             0          0               0
                    2          0             0          0               0
                    3          0             0          0               0
                    4          0             0          0               0
                    5          0             0          0               0
                    6          0             0          0               0
                    7          0             0         10              10

        Downstream BC1 (kbits/sec):

        KEEP PRIORITY BW HELD    BW TOTAL HELD BW LOCKED  BW TOTAL LOCKED
        ------------- ---------- ------------- ---------- ---------------
                    0          0             0          0               0
                    1          0             0          0               0
                    2          0             0          0               0
                    3          0             0          0               0
                    4          0             0          0               0
                    5          0             0          0               0
                    6          0             0          0               0
```

This table describes the significant fields shown in the display.

Table 39: show mpls traffic-eng link-management bandwidth-allocation Command Field Descriptions

Field	Description
Links Count	Number of links configured for MPLS-TE.
Bandwidth Hold Time	Time, in seconds, that bandwidth can be held.
Link ID	Interface name and IP address of the link.
Link Label type	Label type of the link, for example: • PSC[15] • TDM[16] • FSC[17]

Field	Description
Physical BW	Link bandwidth capacity (in bits per second).
BCID	Bandwidth constraint model ID (RDM or MAM).
Max Reservable BW	Maximum reservable bandwidth on this link.
BC0	Maximum RSVP bandwidth in BC0.
BC1	Maximum RSVP bandwidth in BC1.
BW Descriptors	Number of bandwidth allocations on this link.
MPLS-TE Link State	Status of the link MPLS-TE-related functions.
Inbound Admission	Link admission policy for incoming tunnels.
Outbound Admission	Link admission policy for outgoing tunnels.
IGP Neighbor Count	IGP neighbors directly reachable over this link.
BW Descriptors	Internal bandwidth descriptors created when tunnels are admitted.
Admin Weight	Administrative weight associated with this link.
Up Thresholds	Threshold values used to determine link advertisement when available bandwidth increases.
Down Thresholds	Threshold values used to determine link advertisement when available bandwidth decreases.

[15] PSC = Packet switch capable.
[16] TDM = Time-division multiplexing.
[17] FSC = Fiber switch capable.

show mpls traffic-eng link-management igp-neighbors

To display Interior Gateway Protocol (IGP) neighbors, use the **show mpls traffic-eng link-management igp-neighbors** command in XR EXEC mode.

show mpls traffic-eng link-management igp-neighbors [**igp-id** {**isis** *isis-address* | **ospf** *ospf-id*} [**interface** *type interface-path-id IP-address*]]

Syntax Description

igp-id	(Optional) Displays the IGP neighbors that are using a specified IGP identification.
isis *isis-address*	Displays the specified Intermediate System-to-Intermediate System (IS-IS) neighbor system ID when neighbors are displayed by IGP ID.
ospf *ospf-id*	Displays the specified Open Shortest Path first (OSPF) neighbor OSPF router ID when neighbors are displayed by IGP ID.
interface	(Optional) Displays information on the specified interface.
type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
IP-address	(Optional) IGP neighbors that are using a specified IGP IP address.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng link-management igp-neighbors** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link igp-neighbors

    Link ID: HundredGigE0/0/0/3
      No Neighbors

    Link ID: HundredGigE0/0/0/4
      Neighbor ID: 10.90.90.90 (area: ospf   area 0, IP: 10.15.12.2)
```

This table describes the significant fields shown in the display.

Table 40: show mpls traffic-eng link-management igp-neighbors Command Field Descriptions

Field	Description
Link ID	Link by which the neighbor is reached.
Neighbor ID	IGP identification information for the neighbor.

show mpls traffic-eng link-management interfaces

To display interface resources, or a summary of link management information, use the **show mpls traffic-eng link-management interfaces** command in XR EXEC mode.

show mpls traffic-eng link-management interfaces [*type interface-path-id*]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You cannot configure more than 250 links under MPLS-TE.

SRLG values can be configured for the link.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following sample output is from the **show mpls traffic-eng link-management interfaces** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management interfaces HundredGigE 0/0/0/3

  System Information::
        Links Count         : 7 (Maximum Links Supported 250)

    Link ID:: HundredGigE0/0/0/3 (12.9.0.1)
      Local Intf ID: 28
      Link Status:

        Link Label Type     : PSC
```

```
Physical BW         : 1000000 kbits/sec
BCID                : RDM
Max Reservable BW   : 10000 kbits/sec (reserved: 2% in, 2% out)
BC0 (Res. Global BW): 10000 kbits/sec (reserved: 2% in, 2% out)
BC1 (Res. Sub BW)   : 0 kbits/sec (reserved: 100% in, 100% out)
MPLS TE Link State  : MPLS TE on, RSVP on, admin-up
Inbound Admission   : reject-huge
Outbound Admission  : allow-if-room
IGP Neighbor Count  : 1
Max Res BW (RDM)    : 10000 kbits/sec
BC0 (RDM)           : 10000 kbits/sec
BC1 (RDM)           : 0 kbits/sec
Max Res BW (MAM)    : 0 kbits/sec
BC0 (MAM)           : 0 kbits/sec
BC1 (MAM)           : 0 kbits/sec
Attributes          : 0x4
Attribute Names     : red2
Flooding Status: (1 area)
  IGP Area[1]: OSPF 100 area 0, flooded
    Nbr: ID 12.9.0.2, IP 0.0.0.0 (Up)
    Admin weight: not set (TE), 1 (IGP)
```

This table describes the significant fields shown in the display.

Table 41: show mpls traffic-eng link-management interfaces Command Field Descriptions

Field	Description
Links Count	Number of links configured for MPLS-TE. Maximum number of links supported is 100.
Link ID	Link identification index.
Link Label Type	Label type assigned to the link.
Physical Bandwidth	Link bandwidth capacity (in kilobits per second).
BCID	Bandwidth constraint model ID (RDM or MAM).
Max Reservable BW	Maximum reservable bandwidth on this link.
BC0	Reservable bandwidth (in kbps) on this link in BC0.
BC1	Reservable bandwidth (in kbps) on this link in BC1.
Attributes	TE link attribute in hexadecimal.
Attribute Names	Name of the affinity attribute of a link.
SRLGs[18].	Links that share a common fiber or a common physical attribute. If one link fails, other links in the group may also fail. Links in the group have a shared risk.
MPLS-TE Link State	Status of the MPLS link.
Inbound Admission	Link admission policy for inbound tunnels.
Outbound Admission	Link admission policy for outbound tunnels.

Field	Description
IGP Neighbor Count	IGP[19] neighbors directly reachable over this link.
Admin. Weight	Administrative weight associated with this link.
Flooding Status	Status for each configured area or Flooding status for the configured area.
IGP Area	IGP type and area and level used for TE flooding.

[18] SRLGs = Shared Risk Link Groups.
[19] IGP = Interior Gateway Protocol .

show mpls traffic-eng link-management statistics

To display interface resources or a summary of link management information, use the **show mpls traffic-eng link-management statistics** command in XR EXEC mode.

show mpls traffic-eng link-management statistics [**summary** | **interface** *type* *interface-path-id*]

Syntax Description

summary	(Optional) Displays the statistics summary.
interface	(Optional) Displays the interface for which information is requested.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show mpls traffic-eng link-management statistics** command displays resource and configuration information for all configured interfaces.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng link-management statistics** command using the **summary** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management statistics summary

    LSP Admission Statistics:

           Setup    Setup    Setup    Setup    Tear     Tear     Tear
           Requests Admits   Rejects  Errors   Requests Preempts Errors
```

```
        -------- -------- -------- -------- -------- -------- --------
Path          13       12        1        0       10        0        0
Resv           8        8        0        0        5        0        0
```

Table 42: show mpls traffic-eng link-management statistics summary Command Field Descriptions, on page 370 describes the significant fields shown in the display.

Table 42: show mpls traffic-eng link-management statistics summary Command Field Descriptions

Field	Description
Path	Path information.
Resv	Reservation information.
Setup Requests	Number of requests for a setup.
Setup Admits	Number of admitted setups.
Setup Rejects	Number of rejected setups.
Setup Errors	Number of setup errors.
Tear Requests	Number of tear requests.
Tear Preempts	Number of paths torn down due to preemption.
Tear Errors	Number of tear errors.

show mpls traffic-eng link-management summary

To display a summary of link management information, use the **show mpls traffic-eng link-management summary** command in XR EXEC mode.

show mpls traffic-eng link-management summary

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You cannot configure more than 250 links for MPLS-TE/FRR.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following sample output is from the **show mpls traffic-eng link-management summary** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management summary

  System Information::
        Links Count         : 6 (Maximum Links Supported 100)
        Flooding System     : enabled
        IGP Areas Count     : 2

    IGP Areas
    ----------

    IGP Area[1]:: isis   level-2
        Flooding Protocol   : ISIS
        Flooding Status     : flooded
        Periodic Flooding   : enabled (every 180 seconds)
        Flooded Links       : 4
        IGP System ID       : 0000.0000.0002.00
        MPLS-TE Router ID   : 20.20.20.20
        IGP Neighbors       : 8

    IGP Area[2]:: ospf   area 0
        Flooding Protocol   : OSPF
        Flooding Status     : flooded
        Periodic Flooding   : enabled (every 180 seconds)
        Flooded Links       : 4
```

```
IGP System ID       : 20.20.20.20
MPLS-TE Router ID   : 20.20.20.20
IGP Neighbors       : 8
```

This table describes the significant fields shown in the display.

Table 43: show mpls traffic-eng link-management summary Command Field Descriptions

Field	Description
Links Count	Number of links configured for MPLS-TE. Maximum number of links supported is 100.
Flooding System	Enable status of the MPLS-TE flooding system.
IGP Areas Count	Number of IGP[20] areas described.
IGP Area	IGP type and area and level used for TE flooding.
Flooding Protocol	IGP flooding information for this area.
Flooding Status	Status of flooding for this area.
Periodic Flooding	Status of periodic flooding for this area.
Flooded Links	Links that were flooded.
IGP System ID	IGP for the node associated with this area.
MPLS-TE Router ID	MPLS-TE router ID for this node.
IGP Neighbors	Number of reachable IGP neighbors associated with this area.

[20] IGP = Interior Gateway Protocol.

show mpls traffic-eng maximum tunnels

To display the maximum number of MPLS-TE tunnels that you can configure, use the **show mpls traffic-eng maximum tunnels** command in XR EXEC mode.

show mpls traffic-eng maximum tunnels

Syntax Description

This command has no keywords or arguments.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

This is sample output from the **show mpls traffic-eng maximum tunnels** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng maximum tunnels

Maximum Global Tunnel Count:

Maximum              Current Count
--------------     ---------------------
  4096            2


Maximum Global Destination Count:

Maximum             Current Count
--------------     --------------------
 4096            2

Maximum AutoTunnel Backup Count:

Maximum               Current Count
--------------     --------------------
   200                   122
```

This is sample output of the automatic mesh tunnels from the **show mpls traffic-eng maximum tunnels** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng maximum tunnels

Maximum Global Tunnel Count:

Maximum     Current Count
-------     -------------
 4096           12

Maximum Static Tunnel Count:

Maximum     Current Count
-------     -------------
 4096            8

Maximum Auto-tunnel Mesh Count:

Maximum     Current Count
-------     -------------
  201            3


Maximum Global Destination Count:

Maximum     Current Count
-------     -------------
 4096           13

Maximum GMPLS-UNI Tunnel Count:

Maximum     Current Count
-------     -------------
 500          39
```

Table 44: show mpls traffic-eng maximum tunnels Command Field Descriptions, on page 374 describes the significant fields shown in the display.

Table 44: show mpls traffic-eng maximum tunnels Command Field Descriptions

Field	Description
Maximum Global Tunnel Count	Maximum number of tunnel interfaces (all TE tunnel types, tunnel-te, tunnel-mte, and tunnel-gte) that can be configured.
Maximum Global Tunnel Count	Maximum number of tunnel interfaces (all TE tunnel types and tunnel-te) that can be configured.
Maximum Global Destination Count	Maximum number of tunnel destinations that can be configured.
Maximum	Table heading for the maximum number in each category.

Field	Description
Current Count	Table heading for the current count in each category.
Maximum AutoTunnel Backup Count	Maximum number of automatic backup tunnels that can be configured.
Maximum GMPLS UNI Tunnel Count	Maximum number of Generalized Multiprotocol Label Switching (GMPLS) User-Network Interface (UNI) tunnels that can be configured and the current tunnel count.
Maximum AutoTunnel Mesh Count	Maximum number of automatic mesh tunnels that can be configured.

show mpls traffic-eng preemption log

To display the log of preemption events, use the **show mpls traffic-eng preemption log** command in XR EXEC mode mode.

show mpls traffic-eng preemption log

Syntax Description

log	Displays a log of preemption events.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read

This is sample output from the **show mpls traffic-eng preemption log** command displaying the log of preemption events:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng preemption log
  Bandwidth Change on GigabitEthernet0/0/0/0
    Old BW (BC0/BC1): 200000/100000, New BW (BC0/BC1): 1000/500 kbps
    BW Overshoot (BC0/BC1): 1000/0 kbps
    Preempted BW (BC0/BC1): 35000/0 kbps; Soft 30000/0 kbps; Hard 5000/0 kbps;
    Preempted 2 tunnels; Soft 1 tunnel; Hard 1 tunnel
--------------------------------------------------------------------------------
 TunID LSP ID          Source     Destination Preempt  Pri  Bandwidth  BW Type
                                              Type  S/H  (in kbps)
------ ------ --------------- --------------- ------- ---- ---------- --------
     1  10002     192.168.0.1         1.0.0.0    Hard  7/7       5000      BC0
     1      2     192.168.0.1     192.168.0.4    Soft  7/7      30000      BC0
```

This sample output displays the log of soft-preemption over FRR backup tunnels events:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng preemption log
Thu Apr 25 13:12:04.863 EDT
  Bandwidth Change on GigabitEthernet0/0/0/1 at 04/25/2013 12:56:14
    Old BW (BC0/BC1): 200000/100000, New BW (BC0/BC1): 100000/0 kbps
    BW Overshoot (BC0/BC1): 30000/0 kbps
    Preempted BW (BC0/BC1): 130000/0 kbps; Soft 60000/0 kbps; Hard 0/0 kbps; FRRSoft 70000/0
```

```
    Preempted 2 tunnel, 2 LSP; Soft 1 tunnel, 1 LSP; Hard 0 tunnels, 0 LSPs; FRRSoft 1
tunnel, 1 LSP
--------------------------------------------------------------------------------
 TunID LSP ID          Source     Destination Preempt  Pri  Bandwidth  BW Type
                                              Type  S/H  (in kbps)
------ ------ --------------- --------------- ------- ---- ---------- --------
     1     13     192.168.0.1     192.168.0.3 FRRSoft  7/7      70000      BC0
     2     22     192.168.0.1     192.168.0.3 Soft     7/7      60000      BC0
```

show mpls traffic-eng self-ping statistics

To display various self-ping counters collected over time, use the **show mpls traffic-eng self-ping statistics** command in XR EXEC mode.

show mpls traffic-eng self-ping statistics

Syntax Description

This command has no keywords or arguments.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.5.3	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following shows a sample output from the **show mpls traffic-eng self-ping statistics** :

```
Router# show mpls traffic-eng self-ping statistics
Self-Ping Statistics:
  Collected since: Tue Jun 14 09:35:52 2022 (1d04h ago)
  Operations:
    Started 2
    Running 0
    Successful 1
    Timed-out 1
    Terminated 0
  Probes sent 11
  Probes failed 0
  Received responses 1 (Average response time 00:00:00)
  Mismatched responses 0
```

The following table describes the significant fields shown in the display.

Table 45: show mpls traffic-eng self-ping statistics Command Field Descriptions

Field	Description
Started	Number of self-ping operations initiated.
Running	Number of active self-ping sessions (for tunnels under reoptimization) at the moment.
Successful	Number of successful (response received) self-ping operations.

Field	Description
Timed-out	Number of timed-out (response not received) self-ping operations.
Terminated	Number of terminated (intentionally stopped) self-ping operations.
Probes sent	Number of self-ping probe packets.
Probes failed	Number of errors occurred in sending self-ping probes. It is possible in OOR case or when packet sending layer experiences some trouble.
Received responses	Number of response probes received and the average time required to receive a probe since self-ping operation started.
Mismatched responses	Number of self-ping responses which cannot be matched to active self-ping session. It can happen in slower networks when LER send multiple probes out before first response received. First response stops self-ping for tunnel, but additional responses may come later. Those packets do not match active session anymore.

show mpls traffic-eng topology

To display the current MPLS-TE network topology for the node, use the **show mpls traffic-eng topology** command in XR EXEC mode.

show mpls traffic-eng topology [*IP-address*] [**affinity**] [**brief**] [**exclude-srlg** *exclude-srlg-interface-address*| **explicit-path** {**identifier** *explicit-path-id-number* | **name** *explicit-path-name*}| **priority** *level*] [**isis** *nsap-address* | **ospf** *ospf-address* | [**path** { **destination** *IP-address* | **tunnel** *P2P-tunnel-number* }] | {**router** | **network**}] [**model-type** {**rdm** | **mam**}] [**srlg**][**static**]

Syntax Description

IP-address	(Optional) Node IP address (router identifier to interface address).
destination *IP-address*	Displays the LSP destination IPv4 address.
exclude-srlg	Specifies an IP address to get SRLG values from for exclusion.
explicit-path	Displays the explicit LSP path.
tunnel	Displays the topology path that is based on the Point-to-Point (P2P) tunnel number.
P2P -tunnel-number	P2P tunnel number. Range is 0 to 65535.
affinity	(Optional) Displays the attribute values that are required for links carrying this tunnel. A 32-bit decimal number. Range is 0x0 to 0xFFFFFFFF, representing 32 attributes (bits), where the value of an attribute is 0 or 1.
priority *level*	(Optional) Displays the priority used when signaling a LSP for this tunnel, to determine which existing tunnels can be preempted.
isis *nsap-address*	(Optional) Displays the node router identification, if Intermediate System-to-Intermediate System (IS-IS) is enabled.
ospf *ospf-address*	(Optional) Displays the node router identifier, if Open Shortest Path First (OSPF) is enabled.

path	(Optional) Displays the path to a destination from this router.
router	Displays the given OSPF address type of the router node.
network	Displays the given OSPF address type of the network node.
brief	(Optional) Displays the brief form of the output that provides a less detailed version of the topology.
model-type { **rdm** | **mam** }	(Optional) Displays the bandwidth constraints model type, RDM or MAM.
srlg	(Optional) Displays the SRLG information.
static	(Optional) Displays the staticically configured SRLG.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following shows a sample output from the **show mpls traffic-eng topology** command specifying the tunnel number in brief form:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology path tunnel 160

  Tunnel160 Path Setup to 10.10.10.10: FULL_PATH
  bw 100 (CT0), min_bw 0, metric: 10
  setup_pri 7, hold_pri 7
  affinity_bits 0x0, affinity_mask 0xffff
  Hop0:10.2.2.1
  Hop1:10.10.10.10
```

The following shows a sample output from the **show mpls traffic-eng topology** command specifying the destination IP address:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology path destination 10.10.10.10

  Path Setup to 10.10.10.10:
  bw 0 (CT0), min_bw 999900, metric: 10
  setup_pri 7, hold_pri 7
  affinity_bits 0x0, affinity_mask 0xffffffff
  Hop0:10.2.2.1
  Hop1:10.10.10.10
```

The following sample output shows the MPLS-TE network topology with the name of the affinity attribute of the link:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology

  Link[1]:Point-to-Point, Nbr IGP Id:209.165.201.1, Nbr Node Id:9, gen:23
        Frag Id:25, Intf Address:10.9.1.1, Intf Id:0
        Nbr Intf Address:10.9.1.3, Nbr Intf Id:0
        TE Metric:1, IGP Metric:1, Attribute Flags:0x0
        Attribute Names:
        Switching Capability:, Encoding:
        BC Model ID:RDM
        Physical BW:155520 (kbps), Max Reservable BW Global:116640 (kbps)
        Max Reservable BW Sub:0 (kbps)
                                 Global Pool       Sub Pool
                 Total Allocated Reservable        Reservable
                 BW (kbps)       BW (kbps)         BW (kbps)
                 ---------------  -----------      ----------
          bw[0]:            0         116640               0
          bw[1]:            0         116640               0
          bw[2]:            0         116640               0
          bw[3]:            0         116640               0
          bw[4]:            0         116640               0
          bw[5]:            0         116640               0
          bw[6]:            0         116640               0
          bw[7]:            0         116640               0

    Link[2]:Broadcast, DR:10.9.0.2, Nbr Node Id:1, gen:23
        Frag Id:28, Intf Address:10.9.0.1, Intf Id:0
        Nbr Intf Address:0.0.0.0, Nbr Intf Id:0
        TE Metric:1, IGP Metric:1, Attribute Flags:0x4
        Attribute Names: red2
        Switching Capability:, Encoding:
        BC Model ID:RDM
        Physical BW:1000000 (kbps), Max Reservable BW Global:10000 (kbps)
        Max Reservable BW Sub:0 (kbps)
                                 Global Pool       Sub Pool
                 Total Allocated Reservable        Reservable
                 BW (kbps)       BW (kbps)         BW (kbps)
                 ---------------  -----------      ----------
          bw[0]:            0          10000               0
          bw[1]:            0          10000               0
          bw[2]:            0          10000               0
          bw[3]:            0          10000               0
          bw[4]:            0          10000               0
          bw[5]:            0          10000               0
          bw[6]:            0          10000               0
          bw[7]:            0          10000               0
```

The following shows a sample output from the **show mpls traffic-eng topology** command in detail form in prestandard DS-TE mode:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology

  My_System_id: 0000.0000.0002.00 (isis   level-2)
  My_System_id: 10.20.20.20 (ospf   area 0)
  My_BC_Model_Type: RDM

  Signalling error holddown: 10 sec Global Link Generation 36

  IGP Id: 0000.0000.0002.00, MPLS-TE Id: 10.20.20.20 Router Node  (isis   level-2)

  Link[0]:Point-to-Point, Nbr IGP Id:0000.0000.0003.00, Nbr Node Id:3, gen:36
        Frag Id:0, Intf Address:10.3.3.1, Intf Id:0
         Nbr Intf Address:10.3.3.2, Nbr Intf Id:0
        TE Metric:10, IGP Metric:10, Attribute Flags:0x0
        Switching Capability:SRLGs: 10, Encoding:20
        Switching Capability:, Encoding:
  BC Model ID:RDM
  Physical BW:155520 (kbps), Max Reservable BW Global:100000 (kbps)
        Max Reservable BW Sub:50000 (kbps)
                                 Global Pool       Sub Pool
                 Total Allocated Reservable        Reservable
                 BW (kbps)       BW (kbps)         BW (kbps)
                 ---------------  -----------      ----------
          bw[0]:            0         100000           50000
          bw[1]:            0         100000           50000
          bw[2]:            0         100000           50000
          bw[3]:            0         100000           50000
          bw[4]:            0         100000           50000
          bw[5]:            0         100000           50000
          bw[6]:            0         100000           50000
          bw[7]:            0         100000           50000
```

The following shows a sample output from the **show mpls traffic-eng topology** command in detail form in IETF DS-TE mode.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology

  My_System_id: 0000.0000.0001.00 (isis 1 level-2)
  My_System_id: 10.10.10.10 (ospf 100 area 0)
  My_BC_Model_Type: MAM

  Signalling error holddown: 10 sec Global Link Generation 84

  IGP Id: 0000.0000.0001.00, MPLS-TE Id: 10.10.10.10 Router Node  (isis 1 level-2)

  Link[0]:Point-to-Point, Nbr IGP Id:0000.0000.0002.00, Nbr Node Id:6, gen:84
        Frag Id:0, Intf Address:10.2.2.1, Intf Id:0
         Nbr Intf Address:10.2.2.2, Nbr Intf Id:0
        TE Metric:10, IGP Metric:10, Attribute Flags:0x0
        TE Metric:SRLGs: 10, IGP Metric:10, Attribute Flags:0x020
        Switching Capability:, Encoding:
  BC Model ID:MAM
        Physical BW:155520 (kbps), Max Reservable BW:1000 (kbps)
        BC0:600 (kbps) BC1:400 (kbps)
                       Total Allocated   Reservable
                       BW (kbps)         BW (kbps)
                       ---------------   -----------
          TE-class[0]:          10            590
```

```
          TE-class[1]:            0            400
          TE-class[2]:            0              0
          TE-class[3]:            0              0
          TE-class[4]:            0            600
          TE-class[5]:            0            400
  Link[1]:Point-to-Point, Nbr IGP Id:0000.0000.0002.00, Nbr Node Id:6, gen:84
        Frag Id:0, Intf Address:10.1.1.1, Intf Id:0
         Nbr Intf Address:10.1.1.2, Nbr Intf Id:0
        TE Metric:10, IGP Metric:10, Attribute Flags:0x0
        TE Metric:SRLGs: 10, IGP Metric:10, Attribute Flags:0x020
        Switching Capability:, Encoding:
        BC Model ID:MAM
        Physical BW:155520 (kbps), Max Reservable BW:1000 (kbps) BC0:600 (kbps) BC1:400
(kbps)
                        Total Allocated   Reservable
                        BW (kbps)         BW (kbps)
                        ---------------   -----------
          TE-class[0]:           10            590
          TE-class[1]:            0            400
          TE-class[2]:            0              0
          TE-class[3]:            0              0
          TE-class[4]:            0            600
          TE-class[5]:            0            400
          TE-class[6]:            0              0
          TE-class[7]:            0              0
```

The following shows a sample output for the **show mpls traffic-eng topology** command in brief form:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology 192.168.0.145 brief

  IGP Id: 0000.0000.0010.00, MPLS TE Id: 192.168.0.145 Router Node  (ISIS test level-1)
    Link[0]:Point-to-Point, Nbr IGP Id:0000.0000.0234.00, Nbr Node Id:4, gen:5
        Frag Id:0, Intf Address:10.3.11.145, Intf Id:0
        Nbr Intf Address:10.3.11.143, Nbr Intf Id:0
        TE Metric:10, IGP Metric:10, Attribute Flags:0x0
        SRLGs: 10, 20
        Attribute Names:  red2
        Switching Capability:, Encoding:
        BC Model ID:RDM
        Physical BW:155520 (kbps), Max Reservable BW Global:0 (kbps)
        Max Reservable BW Sub:0 (kbps)
```

The following sample output shows a brief topology for the affinity attributes:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology affinity

  affinity
  Mon Mar 23 13:25:47.236 EST EST
  My_System_id: 10.0.0.1 (OSPF 100 area 0)
  My_System_id: 0000.0000.0001.00 (IS-IS 100 level-2)
  My_BC_Model_Type: RDM

  Signalling error holddown: 10 sec Global Link Generation 233

  IGP Id: 0000.0000.0001.00, MPLS TE Id: 10.11.1.1 Router Node  (IS-IS 100 level-2)

  IGP Id: 10.0.0.1, MPLS TE Id: 10.0.0.1 Router Node  (OSPF 100 area 0)
    Link[0]:      Intf Address: 10.9.1.1, Nbr Intf Address: 10.9.1.2
        Attribute Flags: 0x0
        Attribute Names:
```

```
    Link[1]:      Intf Address: 10.9.1.1, Nbr Intf Address: 10.9.1.3
        Attribute Flags: 0x0
        Attribute Names:
    Link[2]:      Intf Address: 10.9.0.1, DR: 10.9.0.2
        Attribute Flags: 0x4
        Attribute Names: red2
    Link[3]:      Intf Address: 10.9.0.1, DR: 10.9.0.4
        Attribute Flags: 0x0
        Attribute Names:
    Link[4]:      Intf Address: 10.9.0.1, DR: 10.9.0.3
        Attribute Flags: 0x0
        Attribute Names:

  IGP Id: 209.165.201.1, MPLS TE Id: 209.165.201.1 Router Node  (OSPF 100 area 0)
    Link[0]:      Intf Address: 34.9.1.4, Nbr Intf Address: 34.9.1.3
        Attribute Flags: 0x0
        Attribute Names:
    Link[1]:      Intf Address: 10.9.0.4, DR: 10.9.0.4
        Attribute Flags: 0x1e
        Attribute Names: red1 red2 red3 red4
    Link[2]:      Intf Address: 24.9.0.4, DR: 24.9.0.4
        Attribute Flags: 0x0
        Attribute Names:
    Link[3]:      Intf Address: 34.9.0.4, DR: 34.9.0.3
        Attribute Flags: 0x0
        Attribute Names:
    Link[4]:      Intf Address: 24.9.1.4, Nbr Intf Address: 24.9.1.2
        Attribute Flags: 0x0
        Attribute Names:
```

The following sample output for the **show mpls traffic-eng topology** command that shows the output to a single link:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology 10.9.1.1 link-only

Wed Sep  2 13:24:48.821 EST


IGP Id: 0000.0000.0002.00, MPLS TE Id: 172.16.0.1 Router Node  (IS-IS 100 level-2)

  Link[0]:Point-to-Point, Nbr IGP Id:0000.0000.0001.00, Nbr Node Id:-1, gen:277740
      Frag Id:0, Intf Address:10.9.1.2, Intf Id:0
      Nbr Intf Address:10.9.1.1, Nbr Intf Id:0
      TE Metric:10, IGP Metric:10, Attribute Flags:0x0
      Attribute Names:
      Switching Capability:, Encoding:
      BC Model ID:RDM
      Physical BW:155520 (kbps), Max Reservable BW Global:116640 (kbps)
      Max Reservable BW Sub:0 (kbps)
                               Global Pool       Sub Pool
               Total Allocated Reservable        Reservable
               BW (kbps)       BW (kbps)         BW (kbps)
               ---------------  -----------      ----------
         bw[0]:            0         116640              0
         bw[1]:            0         116640              0
         bw[2]:            0         116640              0
         bw[3]:            0         116640              0
         bw[4]:            0         116640              0
         bw[5]:            0         116640              0
         bw[6]:            0         116640              0
         bw[7]:            0         116640              0
```

```
IGP Id: 172.16.0.1, MPLS TE Id: 172.16.0.1 Router Node  (OSPF 100 area 0)

  Link[3]:Point-to-Point, Nbr IGP Id:10.0.0.1, Nbr Node Id:-1, gen:277737
      Frag Id:29, Intf Address:10.9.1.2, Intf Id:0
      Nbr Intf Address:10.9.1.1, Nbr Intf Id:0
      TE Metric:1, IGP Metric:1, Attribute Flags:0x0
      Attribute Names:
      Switching Capability:, Encoding:
      BC Model ID:RDM
      Physical BW:155520 (kbps), Max Reservable BW Global:116640 (kbps)
      Max Reservable BW Sub:0 (kbps)
                              Global Pool       Sub Pool
              Total Allocated   Reservable        Reservable
              BW (kbps)         BW (kbps)         BW (kbps)
              ---------------   -----------       ----------
        bw[0]:            0         116640               0
        bw[1]:            0         116640               0
        bw[2]:            0         116640               0
        bw[3]:            0         116640               0
        bw[4]:            0         116640               0
        bw[5]:            0         116640               0
        bw[6]:            0         116640               0
        bw[7]:            0         116640               0
```

The following shows a sample output for the **show mpls traffic-eng topology model-type mam** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology model-type mam

  IGP Id: 0000.0000.0001.00, MPLS-TE Id: 10.10.10.10 Router Node  (isis 1 level-2)
    Link[0]:      Intf Address:10.2.2.1, Nbr Intf Address:10.2.2.2
    Link[1]:      Intf Address:10.1.1.1, Nbr Intf Address:10.1.1.2

  IGP Id: 0000.0000.0002.00, MPLS-TE Id: 10.20.20.20 Router Node  (isis 1 level-2)
    Link[0]:      Intf Address:10.2.2.2, Nbr Intf Address:10.2.2.1
    Link[1]:      Intf Address:10.1.1.2, Nbr Intf Address:10.1.1.1
    Link[2]:      Intf Address:10.3.3.1, Nbr Intf Address:10.3.3.2

  IGP Id: 0000.0000.0003.00, MPLS-TE Id: 30.30.30.30 Router Node  (isis 1 level-2)
    Link[0]:      Intf Address:10.3.3.2, Nbr Intf Address:10.3.3.1
```

The following shows a sample output from the **show mpls traffic-eng topology** command specifying the topology for the SRLG interfaces:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology srlg


Tue Oct  6 13:10:30.342 UTC
My_System_id: 0000.0000.0005.00 (IS-IS 1 level-2)

      SRLG      Interface Addr  TE Router ID    IGP Area  ID
_________      ______________  ____________    _______________
         1      10.1.2.1        192.0.2.1       IS-IS 1 level-2
         2      10.1.2.1        192.0.2.1       IS-IS 1 level-2
         3      10.1.2.1        192.0.2.1       IS-IS 1 level-2
         4      10.1.2.1        192.0.2.1       IS-IS 1 level-2
         5      10.1.2.1        192.0.2.1       IS-IS 1 level-2
         6      10.1.2.1        192.0.2.1       IS-IS 1 level-2
         7      10.1.2.1        192.0.2.1       IS-IS 1 level-2
         8      10.1.2.1        192.0.2.1       IS-IS 1 level-2
        10      10.4.5.5        192.0.2.5       IS-IS 1 level-2
        30      10.4.5.5        192.0.2.5       IS-IS 1 level-2
```

```
        77      10.4.5.5        192.0.2.5       IS-IS 1 level-2
        88      10.4.5.5        192.0.2.5       IS-IS 1 level-2
      1500      10.4.5.5        192.0.2.5       IS-IS 1 level-2
  10000000      10.4.5.5        192.0.2.5       IS-IS 1 level-2
4294967290      10.4.5.5        192.0.2.5       IS-IS 1 level-2
4294967295      10.4.5.5        192.0.2.5       IS-IS 1 level-2
```

The following shows a sample output from the **show mpls traffic-eng topology path destination** command specifying the topological path with SRLG exclusion:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology path destination 100.0.0.2 exclude-srlg
 10.4.5.5 isis 1 level 2

Tue Oct  6 13:13:44.053 UTC
Path Setup to 100.0.0.2:
bw 0 (CT0), min_bw 0, metric: 20
setup_pri 7, hold_pri 7
affinity_bits 0x0, affinity_mask 0xffff
Exclude SRLG Intf Addr : 10.4.5.5
SRLGs Excluded: 10, 30, 77, 88, 1500, 10000000
                4294967290, 4294967295
Hop0:10.5.1.5
Hop1:10.5.1.1
Hop2:10.1.2.1
Hop3:10.1.2.2
Hop4:10.0.0.2
```

The following shows a sample output from the **show mpls traffic-eng topology path destination** command specifying the topological path based on a given explicit path:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng topology path destination 100.0.0.2 explicit-path
 name exclude-srlg isis 1 level 2

Tue Oct  6 13:16:44.233 UTC
Path Setup to 100.0.0.2:
bw 0 (CT0), min_bw 0, metric: 20
setup_pri 7, hold_pri 7
affinity_bits 0x0, affinity_mask 0xffff
SRLGs Excluded: 10, 30, 77, 88, 1500, 10000000
                4294967290, 4294967295, 1, 2, 3, 4
                5, 6, 7, 8
Hop0:10.5.1.5
Hop1:10.5.1.1
Hop2:10.1.2.1
Hop3:10.1.2.2
Hop4:10.0.0.2
```

show mpls traffic-eng tunnels

To display information about MPLS-TE tunnels, use the **show mpls traffic-eng tunnels** command in XR EXEC mode.

show mpls traffic-eng tunnels [*tunnel-number*] [**affinity**] [**all**] [**auto-bw**] [**attribute-set** {**all***tunnel-name*}] [**auto-tunnel**] [**backup** [*tunnel-number* | **auto-tunnel [mesh]** *mesh-value* | [**name** *tunnel-name*] | **protected-interface** *type interface-path-id* | {**static** | **auto**}]] [**brief**] [**destination** *destination-address*] [**detail**] [**down**] [**interface** {**in** | **out** | **inout**} *type interface-path-id*] [**name** *tunnel-name*] [**p2p**] [**property** { **backup-tunnel** | **fast-reroute**}] [**protection** [**frr** | **path** | **tunnel-id***tunnel-id* | **tabular**]] [**reoptimized within-last** *interval*][**role** {**all** | **head** | **tail** | **middle**}] [**soft-preemption** {**desired** | **triggered}**}][**source** *source-address*] [**suboptimal constraints** {**current** | **max** | **none**}] [**summary**] [**tabular**] [**up**] [**class-type** *ct*]

Syntax Description

tunnel-number	(Optional)Number of the tunnel. Range is from 0 to 65535.
attribute-set	(Optional) Restricts the display of tunnels with an attribute set.
affinity	(Optional) Displays the affinity attributes for all outgoing links. The links, which are used by the tunnel, display color information.
all	(Optional) Displays all MPLS-TE tunnels.
auto-bw	(Optional) Restricts the display to tunnels when the automatic bandwidth is enabled.
auto-tunnel	(Optional) Restricts the display of automatically created tunnels.
mesh *mesh-value*	Displays the tunnels that belong to the specified auto-tunnel mesh group.
backup	(Optional) Displays FRR[21] backup tunnels information. The information includes the physical interface protected by the tunnel, the number of TE LSPs[22] protected, and the bandwidth protected. (Optional) Displays backup information for automatic tunnels and FRR tunnels.
name *tunnel-name*	(Optional) Displays the tunnel with given name.
protected-interface	(Optional) Displays FRR protected interfaces.
static	(Optional) Displays static backup tunnels.
auto-tunnel	(Optional) Displays protected automatic backup tunnels.

brief	(Optional) Displays the brief form of this command.
destination *destination-address*	(Optional) Restricts the display to tunnels destined for the specified IP address.
detail	(Optional) Displays detail information about headend tunnels.
down	(Optional) Displays tunnels that are down.
interface in	(Optional) Displays tunnels that use the specified input interface.
interface out	(Optional) Displays tunnels that use the specified output interface.
interface inout	(Optional) Displays tunnels that use the specified interface as an input or output interface.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
p2p	(Optional) Displays only P2P tunnels.
property backup-tunnel	(Optional) Displays tunnels with property of backup tunnel. Selects MPLS-TE tunnels used to protect physical interfaces on this router. A tunnel configured to protect a link against failure is a backup tunnel and has the backup tunnel property.
property fast-reroute	(Optional) Displays tunnels with property of fast-reroute configured. Selects FRR-protected MPLS-TE tunnels originating on (head), transmitting (router), or terminating (tail) on this router.

protection	(Optional) Displays all protected tunnels (configured as fast-reroutable). Displays information about the protection provided to each tunnel selected by other options specified with this command. The information includes whether protection is configured for the tunnel, the protection (if any) provided to the tunnel by this router, and the tunnel bandwidth protected.
frr	(Optional) Displays all protected tunnels (configured as fast-reroutable).
path	(Optional) Displays information for the path-protection.
tunnel-id	(Optional) Displays information for the path-protection for a particular tunnel.
tunnel-id	(Optional) Tunnel identifier. The range is from 0 to 65535.
tabular	(Optional) Displays information for the path protection tunnel in tabular format.
reoptimized within-last *interval*	(Optional) Displays tunnels reoptimized within the last given time interval.
role all	(Optional) Displays all tunnels.
role head	(Optional) Displays tunnels with their heads at this router.
role middle	(Optional) Displays tunnels at the middle of this router.
role tail	(Optional) Displays tunnels with their tails at this router.
soft-preemption	Displays tunnels on which the soft-preemption feature is enabled.
source *source-address*	(Optional) Restricts the display to tunnels with a matching source IP address.
suboptimal constraints current	(Optional) Displays tunnels whose path metric is greater than the current shortest path constrained by the tunnel's configured options.
suboptimal constraints max	(Optional) Displays tunnels whose path metric is greater than the current shortest path, constrained by the configured options for the tunnel, and taking into consideration only the network capacity.

suboptimal constraints none	(Optional) Displays tunnels whose path metric is greater than the shortest unconstrained path.
summary	(Optional) Displays summary of configured tunnels.
tabular	(Optional) Displays a table showing TE LSPs, with one entry per line.
up	(Optional) Displays tunnels when the tunnel interface is up.
class-type *ct*	(Optional) Displays tunnels using the given class-type value configuration.

[21] FRR = Fast Reroute.
[22] LSPs = Label Switched Paths.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **brief** form of the **show mpls traffic-eng tunnels** command to display information specific to a tunnel interface. Use the command without the **brief** keyword to display information that includes the destination address, source ID, role, name, suboptimal constraints, and interface.

The **affinity** keyword is available for only the source router.

Selected tunnels would have a shorter path if they were reoptimized immediately.

To display the path-protection summary fields, you must configure the options for the path-protection.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This sample output is not changed when no area is specified for the active path-option. If the area is specified, it is added on a line of its own after the existing path-option information.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels 20 detail

Signalling Summary:
              LSP Tunnels Process:  running
                     RSVP Process:  running
                       Forwarding:  enabled
          Periodic reoptimization:  every 3600 seconds, next in 2400 seconds
```

```
          Periodic FRR Promotion:  every 300 seconds, next in 16 seconds
         Auto-bw enabled tunnels:  6

Name: tunnel-te20  Destination: 130.130.130.130
 Status:
   Admin:    up Oper:   up   Path:  valid   Signalling: connected

   path option 1,  type explicit r1r2r3gig_path (Basis for Setup, path weight 200)
   G-PID: 0x0800 (derived from egress interface properties)
   Bandwidth Requested: 113 kbps  CT0

 Config Parameters:
   Bandwidth:      100 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
   Metric Type: TE (interface)
   AutoRoute:  enabled  LockDown: disabled   Policy class: not set
   Forwarding-Adjacency: disabled
   Loadshare:          0 equal loadshares
   Auto-bw: enabled
     Last BW Applied: 113 kbps CT0   BW Applications: 1
     Last Application Trigger: Periodic Application
     Bandwidth Min/Max: 0-4294967295 kbps
     Application Frequency: 5 min   Jitter: 0s   Time Left: 4m 19s
     Collection Frequency: 1 min
     Samples Collected: 0   Next: 14s
     Highest BW: 0 kbps   Underflow BW: 0 kbps
     Adjustment Threshold: 10%   10 kbps
     Overflow Detection disabled
     Underflow Detection disabled
   Fast Reroute: Disabled, Protection Desired: None
   Path Protection: Not Enabled
 History:
   Tunnel has been up for: 00:18:54
   Current LSP:
     Uptime: 00:05:41
   Prior LSP:
     ID: path option 1 [3]
     Removal Trigger: reoptimization completed
 Current LSP Info:
   Instance: 4, Signaling Area: IS-IS 1 level-2
   Uptime: 00:05:41 (since Mon Mar 15 00:01:36 UTC 2010)
   Outgoing Interface: HundredGigE0/0/0/3, Outgoing Label: 16009
   Router-IDs: local      110.110.110.110
               downstream 120.120.120.120
   Path Info:
     Outgoing:
     Explicit Route:
       Strict, 61.10.1.2
       Strict, 61.15.1.1
       Strict, 61.15.1.2
       Strict, 130.130.130.130
     Record Route: Disabled
     Tspec: avg rate=113 kbits, burst=1000 bytes, peak rate=113 kbits
     Session Attributes: Local Prot: Not Set, Node Prot: Not Set, BW Prot: Not Set
   Resv Info: None
     Record Route: Disabled
     Fspec: avg rate=113 kbits, burst=1000 bytes, peak rate=113 kbits
 Displayed 1 (of 6) heads, 0 (of 0) midpoints, 0 (of 0) tails
 Displayed 1 up, 0 down, 0 recovering, 0 recovered heads
```

This is a sample output from the **show mpls traffic-eng tunnels** command using the **property** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels property backup interface out
HundredGigE0/0/0/3

  Signalling Summary:
              LSP Tunnels Process:  running, not registered with RSVP
                     RSVP Process:  not running
                       Forwarding:  enabled
           Periodic reoptimization:  every 3600 seconds, next in 3595 seconds
            Periodic FRR Promotion:  every 300 seconds, next in 295 seconds
        Periodic auto-bw collection:  disabled

  Name: tunnel-te1  Destination: 10.0.0.1
    Status:
      Admin:    up Oper:   up   Path:  valid   Signalling: connected

      path option 1,  type dynamic   (Basis for Setup, path weight 1)
      G-PID: 0x0800 (derived from egress interface properties)

    Config Parameters:
      Bandwidth:        1000 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
      Metric Type: TE (default)
      AutoRoute:  disabled  LockDown: disabled
      Loadshare:      10000 bandwidth-based
      Auto-bw: disabled(0/0) 0  Bandwidth Requested:        0
      Direction: unidirectional
      Endpoint switching capability: unknown, encoding type: unassigned
      Transit switching capability: unknown, encoding type: unassigned
      Backup FRR EXP Demotion: 1 ' 7, 2 ' 1
      Class-Attributes: 1, 2, 7
      Bandwidth-Policer: off

    History:
      Tunnel has been up for: 00:00:08
      Current LSP:
        Uptime: 00:00:08

    Path info (ospf 0 area 0):
    Hop0: 10.0.0.2
    Hop1: 102.0.0.2
  Displayed 1 (of 1) heads, 0 (of 0) midpoints, 0 (of 0) tails
  Displayed 0 up, 1 down, 0 recovering, 0 recovered heads
```

This table describes the significant fields shown in the display.

Table 46: show mpls traffic-eng tunnels Command Field Descriptions

Field	Description
LSP Tunnels Process	Status of the LSP[23] tunnels process.
RSVP Process	Status of the RSVP process.
Forwarding	Status of forwarding (enabled or disabled).
Periodic reoptimization	Time, in seconds, until the next periodic reoptimization.
Periodic FRR Promotion	Time, in seconds, till the next periodic FRR[24] promotion.
Periodic auto-bw collection	Time, in seconds, till the next periodic auto-bw collection.

Field	Description
Name	Interface configured at the tunnel head.
Destination	Tail-end router identifier.
Admin/STATUS	Configured up or down.
Oper/STATE	Operationally up or down.
Signalling	Signaling connected or down or proceeding.
Config Parameters	Configuration parameters provided by tunnel mode MPLS traffic-eng, including those specific to unequal load-balancing functionality (bandwidth, load-share, backup FRR EXP demotion, class-attributes, and bandwidth-policer).
History: Current LSP: Uptime	Time LSP has been up.
Path Info	Hop list of current LSP.

[23] LSP = Link-State Packet.
[24] FRR = Fast Reroute.

This sample output shows the link attributes of links that are traversed by the tunnel (color information):

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels 11 affinity

  Signalling Summary:
              LSP Tunnels Process:  running
                     RSVP Process:  running
                       Forwarding:  enabled
            Periodic reoptimization:  every 3600 seconds, next in 2710 seconds
             Periodic FRR Promotion:  every 300 seconds, next in 27 seconds


            Auto-bw enabled tunnels:  0 (disabled)

  Name: tunnel-te11  Destination: 209.165.201.30
    Status:
      Admin:    up Oper:   up   Path:  valid   Signalling: connected

      path option 1,  type explicit gige_1_2_3 (Basis for Setup, path weight 2)
      G-PID: 0x0800 (derived from egress interface properties)
      Bandwidth Requested: 200 kbps  CT0

    Config Parameters:
      Bandwidth:      200 kbps (CT0) Priority:  2  2
      Number of affinity constraints: 1
         Include bit map       : 0x4
         Include name          : red2

      Metric Type: TE (default)
      AutoRoute: disabled  LockDown: disabled   Policy class: not set
      Forwarding-Adjacency: disabled
      Loadshare:          0 equal loadshares
      Auto-bw: disabled
      Fast Reroute: Enabled, Protection Desired: Any
```

```
    Path Protection: Not Enabled
  History:
    Tunnel has been up for: 02:55:27
    Current LSP:
      Uptime: 02:02:19
    Prior LSP:
      ID: path option 1 [8]
      Removal Trigger: reoptimization completed

  Path info (OSPF 100 area 0):
    Link0: 12.9.0.1
      Attribute flags: 0x4
      Attribute names: red2
    Link1: 23.9.0.2
      Attribute flags: 0x4
      Attribute names: red2

Displayed 1 (of 8) heads, 0 (of 0) midpoints, 0 (of 0) tails
Displayed 1 up, 0 down, 0 recovering, 0 recovered heads
```

This sample output shows the brief summary of the tunnel status and configuration:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels brief

  Signalling Summary:
              LSP Tunnels Process:  running
                     RSVP Process:  running
                        Forwarding:  enabled
            Periodic reoptimization:  every 3600 seconds, next in 2538 seconds
             Periodic FRR Promotion:  every 300 seconds, next in 38 seconds
            Auto-bw enabled tunnels:  0 (disabled)
                      TUNNEL NAME         DESTINATION      STATUS  STATE

                    tunnel-te1060           10.6.6.6          up  up
                    PE6_C12406_t607           10.7.7.7          up  up
                    PE6_C12406_t608           10.8.8.8          up  up
                    PE6_C12406_t609           10.9.9.9          up  up
                    PE6_C12406_t610         10.10.10.10         up  up
                    PE6_C12406_t621         10.21.21.21         up  up
                    PE7_C12406_t706           10.6.6.6          up  up
                    PE7_C12406_t721         10.21.21.21         up  up
                     Tunnel_PE8-PE6           10.6.6.6          up  up
                    Tunnel_PE8-PE21         10.21.21.21         up  up
                     Tunnel_PE9-PE6           10.6.6.6          up  up
                    Tunnel_PE9-PE21         10.21.21.21         up  up
                    Tunnel_PE10-PE6           10.6.6.6          up  up
                   Tunnel_PE10-PE21         10.21.21.21         up  up
                  PE21_C12406_t2106           10.6.6.6          up  up
                  PE21_C12406_t2107           10.7.7.7          up  up
                  PE21_C12406_t2108           10.8.8.8          up  up
                  PE21_C12406_t2109           10.9.9.9          up  up
                  PE21_C12406_t2110         10.10.10.10         up  up
                   PE6_C12406_t6070           10.7.7.7          up  up
                   PE7_C12406_t7060           10.6.6.6          up  up
                  tunnel-te1               200.0.0.3           up  up
                  HundredGigE0/0/0/3      100.0.0.1         up  up
                  HundredGigE0/0/0/4      200.0.0.1         up  up

  Displayed 1 (of 1) heads, 20 (of 20) midpoints, 0 (of 0) tails
  Displayed 1 up, 0 down, 0 recovering, 0 recovered heads
```

This section shows a sample output that results when automatic backup tunnels are created:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels brief

.
.
.
TUNNEL NAME          DESTINATION      STATUS  STATE
              tunnel-te0           200.0.0.3          up  up
              tunnel-te1           200.0.0.3          up  up
              tunnel-te2           200.0.0.3          up  up
             *tunnel-te50          200.0.0.3          up  up
             *tunnel-te60          200.0.0.3          up  up
             *tunnel-te70          200.0.0.3          up  up
             *tunnel-te80          200.0.0.3          up  up
.
.
.

* = automatically created backup tunnel
```

This is sample output that shows a summary of configured tunnels by using the **summary** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels summary

  LSP Tunnels Process:  not running, disabled
                      RSVP Process:  running
                        Forwarding:  enabled
            Periodic reoptimization:  every 3600 seconds, next in 2706 seconds
             Periodic FRR Promotion:  every 300 seconds, next in 81 seconds
        Periodic auto-bw collection:  disabled

  Signalling Summary:
      Head: 1 interfaces, 1 active signalling attempts, 1 established
            0 explicit, 1 dynamic
            1 activations, 0 deactivations
            0 recovering, 0 recovered
      Mids: 0
      Tails: 0

  Fast ReRoute Summary:
      Head:     0 FRR tunnels, 0 protected, 0 rerouted
      Mid:      0 FRR tunnels, 0 protected, 0 rerouted
      Summary:  0 protected, 0 link protected, 0 node protected, 0 bw protected

  Path Protection Summary:
      20 standby configured tunnels, 15 connected, 10 path protected
      2 link-diverse, 4 node-diverse, 4 node-link-diverse



AutoTunnel Backup Summary:
    AutoTunnel Backups:
             50 created, 50 up, 0 down, 8 unused
             25 NHOP, 25 NNHOP, 10 SRLG strict, 10 SRLG pref
    Protected LSPs:
             10 NHOP, 20 NHOP+SRLG
             15 NNHOP, 5 NNHOP+SRLG
    Protected S2L Sharing Families:
             10 NHOP, 20 NHOP+SRLG
             15 NNHOP, 5 NNHOP+SRLG
    Protected S2Ls:              10 NHOP, 20 NHOP+SRLG
             15 NNHOP, 5 NNHOP+SRLG
```

This is a sample output from the **show mpls traffic-eng tunnels** command using the **protection** keyword. This command selects every MPLS-TE tunnel, known to the router, that was signaled as an FRR-protected LSP (property fast-reroute), and displays information about the protection this router provides to each selected tunnel.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels protection

tunnel160
  LSP Head, Admin: up, Oper: up
  Src: 10.20.20.20, Dest: 10.10.10.10, Instance: 28
  Fast Reroute Protection: None

tunnel170
  LSP Head, Admin: up, Oper: up
  Src: 10.20.20.20, Dest: 10.10.10.10, Instance: 945
  Fast Reroute Protection: Requested
    Outbound: FRR Ready
     Backup tunnel160 to LSP nhop
      tunnel160: out I/f: HundredGigE0/0/0/3
     LSP signalling info:
      Original: out I/f: HundredGigE0/0/0/4, label:  3, nhop: 10.10.10.10
      With FRR: out I/f: tunnel160, label:  3
     LSP bw: 10 kbps, Backup level: any unlimited, type: CT0
```

This table describes the significant fields shown in the display.

Table 47: show mpls traffic-eng tunnels protection Command Field Descriptions

Field	Description
Tunnel#	Number of the MPLS-TE backup tunnel.
LSP Head/router	Node is either head or router for this LSP[25].
Instance	LSP ID.
Backup tunnel	Backup tunnel protection for NHOP/NNHOP.
out if	Backup tunnel's outgoing interface
Original	Outgoing interface, label, and next-hop of the LSP when not using backup.
With FRR	Outgoing interface and label when using backup tunnel.
LSP BW	Signaled bandwidth of the LSP.
Backup level	Type of bandwidth protection provided—pool type and limited/unlimited bandwidth.
LSP Tunnels Process	Status of the TE process [26].

[25] LSP = Link-State Packet.
[26] LSP = Label Switched Path

This is sample output from the **show mpls traffic-eng tunnels** command using the **backup** keyword. This command selects every MPLS-TE tunnel known to the router, and displays information about the FRR protection that each selected tunnel provides for interfaces on this route. The command does not generate output for tunnels that do not provide FRR protection of interfaces on this router:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels backup

  tunnel160
   Admin: up, Oper: up
   Src: 10.20.20.20, Dest: 10.10.10.10, Instance: 28
   Fast Reroute Backup Provided:
    Protected I/fs: HundredGigE0/0/0/3
    Protected lsps: 0
    Backup BW: any-class unlimited, Inuse: 0 kbps
```

This table describes the significant fields shown in the display.

Table 48: show mpls traffic-eng tunnels backup Command Field Descriptions

Field	Description
Tunnel#	MPLS-TE backup tunnel number.
Dest	IP address of backup tunnel destination.
State	State of the backup tunnel. Values are up, down, or admin-down.
Instance	LSP ID of the tunnel.
Protected I/fs	List of interfaces protected by the backup tunnel.
Protected lsps	Number of LSPs currently protected by the backup tunnel.
Backup BW	Configured backup bandwidth type and amount. Pool from which bandwidth is acquired. Values are any-class, CT0, and CT1. Amount is either unlimited or a configured limit in kbps.
Inuse	Backup bandwidth currently in use on the backup tunnel.

This shows a sample output from the **show mpls traffic-eng tunnels** command using the **backup** and **protected-interface** keywords:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels backup protected-interface

  Interface: HundredGigE0/0/0/3
      Tunnel100  UNUSED : out I/f:              Admin: down  Oper: down

  Interface: HundredGigE0/0/0/4
      Tunnel160    NHOP : out I/f: HundredGigE0/0/0/5   Admin:   up  Oper:   up
```

This table describes the significant fields shown in the display.

Table 49: show mpls traffic-eng tunnels backup protected-interface Command Field Descriptions

Field	Description
Interface	MPLS-TE-enabled FRR protected interface.
Tunnel#	FRR protected tunnel on the interface.

Field	Description
NHOP/NNHOP/UNUSED	State of Protected tunnel. Values are unused, next hop, next-next hop.
out I/f	Outgoing interface of the backup tunnel providing the protection.

This shows a sample output from the **show mpls traffic-eng tunnels** command using the **up within-last** keywords:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels up within-last 200

  Signalling Summary:
              LSP Tunnels Process:  running
                     RSVP Process:  running
                       Forwarding:  enabled
           Periodic reoptimization:  every 3600 seconds, next in 3381 seconds
            Periodic FRR Promotion:  every 300 seconds, next in 81 seconds
       Periodic auto-bw collection:  disabled

  Name: tunnel-te11  Destination: 30.30.30.30
    Status:
      Admin:    up Oper:   up   Path:  valid   Signalling: connected

      path option 1, type explicit back (Basis for Setup, path weight 1)
   G-PID: 0x0800 (derived from egress interface properties)

    Config Parameters:
      Bandwidth:        0 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
      Number of configured name based affinities: 2
      Name based affinity constraints in use:
         Include bit map          : 0x4 (refers to undefined affinity name)
         Include-strict bit map: 0x4
  Metric Type: TE (default)
      AutoRoute:  disabled  LockDown: disabled   Loadshare:        0 bw-based
      Auto-bw: disabled(0/0) 0  Bandwidth Requested:        0
      Direction: unidirectional
   Endpoint switching capability: unknown, encoding type: unassigned
      Transit switching capability: unknown, encoding type: unassigned

    History:
      Tunnel has been up for: 00:00:21
      Current LSP:
        Uptime: 00:00:21
      Prior LSP:
        ID: path option 1 [4]
        Removal Trigger: tunnel shutdown

    Path info (ospf   area 0):
    Hop0: 7.4.4.2
    Hop1: 30.30.30.30

  Displayed 1 (of 3) heads, 0 (of 0) midpoints, 0 (of 0) tails
  Displayed 1 up, 0 down, 0 recovering, 0 recovered heads
```

This shows a sample output from the **show mpls traffic-eng tunnels** command using the **reoptimized within-last** keywords:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels reoptimized within-last 600

  Signalling Summary:
```

```
                LSP Tunnels Process:  running
                       RSVP Process:  running
                         Forwarding:  enabled
              Periodic reoptimization:  every 60000 seconds, next in 41137 seconds
               Periodic FRR Promotion:  every 300 seconds, next in 37 seconds
          Periodic auto-bw collection:  disabled

  Name: tunnel-te1  Destination: 30.30.30.30
    Status:
      Admin:    up Oper:   up   Path:  valid   Signalling: connected

      path option 1, type explicit prot1 (Basis for Setup, path weight 1)
   G-PID: 0x0800 (derived from egress interface properties)

    Config Parameters:
      Bandwidth:       66 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
      Metric Type: IGP (global)
      AutoRoute:   enabled  LockDown: disabled   Loadshare:       66 bw-based
      Auto-bw: disabled(0/0) 0  Bandwidth Requested:       66
      Direction: unidirectional
   Endpoint switching capability: unknown, encoding type: unassigned
      Transit switching capability: unknown, encoding type: unassigned

    History:
      Tunnel has been up for: 00:14:04
      Current LSP:
        Uptime: 00:03:52
        Selection: reoptimization
      Prior LSP:
        ID: path option 1 [2017]
        Removal Trigger: reoptimization completed

    Path info (ospf   area 0):
    Hop0: 7.2.2.2
    Hop1: 7.3.3.2
    Hop2: 30.30.30.30
  Displayed 1 (of 1) heads, 0 (of 0) midpoints, 0 (of 0) tails
  Displayed 1 up, 0 down, 0 recovering, 0 recovered heads
```

This is a sample output from the **show mpls traffic-eng tunnels** command using the **detail** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels 100 detail

  Name: tunnel-te1  Destination: 24.24.24.24
    Status:
      Admin:    up Oper:   up

          Working Path:  valid  Signalling: connected
          Protecting Path:  valid  Protect Signalling: connected
          Working LSP is carrying traffic

      path option 1,  type explicit po4 (Basis for Setup, path weight 1)
        (Basis for Standby, path weight 2)
      G-PID: 0x001d (derived from egress interface properties)
      Path protect LSP is present.

      path option 1,  type explicit po6 (Basis for Setup, path weight 1)

    Config Parameters:
      Bandwidth:       10 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
      Metric Type: TE (default)
      AutoRoute:   enabled  LockDown: disabled   Loadshare:       10 bw-based
      Auto-bw: disabled(0/0) 0  Bandwidth Requested:       10
```

```
    Direction: unidirectional
    Endpoint switching capability: unknown, encoding type: unassigned
    Transit switching capability: unknown, encoding type: unassigned

  History:
    Tunnel has been up for: 00:04:06
    Current LSP:
      Uptime: 00:04:06
    Prior LSP:
      ID: path option 1 [5452]
      Removal Trigger: path verification failed
Current LSP Info:
    Instance: 71, Signaling Area: ospf optical area 0
    Uptime: 00:10:41
    Incoming Label: explicit-null
    Outgoing Interface: HundredGigE0/0/0/3, Outgoing Label: implicit-null
    Path Info:
      Explicit Route:
        Strict, 100.0.0.3
        Strict, 24.24.24.24
      Record Route: None
      Tspec: avg rate=2488320 kbits, burst=1000 bytes, peak rate=2488320 kbits
Resv Info:
      Record Route:
        IPv4 100.0.0.3, flags 0x0
      Fspec: avg rate=2488320 kbits, burst=1000 bytes, peak rate=2488320 kbits
  Protecting LSP Info:
    Instance: 72, Signaling Area: ospf optical area 0
    Incoming Label: explicit-null
    Outgoing Interface: HundredGigE0/0/0/4, Outgoing Label: implicit-null
    Path Info:
      Explicit Route:
        Strict, 101.0.0.3
        Strict, 24.24.24.24
      Record Route: None
      Tspec: avg rate=2488320 kbits, burst=1000 bytes, peak rate=2488320 kbits
    Resv Info:
      Record Route:
        IPv4 101.0.0.3, flags 0x0
      Fspec: avg rate=2488320 kbits, burst=1000 bytes, peak rate=2488320 kbits
  Reoptimized LSP Info (Install Timer Remaining 11 Seconds):
  Cleaned LSP Info (Cleanup Timer Remaining 19 Seconds):
```

This is a sample output that shows the path-protection options for tunnel-te 100 using the **detail** keyword.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels 100 detail

  Signalling Summary:
              LSP Tunnels Process:  running
                     RSVP Process:  running
                       Forwarding:  enabled
           Periodic reoptimization:  every 60 seconds, next in 31 seconds
            Periodic FRR Promotion:  every 300 seconds, next in 299 seconds
           Auto-bw enabled tunnels:  0 (disabled)

  Name: tunnel-te100  Destination: 33.3.33.3
    Status:
      Admin:    up Oper:   up (Up for 02:06:14)
      Path:  valid   Signalling: connected

  Path options:
```

```
    path-option 5 explicit name to-gmpls3 verbatim lockdown OSPF 0 area 0
      PCALC Error [Standby]: Wed Oct 15 15:53:24 2008
        Info: Destination IP address, 1.2.3.4, not found in topology
    path-option 10 dynamic
    path option 15 explicit name div-wrt-to-gmpls3 verbatim
    path option 20 dynamic standby OSPF 0 area 0
      (Basis for Standby, path weight 2)
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 0 kbps  CT0

Config Parameters:
    Bandwidth:        0 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
    Metric Type: TE (default)
    AutoRoute:  disabled  LockDown: disabled
    Loadshare:          0 equal loadshares
    Auto-bw: disabled(0/0) 0  Bandwidth Requested:        0
    Direction: unidirectional
    Endpoint switching capability: unknown, encoding type: unassigned
    Transit switching capability: unknown, encoding type: unassigned
    Path Protection: enabled

  Reoptimization Info in Inter-area:
    Better Path Queries sent = 13; Preferred Path Exists received = 0
    Last better path query was sent 00:08:22 ago
    Last preferred path exists was received 00:00:00 ago

  History:
    Tunnel has been up for: 02:15:56
    Current LSP:
      Uptime: 02:15:56
    Prior LSP:
      ID: path option 10 [22]
      Removal Trigger: path verification failed
  Current LSP Info:

    Bandwidth:        0 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
    Metric Type: TE (default)
    AutoRoute: disabled  LockDown: disabled   Policy class: not set
    Loadshare:          0 equal loadshares
    Auto-bw: disabled
    Direction: unidirectional
    Endpoint switching capability: unknown, encoding type: unassigned
    Transit switching capability: unknown, encoding type: unassigned
    Fast Reroute: Disabled, Protection Desired: None
Reoptimization Info in Inter-area:
    Better Path Queries sent = 13; Preferred Path Exists received = 0
    Last better path query was sent 00:08:22 ago
    Last preferred path exists was received 00:00:00 ago
Path Protection Info:
  Standby Path: Node and Link diverse Last switchover 00:08:22 ago
    Switchover Reason: Path delete request
  Number of Switchovers 13, Standby Ready 15 times

  History:
    Prior LSP:
      ID: path option 10 [188]
      Removal Trigger: path option removed
Tunnel has been up for: 00:03:58
    Current LSP:
      Uptime: 00:03:58
    Reopt. LSP:
      Setup Time: 272 seconds
  Current LSP Info:
    Instance: 1, Signaling Area: OSPF 0 area 0
```

```
  Uptime: 00:03:58
  Outgoing Interface: HundredGigE0/0/0/3, Outgoing Label: implicit-null
  Router-IDs: local      222.22.2.2
              downstream 33.3.33.3
  Path Info:
    Outgoing:
    Explicit Route:
      Strict, 23.0.0.3
      Strict, 33.3.33.3
    Record Route: None
    Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits
    Session Attributes: Local Prot: Not Set, Node Prot: Not Set, BW Prot: Not Set
  Resv Info:
    Record Route: None
    Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits
Standby LSP Info:
  Instance: 1, Signaling Area: OSPF 0 area 0
  Uptime: 00:03:58
  Outgoing Interface: HundredGigE0/0/0/3, Outgoing Label: implicit-null
  Router-IDs: local      222.22.2.2
              downstream 33.3.33.3
  Path Info:
    Outgoing:
    Explicit Route:
      Strict, 23.0.0.3
      Strict, 33.3.33.3
    Record Route: None
    Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits
    Session Attributes: Local Prot: Not Set, Node Prot: Not Set, BW Prot: Not Set
  Resv Info:
    Record Route: None
    Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits
Reoptimized LSP Info:
  Instance: 5, Signaling Area: OSPF 0 area 0
  Outgoing Interface: HundredGigE0/0/0/4, Outgoing Label: 16000
  Path Info:
    Outgoing:
    Explicit Route:
      Strict, 26.0.0.6
      Strict, 36.0.0.3
      Strict, 33.3.33.3
    Record Route: None
    Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits
    Session Attributes: Local Prot: Not Set, Node Prot: Not Set, BW Prot: Not Set
  Resv Info:
    Record Route: None
    Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits
Delayed Clean Standby LSP Info:
  Instance: 1, Signaling Area: OSPF 0 area 0
  Uptime: 00:03:58
  Outgoing Interface: HundredGigE0/0/0/3, Outgoing Label: implicit-null
  Router-IDs: local      222.22.2.2
              downstream 33.3.33.3
  Path Info:
    Outgoing:
    Explicit Route:
      Strict, 23.0.0.3
      Strict, 33.3.33.3
    Record Route: None
    Tspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits
    Session Attributes: Local Prot: Not Set, Node Prot: Not Set, BW Prot: Not Set
  Resv Info:
    Record Route: None
    Fspec: avg rate=0 kbits, burst=1000 bytes, peak rate=0 kbits
```

```
  Displayed 0 (of 2) heads, 0 (of 0) midpoints, 0 (of 0) tails
  Displayed 0 up, 0 down, 0 recovering, 0 recovered heads
```

This is a sample output from the **show mpls traffic-eng tunnels** command using the **role mid** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels role mid

  Signalling Summary:
              LSP Tunnels Process:  running
                     RSVP Process:  running
                       Forwarding:  enabled
           Periodic reoptimization:  every 3600 seconds, next in 1166 seconds
            Periodic FRR Promotion:  every 300 seconds, next in 90 seconds
        Periodic auto-bw collection:  disabled
  LSP Tunnel 10.10.10.10 1 [5508] is signalled, connection is up
    Tunnel Name: FRR1_t1  Tunnel Role: Mid
    InLabel: HundredGigE0/0/0/3, 33
    OutLabel: HundredGigE0/0/0/4, implicit-null
    Signalling Info:
      Src 10.10.10.10 Dst 30.30.30.30, Tunnel ID 1, Tunnel Instance 5508
      Path Info:1
        Incoming Address: 7.3.3.1
  Incoming      Explicit Route:
          Strict, 7.3.3.1
          Loose, 30.30.30.30
       ERO Expansion Info:
        ospf 100 area 0, Metric 1 (TE), Affinity 0x0, Mask 0xffff, Queries 0
        Outgoing      Explicit Route:
          Strict, 7.2.2.1
          Strict, 30.30.30.30
  Record Route: None
        Tspec: avg rate=10 kbits, burst=1000 bytes, peak rate=10 kbits
      Resv Info:
        Record Route:
          IPv4 30.30.30.30, flags 0x20
          Label 3, flags 0x1
          IPv4 7.3.3.2, flags 0x0
          Label 3, flags 0x1
        Fspec: avg rate=10 kbits, burst=1000 bytes, peak rate=10 kbits
  Displayed 0 (of 1) heads, 1 (of 1) midpoints, 0 (of 1) tails
  Displayed 0 up, 0 down, 0 recovering, 0 recovered heads
```

This sample output shows a tabular table for TE LSPs by using the **tabular** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels tabular

  Tunnel                LSP     Destination          Source     Tun     FRR    LSP
  Name                   ID          Address         Address   State   State   Role
  ------------------ ------ --------------- --------------- ------- ------- ------
  tunnel-mte100      1         172.16.0.1     60.60.60.60      up   Inact   Head
       tunnel-mte300      1     60.60.60.60        172.16.0.1       up   Inact   Tail
       tunnel-te1060      2        10.6.6.6        10.1.1.1       up   Inact   Head
     PE6_C12406_t607      2        10.7.7.7        10.6.6.6       up   Inact    Mid
     PE6_C12406_t608      2        10.8.8.8        10.6.6.6       up   Inact    Mid
     PE6_C12406_t609      2        10.9.9.9        10.6.6.6       up   Inact    Mid
     PE6_C12406_t610      2     10.10.10.10        10.6.6.6       up   Inact    Mid
     PE6_C12406_t621      2     10.21.21.21        10.6.6.6       up   Inact    Mid
     PE7_C12406_t706    835        10.6.6.6        10.7.7.7       up   Inact    Mid
     PE7_C12406_t721    603     10.21.21.21        10.7.7.7       up   Inact    Mid
      Tunnel_PE8-PE6   4062        10.6.6.6        10.8.8.8       up   Inact    Mid
```

```
    Tunnel_PE8-PE21   6798     10.21.21.21        10.8.8.8      up   Inact    Mid
     Tunnel_PE9-PE6   4062        10.6.6.6        10.9.9.9      up   Inact    Mid
    Tunnel_PE9-PE21   6795     10.21.21.21        10.9.9.9      up   Inact    Mid
    Tunnel_PE10-PE6   4091        10.6.6.6     10.10.10.10      up   Inact    Mid
   Tunnel_PE10-PE21   6821     10.21.21.21     10.10.10.10      up   Inact    Mid
  PE21_C12406_t2106      2        10.6.6.6     10.21.21.21      up   Ready    Mid
  PE21_C12406_t2107      2        10.7.7.7     10.21.21.21      up   Inact    Mid
  PE21_C12406_t2108      2        10.8.8.8     10.21.21.21      up   Inact    Mid
  PE21_C12406_t2109      2        10.9.9.9     10.21.21.21      up   Inact    Mid
  PE21_C12406_t2110      2     10.10.10.10     10.21.21.21      up   Inact    Mid
   PE6_C12406_t6070      2        10.7.7.7        10.6.6.6      up   Inact    Mid
   PE7_C12406_t7060    626        10.6.6.6        10.7.7.7      up   Inact    Mid
       tunnel-te1        1       200.0.0.3       200.0.0.1      up   Inact   Head InAct
      tunnel-te100       1       200.0.0.3       200.0.0.1      up   Ready   Head InAct
   HundredGigE0/0/0/3    2       100.0.0.1       200.0.0.1      up   Inact   Head InAct
   HundredGigE0/0/0/4    6       200.0.0.1       100.0.0.1      up   Inact   Tail InAct
```

This sample output shows a tabular table indicating automatic backup tunnels when using the **tabular** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels tabular

            Tunnel     LSP      Destination          Source             FRR     LSP  Path
              Name      ID         Address          Address   State    State    Role  Prot
------------------ ------ --------------- --------------- ------- -------- ------ -----
        tunnel-te0     549       200.0.0.3       200.0.0.1      up    Inact   Head InAct
        tunnel-te1     546       200.0.0.3       200.0.0.1      up    Inact   Head InAct
        tunnel-te2       6       200.0.0.3       200.0.0.1      up    Inact   Head InAct
      *tunnel-te50       6       200.0.0.3       200.0.0.1      up   Active   Head InAct
      *tunnel-te60       4       200.0.0.3       200.0.0.1      up   Active   Head InAct
      *tunnel-te70       4       200.0.0.3       200.0.0.1      up   Active   Head InAct
      *tunnel-te80       3       200.0.0.3       200.0.0.1      up   Active   Head InAct

* = automatically created backup tunnel
```

This table describes the significant fields shown in the display.

Table 50: show mpls traffic-eng tunnels tabular Command Field Descriptions

Field	Description
Tunnel Name	MPLS-TE tunnel name.
LSP ID	LSP ID of the tunnel.
Destination Address	Destination address of the TE tunnel (identified in Tunnel Name).
Source Address	Source address for the filtered tunnels.
Tunnel State	State of the tunnel. Values are up, down, or admin-down.
FRR State	FRR state identifier.
LSP Role	Role identifier. Values are All, Head, or Tail.

This sample output shows a path protection for tunnel ID 10:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels protection path tunnel-id 10

  Tun ID 10, Src 22.2.22.2 Dst 66.6.66.6, Ext ID 22.2.22.2
    Switchover 00:08:22 ago, Standby Path: {Not found | Link diverse | Node diverse | Node
 and Link diverse}
  Current LSP: LSP ID 10022, Up time 12:10:24,
      Local lbl: 16001, Out Interface: HundredGigE0/0/0/3, Out lbl: implicit-null
      Path: 10.0.0.1, 172.16.0.1, 209.165.201.30, 8.8.8.8
  Standby LSP: None | LSP ID, Up time 12:00:05,
      Local lbl: 16002, Out Interface: HundredGigE0/0/0/4, Out lbl: implicit-null
      Path 4.4.4.4, 5.5.5.5, 6.6.6.6, 7.7.7.7
```

This sample output shows the path protection in a tabular format:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels protection path tabular

  Tunnel  Current  Standby       Protected                  Standby
        ID   LSP ID   LSP ID           State                Diversity
       155       10       11           Ready     Node and Link Diverse
      1501       11       12           Ready     Node and Link Diverse
      1502       10       11           Ready     Node and Link Diverse
      1504       10       11           Ready     Node and Link Diverse
      1505       10       11           Ready     Node and Link Diverse
```

This table describes the significant fields shown in the display.

Table 51: show mpls traffic-eng tunnels protection path tabular Command Field Descriptions

Field	Description
Tunnel ID	Identifier of the tunnel.
Current LSP ID	Identifier of the LSP that is carrying traffic.
Standby LSP ID	Identifier of the standby LSP that is protecting traffic.
Protected State	Values are Ready and Not Ready.
Standby Diversity	Values are Node and Link Diverse along with Node Diverse and Link Diverse. Values that state that the current and standby LSP do not have nodes or links in common. The current and standby LSP do not have nodes in common (but can share a link), or they have no links in common (but can share nodes).

This sample output shows the MPLS-TE tunnel information only for tunnels in which the automatic bandwidth is enabled using the **auto-bw** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels auto-bw

  Signalling Summary:
              LSP Tunnels Process:  running
                     RSVP Process:  running
                       Forwarding:  enabled
            Periodic reoptimization:  every 3600 seconds, next in 636 seconds
             Periodic FRR Promotion:  every 300 seconds, next in 276 seconds
            Auto-bw enabled tunnels:  1

  Name: tunnel-te1  Destination: 0.0.0.0
```

```
  Status:
    Admin:    up Oper: down   Path: not valid   Signalling: Down
    G-PID: 0x0800 (internally specified)
    Bandwidth Requested: 0 kbps  CT0

  Config Parameters:
    Bandwidth:        0 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
    Metric Type: TE (default)
    AutoRoute: disabled  LockDown: disabled   Policy class: not set
    Loadshare:          0 equal loadshares
Auto-bw: (collect bw only)
      Last BW Applied: 500 kbps (CT0)   BW Applications: 25
      Last Application Trigger: Periodic Application
      Bandwidth Min/Max: 10-10900 kbps
      Application Frequency: 10 min (Cfg: 10 min)  Time Left: 5m 34s
      Collection Frequency: 2 min
      Samples Collected: 2   Highest BW: 450 kbps   Next: 1m 34s
      Adjustment Threshold: 5%
      Overflow Threshold: 15%   Limit: 1/4   Early BW Applications: 0
    Direction: unidirectional
    Endpoint switching capability: unknown, encoding type: unassigned
    Transit switching capability: unknown, encoding type: unassigned
    Fast Reroute: Disabled, Protection Desired: None

  Reason for the tunnel being down: No destination is configured
  History:
Displayed 1 (of 1) heads, 0 (of 0) midpoints, 0 (of 0) tails
Displayed 0 up, 1 down, 0 recovering, 0 recovered heads
```

This table describes the significant fields shown in the display.

Table 52: show mpls traffic-eng tunnels auto-bw Command Field Descriptions

Field	Description
collect bw only	Field is displayed only if the bandwidth collection is configured in the tunnel automatic bandwidth configuration.
Last BW Applied	Last bandwidth change that is requested by the automatic bandwidth for the tunnel. In addition, this field indicates which pool is used for the bandwidth.
BW Applications	Total number of bandwidth applications that is requested by the automatic bandwidth, which includes the applications triggered by an overflow condition.
Last Application Trigger	These last application options are displayed: • Periodic Application • Overflow Detected • Manual Application
Bandwidth Min/Max	Bandwidth configured is either minimum or maximum.
Application Frequency	Configured application frequency. The Time Left field indicates the time left before the next application executes.
Collection Frequency	Globally configured collection frequency, which is the same value for all the tunnels.

Field	Description
Samples Collected	Number of samples that are collected during the current application period. This field is replaced by the Collection Disabled field if Collection Frequency is not currently configured.
Highest BW	Highest bandwidth that is collected for the application period.
Next	Time left before the next collection event.
Overflow Threshold	Overflow threshold that is configured. The Overflow field appears only if the overflow detection is configured in the tunnel automatic bandwidth configuration.
Limit	Consecutive overflow detected or configured limit.
Early BW Applications	Number of early bandwidth applications that are triggered by an overflow condition.

This is sample output from the **show mpls traffic-eng tunnels** command after the NNHOP SRLG preferred automatic backup tunnel is configured:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels 1

Signalling Summary:
              LSP Tunnels Process:  running
                     RSVP Process:  running
                       Forwarding:  enabled
          Periodic reoptimization:  every 3600 seconds, next in 2524 seconds
           Periodic FRR Promotion:  every 300 seconds, next in 49 seconds
          Auto-bw enabled tunnels:  1

Name: tunnel-te1  Destination: 200.0.0.3 (auto backup)
  Status:
    Admin:    up Oper:   up   Path:  valid   Signalling: connected

    path option 10,  type explicit (autob_nnhop_srlg_tunnel1) (Basis for Setup, path weight
 11)
    path option 20,  type explicit (autob_nnhop_tunnel1)
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 0 kbps  CT0
    Creation Time: Fri Jul 10 01:53:25.581 PST  (1h 25m 17s ago)

  Config Parameters:
    Bandwidth:        0 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
    Metric Type: TE (default)
    AutoRoute: disabled  LockDown: disabled   Policy class: not set
    Forwarding-Adjacency: disabled

Loadshare:          0 equal loadshares
    Auto-bw: disabled
    Fast Reroute: Disabled, Protection Desired: None
    Path Protection: Not Enabled
  Auto Backup:
     Protected LSPs: 4
     Protected S2L Sharing Families: 0
     Protected S2Ls: 0
     Protected i/f: HundredGigE0/0/0/2    Protected node: 20.0.0.2
     Protection: NNHOP+SRLG
     Unused removal timeout: not running
  History:
    Tunnel has been up for: 00:00:08
```

```
    Current LSP:
      Uptime: 00:00:08
    Prior LSP:
      ID: path option 1 [545]
      Removal Trigger: configuration changed

  Path info (OSPF 0 area 0):
  Hop0: 10.0.0.2
  Hop1: 100.0.0.2
  Hop2: 100.0.0.3
  Hop3: 200.0.0.3
```

This table describes the significant fields shown in the display.

Table 53: show mpls traffic-eng tunnels Command Field Descriptions

Field	Description
Auto Backup	Auto backup section header.
Creation Time	Time when the tunnel was created and for what period was the tunnel created.
Protected LSPs	Number of ready and active LSPs protected by this backup.
Protected S2L Sharing Familes	Number of ready and active sharing families protected by this backup.
Protected S2Ls	Number of ready and active primary tunnels protected by this backup.
Protected i/f Protected node	Interface and NNHOP node protected by this backup.
Protection: NNHOP+SRLG	Type of protection provided by this backup. **Note** Protection can be different when a preferred SRLG is configured and an SRLG path is not found.
Example when backup is in use: Unused removal timeout: not running Example when backup is unused: Unused removal timeout: 1h26m	Amount of time left before the unused removal timout expires. This timer only runs when the backup is in the unused state. After the timer expires, the automatic backup tunnel is removed.

This is sample output from the **show mpls traffic-eng tunnels** command using the **detail** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels 999 detail

Name: tunnel-te999  Destination: 10.0.0.1
  Status:
    Admin:    up Oper:   up   Path:  valid   Signalling: connected

    path option 1,  type dynamic  (Basis for Setup, path weight 2)
      Path-option attribute: po
        Number of affinity constraints: 2
           Include bit map       : 0x4
           Include name          : blue
           Exclude bit map       : 0x2
```

```
          Exclude name          : red

        Bandwidth: 300 (CT0)
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 300 kbps  CT0
    Creation Time: Fri Jan 14 23:35:58 2017 (00:00:42 ago)
  Config Parameters:
    Bandwidth:      100 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
    Metric Type: TE (default)
    Hop-limit: disabled
    AutoRoute: disabled  LockDown: disabled   Policy class: not set
    Forwarding-Adjacency: disabled
    Loadshare:          0 equal loadshares
    Auto-bw: disabled
    Fast Reroute: Enabled, Protection Desired: Any
    Path Protection: Not Enabled
    Soft Preemption: Disabled
  SNMP Index: 42
  History:
    Tunnel has been up for: 00:00:30 (since Fri Jan 14 23:36:10 EST 2017)
    Current LSP:
      Uptime: 00:00:30 (since Fri Jan 14 23:36:10 EST 2017)
  Current LSP Info:
    Instance: 2, Signaling Area: OSPF 100 area 16909060
    Uptime: 00:00:30 (since Fri Jan 14 23:36:10 EST 2017)
    Outgoing Interface: HundredGigE0/0/0/4, Outgoing Label: 16005
    Router-IDs: local      209.165.201.30
                downstream 172.16.0.1
    Soft Preemption: None
    Path Info:
      Outgoing:
        Explicit Route:
          Strict, 23.9.0.2
          Strict, 12.9.0.2
          Strict, 12.9.0.1
          Strict, 10.0.0.1

      Record Route: Disabled
      Tspec: avg rate=300 kbits, burst=1000 bytes, peak rate=300 kbits
      Session Attributes: Local Prot: Set, Node Prot: Not Set, BW Prot: Not Set
                          Soft Preemption Desired: Not Set
    Resv Info:
      Record Route:
        IPv4 172.16.0.1, flags 0x20
        Label 16005, flags 0x1
        IPv4 23.9.0.2, flags 0x0
        Label 16005, flags 0x1
        IPv4 10.0.0.1, flags 0x20
        Label 3, flags 0x1
        IPv4 12.9.0.1, flags 0x0
        Label 3, flags 0x1
      Fspec: avg rate=300 kbits, burst=1000 bytes, peak rate=300 kbits Displayed 1 (of 8)
heads, 0 (of 3) midpoints, 0 (of 0) tails Displayed 1 up, 0 down, 0 recovering, 0 recovered
 heads
```

This is sample output from the **show mpls traffic-eng tunnels** command using the **auto-tunnel backup** keywords:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels auto-tunnel backup

AutoTunnel Backup Configuration:
  Interfaces count: 30
  Unused removal timeout: 2h
```

```
  Configured tunnel number range: 0-100
AutoTunnel Backup Summary:
         50 created, 50 up, 0 down, 8 unused
         25 NHOP, 25 NNHOP, 10 SRLG strict, 10 SRLG pref
Protected LSPs:
         10 NHOP, 20 NHOP+SRLG
         15 NNHOP, 5 NNHOP+SRLG
Protected S2L Sharing Families:
         10 NHOP, 20 NHOP+SRLG
         15 NNHOP, 5 NNHOP+SRLG
Protected S2Ls:
         10 NHOP, 20 NHOP+SRLG
         15 NNHOP, 5 NNHOP+SRLG

Cumulative Counters (last cleared 1h ago):
                   Total     NHOP   NNHOP
 Created:            550      300     250
 Connected:          500      250     250
 Removed (down):       0        0       0
 Removed (unused):   200      100     100
 Removed (in use):     0        0       0
 Range exceeded:       0        0       0
```

This table describes the significant fields shown in the display.

Table 54: show mpls traffic-eng tunnels auto-tunnel backup Command Field Descriptions

Field	Description
AutoTunnel Backup Configuration	Header for the automatic tunnel backup configuration.
Interfaces count	Number of interfaces that have automatic tunnel backup enabled.
Unused removal timeout	Configured value and time left before expiration of the unused removal timeout attribute.
Configured tunnel number range	Configured tunnel number range.
AutoTunnel Backup Summary	Header for the automatic tunnel backup summary information.
50 created	Number of automatic backup tunnels created.
50 up	Number of automatic backup tunnels in the up state.
0 down	Number of automatic backup tunnels in the down state.
8 unused	Number of automatic backup tunnels in the unused state.
25 NHOP	Number of automatic backup tunnels created for NHOP protection.
25 NNHOP	Number of automatic backup tunnels created for NNHOP protection.
10 SRLG strict	Number of automatic backup tunnels created with the SRLG preferred attribute.

Field	Description
10 SRLG pref	Number of automatic backup tunnels created with the SRLG preferred attribute.
Protected LSPs Protected S2L Sharing Families Protected S2Ls	Headings for summary information showing current status of LSPs, S2L Sharing Families, and S2Ls that are protected by the automatic tunnel backups. Numbers include primary tunnels in FRR ready and active state.
10 NHOP	Number of automatic backup tunnels that are link protected.
20 NHOP+SRLG	Number of automatic backup tunnels that are link protected and using an SRLG diverse backup path.
15 NNHOP	Number of automatic backup tunnels that are node protected.
20 NNHOP+SRLG	Number of automatic backup tunnels that are node protected and use an SRLG diverse backup path.
Cumulative Counters (last cleared 1h ago):	Cumulative counters for automatic backup tunnels.
Headers: Total, NHOP, NNHOP	Total number of counters and breakdown of NHOP and NNHOP counters.
Created:	Cumulative number of created automatic backup tunnels since the last counter was cleared.
Connected:	Cumulative number of the connected automatic backup tunnels since the last counter was cleared. **Note** Counter increments only the first time that a tunnel connects.
Removed (down/unused/in use)	Number of automatic backup tunnels that are removed based on state.
Range exceeded	Number of automatic backup tunnels attempted and later rejected when the total number exceeds the configured range.

This is sample output from the **show mpls traffic-eng tunnels name tunnel-te1 detail** command, which displays the soft preemption information for the tunnel-te1 tunnel:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels name tunnel-te1 detail
Name: tunnel-te1  Destination: 192.168.0.4
  Status:
    Admin:    up Oper:   up   Path:  valid   Signalling: connected

    path option 1,  type explicit ABC1 (Basis for Setup, path weight 2)
    Last PCALC Error [Reopt]: Fri Jan 13 16:40:24 2017
```

```
    Info: Can't reach 10.10.10.2 on 192.168.0.2, from node 192.168.0.1 (bw)
  Last Signalled Error: Fri Jan 13 16:38:53 2017
    Info: [2] PathErr(34,1)-(reroute, flow soft-preempted) at 10.10.10.1
  G-PID: 0x0800 (derived from egress interface properties)
  Bandwidth Requested: 30000 kbps  CT0
  Creation Time: Thu Jan 13 15:46:45 2017 (00:53:44 ago)
 Config Parameters:
  Bandwidth:    30000 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
  Metric Type: TE (default)
  Hop-limit: disabled
  AutoRoute:  enabled  LockDown: disabled   Policy class: not set
  Forwarding-Adjacency: disabled
  Loadshare:          0 equal loadshares
  Auto-bw: disabled
  Fast Reroute: Enabled, Protection Desired: Any
  Path Protection: Not Enabled
  Soft Preemption: Enabled
 Soft Preemption:
  Current Status: Preemption pending
  Last Soft Preemption: Fri Jan 13 16:38:53 2017 (00:01:36 ago)
    Addresses of preempting links:
      10.10.10.1: Fri Jan 13 16:38:53 2017 (00:01:36 ago)
    Duration in preemption pending: 96 seconds
    Preemption Resolution: Pending
  Stats:
    Number of preemption pending events: 1
    Min duration in preemption pending: 0 seconds
    Max duration in preemption pending: 0 seconds
    Average duration in preemption pending: 0 seconds
    Resolution Counters: 0 reopt complete, 0 torn down
                         0 path protection switchover
SNMP Index: 9
 History:
  Tunnel has been up for: 00:52:46 (since Thu Jan 13 15:47:43 EDT 2017)
  Current LSP:
    Uptime: 00:52:46 (since Thu Jan 13 15:47:43 EDT 2017)
  Reopt. LSP:
    Last Failure:
      LSP not signalled, has no S2Ls
      Date/Time: Thu Jan 13 16:40:24 EDT 2017 [00:00:05 ago]
  Prior LSP:
    ID: path option 1 [2]
    Removal Trigger: path error
 Current LSP Info:
  Instance: 2, Signaling Area: OSPF ring area 0
  Uptime: 00:52:46 (since Thu Jan 13 15:47:43 EDT 2017)
  Outgoing Interface: HundredGigE0/0/0/3, Outgoing Label: 16002
  Router-IDs: local      192.168.0.1
              downstream 192.168.0.2
  Soft Preemption: Pending
    Preemption Link: HundredGigE0/0/0/3; Address: 10.10.10.1
    Preempted at: Fri Jan 13 16:38:53 2017 (00:01:36 ago)
    Time left before hard preemption: 204 seconds
  Path Info:
    Outgoing:
    Explicit Route:
      Strict, 10.10.10.2
      Strict, 14.14.14.2
      Strict, 14.14.14.4
      Strict, 192.168.0.4
    Record Route: Empty
    Tspec: avg rate=30000 kbits, burst=1000 bytes, peak rate=30000 kbits
    Session Attributes: Local Prot: Set, Node Prot: Not Set, BW Prot: Not Set
                        Soft Preemption Desired: Set
```

```
    Resv Info:
      Record Route:
        IPv4 192.168.0.2, flags 0x20
        Label 16002, flags 0x1
        IPv4 10.10.10.2, flags 0x0
        Label 16002, flags 0x1
        IPv4 192.168.0.4, flags 0x20
        Label 3, flags 0x1
        IPv4 14.14.14.4, flags 0x0
        Label 3, flags 0x1
      Fspec: avg rate=30000 kbits, burst=1000 bytes, peak rate=30000 kbits
Displayed 1 (of 4) heads, 0 (of 0) midpoints, 0 (of 2) tails
Displayed 1 up, 0 down, 0 recovering, 0 recovered heads
```

This is sample output from the **show mpls traffic-eng tunnels** command with the **mesh** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels auto-tunnel
Signalling Summary:
              LSP Tunnels Process:  running
                     RSVP Process:  running
                       Forwarding:  enabled
          Periodic reoptimization:  every 3600 seconds, next in 3098 seconds
           Periodic FRR Promotion:  every 300 seconds, next in 238 seconds
          Auto-bw enabled tunnels:  1000

Name: tunnel-te9000  Destination: 20.20.20.20 (auto-tunnel mesh)
  Status:
    Admin:    up Oper:   up   Path:  valid   Signalling: connected
    path option 10,  type dynamic (Basis for Setup, path weight 11)
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 0 kbps  CT0
    Creation Time: Fri Jan 14 09:09:31 2010 (01:41:20 ago)
  Config Parameters:
    Bandwidth:        0 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
    Metric Type: TE (default)
    AutoRoute: disabled  LockDown: disabled   Policy class: not set
    Forwarding-Adjacency: disabled
    Loadshare:          0 equal loadshares
    Auto-bw: disabled
    Fast Reroute: Disabled, Protection Desired: None
    Path Protection: Not Enabled
    Attribute-set: TA-NAME (type auto-mesh)
Auto-tunnel Mesh:
  Group 40: Destination-list dl-40
    Unused removal timeout: not running
  History:
    Tunnel has been up for: 01:40:53 (since Fri Jan 14 09:09:58 EST 2010)
    Current LSP:
      Uptime: 01:41:00 (since Fri Jan 14 09:09:51 EST 2010)
    Reopt. LSP:
      Last Failure:
        LSP not signalled, identical to the [CURRENT] LSP
        Date/Time: Fri Jan 14 09:42:30 EST 2010 [01:08:21 ago]

  Path info (OSPF 100 area 0):
  Hop0: 7.0.15.1
  Hop1: 20.20.20.20
```

This shows an auto-tunnel mesh summary sample output from the **show mpls traffic-eng tunnels** command using the **summary** keyword:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels summary
Fri Jan 14 10:46:34.677 EST

              LSP Tunnels Process:  running
```

```
                    RSVP Process:  running
                      Forwarding:  enabled
           Periodic reoptimization:  every 3600 seconds, next in 3354 seconds
            Periodic FRR Promotion:  every 300 seconds, next in 193 seconds
      Periodic auto-bw collection:  1000

Signalling Summary:
    Head: 2000 interfaces, 2000 active signalling attempts, 2000 established
          2000 explicit, 0 dynamic
          9250 activations, 7250 deactivations
          0 recovering, 2000 recovered
    Mids: 0
    Tails: 0

Fast ReRoute Summary:
    Head:     1000 FRR tunnels, 1000 protected, 0 rerouted
    Mid:      0 FRR tunnels, 0 protected, 0 rerouted
    Summary:  1000 protected, 500 link protected, 500 node protected, 0 bw protected

<snip>

Auto-tunnel Mesh Summary:
  Auto-mesh Tunnels:
      50 created, 50 up, 0 down, 25 FRR, 20 FRR enabled
Mesh Groups:
    4 groups, 50 destinations
```

This sample output displays the *Signalled-Name* information:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng tunnels
Name: tunnel-te1  Destination: 192.168.0.4
Signalled-Name: rtrA_t1
  Status:
    Admin:    up Oper:   up   Path:  valid   Signalling: connected
.
.
.
```

This sample output displays the cost-limit configuration information:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng tunnels detail
Name: tunnel-te1
  Signalled-Name: ios_t1
  Status:
    Admin:    up Oper: down   Path: not valid   Signalling: Down
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 0 kbps  CT0
    Creation Time: Fri Jan 15 13:00:29 2014 (5d06h ago)
  Config Parameters:
    Bandwidth:        0 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
    Metric Type: TE (default)
    Hop-limit: disabled
    Cost-limit: 2
    AutoRoute: disabled  LockDown: disabled   Policy class: not set
    Forward class: 0 (default)
    Forwarding-Adjacency: disabled
    Loadshare:          0 equal loadshares
    Auto-bw: disabled
    Fast Reroute: Disabled, Protection Desired: None
    Path Protection: Not Enabled
    BFD Fast Detection: Disabled
    Reoptimization after affinity failure: Enabled
```

```
    Soft Preemption: Disabled
  Reason for the tunnel being down: No destination is configured
  SNMP Index: 10
Displayed 1 (of 1) heads, 0 (of 0) midpoints, 0 (of 0) tails
Displayed 0 up, 1 down, 0 recovering, 0 recovered heads
```

This sample output displays the 'Traffic switched to FRR backup tunnel' message, when the FRR backup is activated as part of soft-preemption:

```
RP/0/RP0/CPU0:router#show mpls traffic-eng tunnels detail
.
.
.
Soft Preemption: Pending
      Preemption Link: HundredGigE0/0/0/3; Address: 14.14.14.2
      Traffic switched to FRR backup tunnel-te 1000
      Preempted at: Fri Jan 27 12:56:14 2017 (00:00:03 ago)
      Time left before hard preemption: 96 seconds
.
.
.
```

show mpls traffic-eng tunnels auto-bw brief

To display the list of automatic bandwidth enabled tunnels, and to indicate if the current signaled bandwidth of the tunnel is identical to the bandwidth that is applied by the automatic bandwidth, use the **show mpls traffic-eng tunnels auto-bw brief** command in XR EXEC mode.

show mpls traffic-eng tunnels auto-bw brief

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **show mpls traffic-eng tunnels auto-bw brief** command to determine if the automatic bandwidth application has been applied on a specified tunnel. If a single tunnel is specified, only the information for that tunnel is displayed.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following sample output shows the list of automatic bandwidth enabled tunnels:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng tunnels auto-bw brief

  Tunnel    LSP  Last appl  Requested  Signalled    Highest    Application
  Name       ID   BW(kbps)   BW(kbps)   BW(kbps)   BW(kbps)      Time Left
  ------------- ------ ---------- ---------- ---------- ---------- --------------
  tunnel-te0      1           10          10         50      2h 5m
  tunnel-te1      5          500         300        420     1h 10m
```

This table describes the significant fields shown in the display.

Table 55: show mpls traffic-eng tunnels auto-bw brief Field Descriptions

Field	Description
Tunnel Name	Name for the tunnel.
LSP ID	ID of the Label Switched Path that is used by the tunnel.
Last appl BW (kbps)	Last bandwidth applied (for example, requested) by the automatic-bandwidth feature for the tunnel.

Field	Description
Requested BW (kbps)	Bandwidth that is requested for the tunnel.
Signalled BW (kbps)	Bandwidth that is actually signalled for the tunnel.
Highest BW (kbps)	Highest bandwidth measured since the last start of the application interval.
Application Time Left	Time left until the application period ends for this tunnel.

show mpls traffic-eng link-management soft-preemption

To display information about soft-preemption activity on a MPLS TE link, use the **show mpls traffic-eng link-management soft-preemption** command in XR EXEC mode.

show mpls traffic-eng link-management soft-preemption [**interface***type* *interface-path-id*]

Syntax Description

interface	Displays information on the specified interface.
type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced .

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

This is sample output from the **show mpls traffic-eng link-management soft-preemption** command:

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management soft-preemption interface
HundredGigE0/0/0/3
```

```
Name: HundredGigE0/0/0/3; IPv4 Address: 10.2.1.10
Total Soft Preempted Bandwidth (BC0/BC1) kbps: 1500/1000
Currently Soft Preempted Bandwidth (BC0/BC1) kbps: 1200/800
Released Soft Preempted Bandwidth (BC0/BC1) kbps: 300/200
Currently Over-subscribed Bandwidth (BC0/BC1) kbps: 1000/600
Currently Soft Preempted Tunnels: 5 tunnels
 TunID  LSPID          Source     Destination   Pri         BW   Class  Time
                                                S/H       Kbps    Type   out
------ ------ --------------- --------------- ----- ---------- -------- ----
    50     10        10.4.4.40        10.1.1.10   2/2        400      BC0  100
    51     11        10.4.4.40        10.1.1.10   2/2        600      BC0  100
    52     12        10.4.4.40        10.1.1.10   3/3        200      BC0   80
    53     11        10.4.4.40        10.1.1.10   3/3        500      BC1   90
    54     12        10.4.4.40        10.1.1.10   4/4        300      BC1   90
```

show srlg

To show the SRLG interface and configuration information, use the **show srlg** command in XR EXEC mode.

show srlg [**group** *group-name*] [**inherit-location** {*location*}] [**interface** *type interface-path-id*] [**location** {*name* | **mgmt-nodes**}] [**mapping** {*locationname*}] [**name** *name*] [**optical-interface** {*locationinterface-id*}] [**producers** *name*] [**value** *value-number*] [**trace** {**file** *filename* **original** | **hexdump** | **last** *entries* | **reverse** | **stats** | **tailf** | **unique** | **verbose** | **wrapping**}]

Syntax Description

group *group-name*	(Optional) Specifies a group.
inherit-location *location*	(Optional) Specifies a particular location.
interface *type*	(Optional) Displays information on the specific interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (**?**) online help function.
location	(Optional) Specifies a node.
node-id	Node ID. The *node-id* argument is entered in the *rack/slot/module* notation.
all	Specifies all locations.
mgmt-nodes	Specifies all management nodes.
mapping	(Optional) Specifies a mapping
location	Node location
name	Name of the mapping
name *name*	(Optional) Specifies an SRLG name.
optical-interface *interface-id*	(Optional) Specifies an optical interface.
producers *name*	(Optional) Specifies a SRLG producer.
value *value-number*	(Optional) Displays SRLG value numbers.
trace	(Optional) Displays trace information for SRLG.
file *filename*	(Optional) Displays trace information for a specific file name.

original	Displays the original location of the file.
hexdump	(Optional) Displays traces in hexadecimal format.
last	(Optional) Displays trace information for a specific number of entries.
entries	Number of entries. Replace entries with the number of entries you want to display. For example, if you enter 5, the display shows the last 5 entries in the trace data. Range is 1 to 4294967295.
reverse	(Optional) Displays the latest traces first.
stats	(Optional) Displays the statistics in the command output.
tailf	(Optional) Displays the new traces as they are added in the command output.
unique	(Optional) Displays the unique entries with counts in the command output.
verbose	(Optional) Displays the information for internal debugging in the command output.
wrapping	(Optional) Displays the wrapping entries in the command output.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
ip-services	read

Example

The following sample output is from the **show srlg value** command.

```
System Information::
Interface Count   : 2 (Maximum Interfaces Supported 250)
```

```
Interface   : HundredGigE0/0/0/3, Value Count : 2
SRLG Values : 10,20

Interface   : HundredGigE0/0/0/3, Value Count : 2
SRLG Values : 10,30

Interface   : HundredGigE0/0/0/3, Value Count : 2
SRLG Values : 10,40

Interface  : HundredGigE0/0/0/3, Value Count : 1
SRLG Values : 100
```

signalled-bandwidth

To configure the bandwidth required for an MPLS-TE tunnel, use the **signalled-bandwidth** command in interface configuration mode. To disable the behavior, use the **no** form of this command.

signalled-bandwidth {*bandwidth* [**class-type** *ct*] | **sub-pool** *bandwidth*}
no signalled-bandwidth {*bandwidth* [**class-type** *ct*] | **sub-pool** *bandwidth*}

Syntax Description

bandwidth	Bandwidth required for an MPLS-TE tunnel. Bandwidth is specified in kilobits per second. By default, bandwidth is reserved in the global pool. Range is from 0 to 4294967295.
class-type *ct*	(Optional) Configures the class type of the tunnel bandwidth request. Range is from 0 to 1. Class-type 0 is strictly equivalent to global-pool. Class-type 1 is strictly equivalent to subpool.
sub-pool *bandwidth*	Reserves the bandwidth in the subpool instead of the global pool. Range is 1 to 4294967295. A subpool bandwidth value of 0 is not allowed.

Command Default

The default is 0 in class-type 0.

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **signalled-bandwidth** command supports two bandwidth pools (class-types) for the Diff-Serv Aware TE (DS-TE) feature. This command is also used as the bandwidth startup value to bring up the auto bandwidth enabled tunnels.

Note The Cisco Diff-Serve Aware TE feature is compliant to IETF standard and will interoperate with third party vendor DS-TE. Both Russian Doll Model and Maximum Allocation Model for bandwidth allocation are supported. We recommended that IETF terminology be used in DS-TE bandwidth configurations, namely, Class-type (CT) and Bandwidth Constraints (BC).

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This example shows how to set the bandwidth required for an MPLS-TE tunnel to 1000 in the global pool (class-type 0):

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# signalled-bandwidth 1000

RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# signalled-bandwidth 1000 class-type 0
```

This example shows how to set the bandwidth required for an MPLS-TE tunnel to 1000 in the sub-pool (class-type 1):

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# signalled-bandwidth sub-pool 1000

RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# signalled-bandwidth 1000 class-type 1
```

signalled-name

To configure the name of the tunnel required for an MPLS-TE tunnel, use the **signalled-name** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

signalled-name *name*
no signalled-bandwidth *name*

Syntax Description

name	Name used to signal the tunnel.

Command Default

Default name is the hostname_tID, where ID is the tunnel interface number.

Command Modes

Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the tunnel name:

```
RP/0/RP0/CPU0:router(config)# interface tunnel-te 1
RP/0/RP0/CPU0:router(config-if)# signalled-name tunnel-from-NY-to-NJ
```

signalling advertise explicit-null (MPLS-TE)

To specify that tunnels terminating on a router use explicit-null labels, use the **signalling advertise explicit-null** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

signalling advertise explicit-null
no signalling advertise explicit-null

Syntax Description

This command has no arguments or keywords.

Command Default

Implicit-null labels are advertised.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **signalling advertise explicit-null** command to specify that tunnels terminating on this router use explicit-null labels. This command applies to tunnel labels advertised to next to last (penultimate) hop.

The explicit label is used to carry quality-of-service (QoS) information up to the terminating-end router of the label switched path (LSP).

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure explicit null tunnel labels:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# signalling advertise explicit-null
```

snmp traps mpls traffic-eng

To enable the router to send Multiprotocol Label Switching traffic engineering (MPLS-TE) Simple Network Management Protocol (SNMP) notifications or informs, use the **snmp traps mpls traffic-eng** command in XR Config mode. To disable this behavior, use the **no** form of this command.

snmp traps mpls traffic-eng [*notification-option*] **preempt**
no snmp traps mpls traffic-eng [*notification-option*]

Syntax Description

notification-option	(Optional) Notification option to enable the sending of notifications to indicate changes in the status of MPLS-TE tunnels. Use one of these values: • up • down • reoptimize • reroute • cisco-ext
preempt	Enables MPLS-TE tunnel preempt trap.

Command Default

None

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

If the command is entered without the *notification-option* argument, all MPLS-TE notification types are enabled.

SNMP notifications can be sent as either traps or inform requests.

The **snmp-server enable traps mpls traffic-eng** command enables both traps and inform requests for the specified notification types. To specify whether the notifications should be sent as traps or informs, use the **snmp-server host** command and specify the keyword **trap** or **informs**.

If you do not enter the **snmp traps mpls traffic-eng** command, no MPLS-TE notifications controlled by this command are sent. To configure the router to send these MPLS-TE SNMP notifications, you must enter at least one **snmp enable traps mpls traffic-eng** command. If you enter the command with no keywords, all MPLS-TE notification types are enabled. If you enter the command with a keyword, only the notification type related to that keyword is enabled. To enable multiple types of MPLS-TE notifications, you must issue a separate **snmp traps mpls traffic-eng** command for each notification type and notification option.

The **snmp traps mpls traffic-eng** command is used in conjunction with the **snmp host** command. Use the **snmp host** command to specify which host or hosts receive MPLS-TE SNMP notifications. To send notifications, you must configure at least one **snmp host** command.

For a host to receive an MPLS-TE notification controlled by this command, both the **snmp traps mpls traffic-eng** command and the **snmp host** command for that host must be enabled.

Task ID

Task ID	Operations
mpls-te	read/write

Examples

This example shows how to configure a router to send MPLS-TE tunnel up SNMP notifications when a configured MPLS-TE tunnel leaves the down state and enters the up state:

```
RP/0/RP0/CPU0:router(config)# snmp traps mpls traffic-eng up
```

soft-preemption

To enable soft-preemption with default timeout on a head-end for the MPLS TE tunnel, use the **soft-preemption** command in MPLS TE mode. To disable this feature, use the **no** form of this command.

soft-preemption timeout *seconds*

no soft-preemption

timeout *seconds*	Defines the timeout for soft-preempted LSP, in seconds. The default timeout is 60. Range is from 30 to 300.

Command Default

The default *timeout seconds*is 60 seconds.

Command Modes

MPLS TE configuration

Tunnel Interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
MPLS-TE	write

This example shows how to enable soft-preemption on a specific tunnel:

```
RP/0/RP0/CPU0:router(config)#interface tunnel-te 50
RP/0/RP0/CPU0:router(config-if)#soft-preemption
```

This example shows how to enable soft-preemption on a node :

```
RP/0/RP0/CPU0:router(config)#mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#soft-preemption
RP/0/RP0/CPU0:router(config-soft-preemption)#
```

soft-preemption frr-rewrite

To enable LSP traffic over backup tunnel, when LSP is soft-preempted, use the **soft-preemption frr-rewrite** command in MPLS TE configuration mode. To disable the LSP traffic over backup tunnel, use the **no** form of this command.

soft-preemption frr-rewrite
no soft-preemption frr-rewrite

Syntax Description

This command has no keywords or arguments.

Command Default

FRR LSP traffic over backup tunnel is disabled.

Command Modes

MPLS TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The fast re-route backup tunnel must be available and ready for the traffic of the preempted LSP to be moved onto the FRR backup. The traffic will not be moved to the backup tunnel, if an LSP is already soft-preempted.

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to enable FRR LSP traffic over backup tunnels, when the LSP is soft-preempted.

```
RP/0/RP0/CPU0:router#configure
RP/0/RP0/CPU0:router(config)#mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)#soft-preemption frr-rewrite
```

srlg

To configure an MPLS traffic engineering shared-risk link group (SRLG) value for a link on a given interface, use the **srlg** command in global configuration mode. To disable this configuration, use the **no** form of this command.

srlg *value*
no srlg *value*

Syntax Description

value	Value number that identifies the SRLG. Range is 0 to 4294967295.

Command Default

Shared Risk Link Group memberships are not configured.

Command Modes

MPLS-TE interface configuration

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

You can enter up to 30 SRLG entries on the ingress and egress ports of the interface. SRLG entries configured over 30 are silently dropped.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure an SRLG with 10 member links:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-mpls-te-if)# srlg 10
```

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router#(config)# srlg
RP/0/RP0/CPU0:router#(config-srlg)# interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router#(config-srlg-if)# value 10
```

timers loose-path (MPLS-TE)

To configure the period between the headend retries after path errors, use the **timers loose-path** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

timers loose-path retry-period *value*
no timers loose-path retry-period *value*

Syntax Description

retry-period *value*	Configures the time, in seconds, between retries upon a path error. Range is 30 to 600.

Command Default

value: 120

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to the period between retries after path errors to 300 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# timers loose-path retry-period 300
```

timers removal unused (auto-tunnel backup)

To configure the frequency at which a timer scans backup autotunnels and removes tunnels that are not in use, use the **timers removal unused (auto-tunnel backup)** command in auto-tunnel backup configuration mode. To return to the default behavior, use the **no** form of this command.

timers removal unused *frequency*
no timers removal unused *frequency*

Syntax Description

frequency	Frequency, in minutes, between backup autotunnel scans to remove tunnels that are not used. Range is 0; 5 to 10080 minutes (7 days). A value of 0 disables the scanning and removal of tunnels.

Command Default

frequency: 60

Command Modes

auto-tunnel backup configuration

Command History

Release	Modification
Release 6.0	This command was introduced

Usage Guidelines

The **unused** auto-tunnel backup tunnel is the tunnel that is not assigned to protect any FRR tunnel.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows that unused automatic backup tunnels are removed after the 10 minute timer scan is reached.

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# auto-tunnel backup
RP/0/RP0/CPU0:router(config-te-auto-bk)# timers removal unused 10
```

timeout (soft-preemption)

To override the soft-preemption default timeout, use the **timeout** command in MPLS TE mode. To remove this configuration, use the **no** form of this command.

soft-preemption timeout *seconds*

no soft-preemption

Syntax Description

timeout *seconds*	Defines the timeout for soft-preempted LSP, in seconds. The default timeout is 60. Range is from 30 to 300.

Command Default

The default *timeout seconds* is 60 seconds.

Command Modes

MPLS TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
MPLS-TE	write

This example shows how to override the soft-preemption default timeout:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# soft-preemption
RP/0/RP0/CPU0:router(config-soft-preemption)# timeout 60
```

topology holddown sigerr (MPLS-TE)

To specify the time that a router should ignore a link in its TE topology database in tunnel path constrained shortest path first (CSPF) computations following a TE tunnel signaling error on the link, use the **topology holddown sigerr** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

topology holddown sigerr *seconds*
no topology holddown sigerr *seconds*

Syntax Description

seconds	Time that the router ignores a link during tunnel path calculations, following a TE tunnel error on the link, specified in seconds. Range is 0 to 300. Default is 10.

Command Default

seconds: 10

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command was introduced

Usage Guidelines

A router at the headend for TE tunnels can receive a Resource Reservation Protocol (RSVP) No Route error message before the router receives a topology update from the IGP routing protocol announcing that the link is down. When this happens, the headend router ignores the link in subsequent tunnel path calculations to avoid generating paths that include the link and are likely to fail when signaled. The link is ignored until the router receives a topology update from its IGP or a link holddown timeout occurs. Use the **topology holddown sigerr** command to change the link holddown time from its 10-second default value.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the link holddown time for signaling errors at 15 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# topology holddown sigerr 15
```

tunnel-id (auto-tunnel backup)

To configure the range of tunnel interface numbers to be used for automatic backup tunnels, use the **tunnel-id** command in auto-tunnel backup configuration mode. To delete the automatic backup tunnels, use the **no** form of this command.

tunnel-id
min *number*
max *number*
no tunnel-id

Syntax Description

min	(Optional) Minimum number for automatic backup tunnels.
number	Valid values are from 0 to 65535.
max	(Optional) Maximum number for automatic backup tunnels.

Command Default

No default behavior or values

Command Modes

Auto-tunnel backup configuration

Command History

Release	Modification
Release 6.0	This command was introduced

Usage Guidelines

If you increase the tunnel ID range, the automatic backup tunnels that failed earlier will get created the next time automatic backup assignments are processed.

Restrictions:

- Command is rejected if the **max** value minus**min** value is >= 1K.
- Command is rejected if **min** value > **max** value.
- Command is rejected if **min** value is greater than the tunnel ID of an existing automatic backup tunnel.
- Command is rejected if **max** value is smaller than the tunnel ID of an existing automatic backup tunnel.
- Command is rejected if a statically configured tunnel ID matches with the configured **min** and **max** range of values.
- Command is rejected if a static backup assignment is already configured to a tunnel with an ID within the **min** value /**max** value range.

Task ID

Task ID	Operation
mple-te	read, write

Example

The following example allows 800 automatic backup tunnels to be created:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# auto-tunnel backup
RP/0/RP0/CPU0:router(config-te-auto-bk)# tunnel-id min 1200 max 2000
```



RSVP Infrastructure Commands

Note All commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router that is introduced from Cisco IOS XR Release 6.3.2. References to earlier releases in Command History tables apply to only the Cisco NCS 5500 Series Router.

Note

- Starting with Cisco IOS XR Release 6.6.25, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 560 Series Routers.
- Starting with Cisco IOS XR Release 6.3.2, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router.
- References to releases before Cisco IOS XR Release 6.3.2 apply to only the Cisco NCS 5500 Series Router.
- Cisco IOS XR Software Release 7.0.1 specific updates are not applicable for the following variants of Cisco NCS 540 Series Routers:
  - N540-28Z4C-SYS-A
  - N540-28Z4C-SYS-D
  - N540X-16Z4G8Q2C-A
  - N540X-16Z4G8Q2C-D
  - N540X-16Z8Q2C-D
  - N540-12Z20G-SYS-A
  - N540-12Z20G-SYS-D
  - N540X-12Z16G-SYS-A
  - N540X-12Z16G-SYS-D

This module describes the commands used to configure and use Resource Reservation Protocol (RSVP). RSVP is a signaling protocol used to set up, maintain, and control end-to-end quality-of-service (QoS)

reservations over IP. RSVP is specified in Internet Engineering Task Force (IETF) RFC 2205 (ftp://ftp.isi.edu/in-notes/rfc2205.txt).

The protocol has been extended to signal Multiprotocol Label Switching traffic engineering (MPLS-TE) tunnels, as specified in the IETF RFC 3209, *RSVP-TE: Extensions to RSVP for LSP Tunnels*. The RSVP implementation supports fault handling as specified in IETF RFC 3473, *Generalized Multiprotocol Label Switching* (GMPLS) Signaling RSVP-TE extensions. The RSVP implementation also supports cryptographic authentication and refresh overhead reduction as specified in the RFC2747, *RSVP Cryptographic Authentication* and RFC2961, *RSVP Refresh Overhead Reduction Extensions* respectively.

For detailed information about MPLS concepts, configuration tasks, and examples, see *MPLS Configuration Guide for Cisco NCS 5500 Series RoutersMPLS Configuration Guide for Cisco NCS 540 Series RoutersMPLS Configuration Guide*.

Disable or Enable RSVP Message Checksum

RSVP computes and sets the checksum field on all outgoing RSVP messages, by default. RSVP also verifies the received checksum on all RSVP received messages to ensure its integrity.

A CLI is provided to override this default behavior and revert to the behavior exhibited in prior releases, whereby RSVP neither computes or sets the RSVP checksum field on outgoing RSVP messages, nor does it verify the checksum on received RSVP messages. This CLI is :

```
RP/0/RP0/CPU0:router(config)#rsvp signalling checksum disable
```

Note When the **rsvp signalling checksum disable** command is configured, RSVP sets a zero checksum on all outgoing RSVP messages and ignores the checksum on all received RSVP incoming messages.

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authentication (RSVP)

To enter RSVP authentication mode, use the **authentication** command in global configuration mode, RSVP interface configuration mode, or RSVP neighbor XR Config mode. To remove authentication parameters in the applicable mode, use the **no** form of this command.

authentication
no authentication

Syntax Description

This command has no arguments or keywords.

Command Default

The default value is no authentication, which means that the feature is disabled.

Command Modes

XR Config mode

RSVP interface configuration

RSVP neighbor configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enter RSVP authentication configuration mode from global configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp authentication
RP/0/RP0/CPU0:router(config-rsvp-auth)#
```

The following example shows how to activate the RSVP on an interface and enter RSVP authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# authentication
RP/0/RP0/CPU0:router(config-rsvp-if-auth)#
```

The following example shows how to configure the RSVP neighbor with IP address 10.0.0.1 and enter neighbor authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp neighbor 10.0.0.1 authentication
RP/0/RP0/CPU0:router(config-rsvp-nbor-auth)#
```

bandwidth mam (RSVP)

To configure RSVP bandwidth on an interface using the Maximum Allocation Model (MAM) bandwidth constraints model, use the **bandwidth mam** command in RSVP interface configuration mode. To return to the default behavior, use the **no** form of this command.

bandwidth mam [**percentage**] {*total-reservable-bandwidth* | **max-reservable-bw** *maximum-reservable-bw*} [*largest-reservable-flow* [**bc0** *reservable-bandwidth*] [**bc1** *reservable-bw*]]
no bandwidth mam

Syntax Description

total-reservable- bandwidth	Total reservable bandwidth (in Kbps, Mbps or Gbps) that RSVP accepts for reservations on this interface. Range is 0 to 4294967295.
max-reservable-bw *maximum-reservable-bw*	Configures the maximum reservable bandwidth (in Kbps, Mbps or Gbps) that RSVP accepts for reservations on this interface. Range is 0 to 4294967295.
largest-reservable-flow	(Optional) Largest reservable flow (in Kbps, Mbps or Gbps) that RSVP accepts for reservations on this interface. Range is 0 to 4294967295.
bc0 *reservable-bandwidth*	(Optional) Configures the total reservable bandwidth in the bc0 pool (in Kbps, Mbps or Gbps).
bc1 *reservable-bw*	(Optional) Configures the total reservable bandwidth in the bc1 pool (in Kbps, Mbps or Gbps).
percentage	(Optional) Bandwidth as a percentage of physical link bandwidth.

Command Default

No default behavior or values.

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Both the MAM and RDM models can be configured on a single interface to allow switching between each model.

Note Non-stop forwarding (NSF) is not guaranteed when the bandwidth constraint model is changed.

Task ID

Task ID	Operations
mpls-te	read, write

Task ID	Operations
ouni	read, write

Examples

The following example shows how to limit the total of all RSVP reservations on an interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# bandwidth mam 7500
```

Examples

The following example shows how to allocate a percentage of total bandwidth to bc0 and bc1 pools:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# bandwidth mam percentage bc0 100 bc1 50
```

bandwidth rdm (RSVP)

To configure RSVP bandwidth on an interface using the Russian Doll Model (RDM) bandwidth constraints model, use the **bandwidth rdm** command in RSVP interface configuration mode. To return to the default behavior, use the **no** form of this command.

bandwidth rdm [**percentage**] {*total-reservable-bw* | **bc0** *total-reservable-bw* | **global-pool** *total-reservable-bw*} [*largest-reservable-flow*] [**bc1** *reservable-bw*] [**sub-pool** *reservable-bw*]
no bandwidth rdm

Syntax Description

total-reservable-bw	Total reservable bandwidth (in Kbps, Mbps or Gbps). The default value is expressed in Kbps.
bc0 *total-reservable-bw*	Reserves bandwidth in the bc0 pool (in Kbps, Mbps or Gbps).
global-pool	Reserves bandwidth in the global pool.
largest-reservable-flow	(Optional) Largest reservable flow (in Kbps, Mbps or Gbps). The default value is expressed in Kbps.
bc1	(Optional) Reserves bandwidth in the bc1 pool (in Kbps, Mbps or Gbps).
sub-pool	(Optional) Reserves bandwidth in the sub-pool.
reservable-bandwidth	Reservable bandwidth in the sub- and bc1 pools (in Kbps, Mbps or Gbps). The default value is expressed in Kbps.
percentage	(Optional) Bandwidth as a percentage of physical link bandwidth.

Command Default

No default behavior or values.

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Both the MAM and RDM bandwidth constraint models support up two bandwidth pools.

Cisco IOS XR software provides global configuration when switching between bandwidth constraint models. Both models are configured on a single interface to allow switching between models.

Note Non-stop forwarding (NSF) is not guaranteed when the bandwidth constraint model is changed.

The **global pool** and **sub-pool** keywords are included in this command for backward compatibility with prestandard DS-TE. The **global pool** keyword is equivalent to the **bc0** keyword. The **sub-pool** keyword is equivalent to the **bc1** keyword.

RDM is the default bandwidth constraint model used in both pre-standard and IETF mode.

Task ID

Task ID	Operations
mpls-te	read, write
ouni	read, write

Examples

The following example shows how to limit the total of all RSVP reservations on an interface to 7500 kbps, and allows each single flow to reserve no more than 1000 kbps:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# bandwidth rdm 7500 1000
```

Examples

The following example shows how to allocate a percentage of total bandwidth to bc0 and bc1 pools:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# bandwidth rdm percentage 100 bc0 100 bc1 50
```

bandwidth (RSVP)

To configure RSVP bandwidth on an interface using prestandard DS-TE mode, use the **bandwidth** command in RSVP interface XR Config mode. To reset the RSVP bandwidth on that interface to its default value, use the **no** form of this command.

bandwidth [**percentage**] [*total-reservable-bandwidth* [*largest-reservable-flow*] [**sub-pool** *reservable-bw*]] [**global-pool** *bandwidth* [**sub-pool** *reservable-bw*]] [**bc0** *bandwidth* [**bc1** *reservable-bw*]]
no bandwidth

Syntax Description

total-reservable-bandwidth	(Optional) Total reservable bandwidth (in Kbps, Mbps or Gbps) that RSVP accepts for reservations on this interface. Range is 0 to 4294967295.
largest-reservable-flow	(Optional) Largest reservable flow (in Kbps, Mbps or Gbps) that RSVP accepts for reservations on this interface. Range is 0 to 4294967295.
sub-pool *reservable-bw*	(Optional) Configures the total reservable bandwidth in the sub-pool (in Kbps, Mbps, or Gbps). Range is 0 to 4294967295.
bc0 *bandwidth*	(Optional) Configures the total reservable bandwidth in the bc0 pool (in Kbps, Mbps or Gbps). The default is Kbps. Range is 0 to 4294967295.
bc1 *reservable-bw*	(Optional) Configures the total reservable bandwidth in the bc1 pool (in Kbps, Mbps or Gbps).
global-pool *bandwidth*	(Optional) Configures the total reservable bandwidth in the global-pool. Range is 0 to 4294967295 Kbps.
percentage	(Optional) Bandwidth as a percentage of physical link bandwidth.

Command Default

sub-pool-bw: 0

Note If the command is entered without the optional arguments, the total bandwidth is set to 75 percent of the intrinsic bandwidth of the interface. (If the interface has zero intrinsic bandwidth, none are reserved.)

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

RSVP is enabled either using the **rsvp interface** command or when MPLS is configured on the interface. In addition, there are other instances in which RSVP is enabled automatically; for example, when an RSVP message is received on an interface that is not configured under RSVP or MPLS (such as out-of-band signaling for an Optical User Network Interface application).

If RSVP reservation messages are received on an interface different from the one through which the corresponding Path message was sent out, the interfaces are adjusted such that all resource reservations, such as bandwidth, are done on the outgoing interface of the Path message.

Prestandard DS-TE uses the Cisco proprietary mechanisms for RSVP signaling and IGP advertisements. This DS-TE mode does not interoperate with third-party vendor equipment. Note that prestandard DS-TE is enabled only after configuring the sub-pool bandwidth values on MPLS-enabled interfaces.



Note You can also configure RSVP bandwidth on an interface using IETF DS-TE mode. This mode supports multiple bandwidth constraint models, including the Russian Doll Model (RDM) and the Maximum Allocation Model (MAM) both with two bandwidth pools.

Task ID

Task ID	Operations
mpls-te	read, write
ouni	read, write

Examples

The following example shows how to limit the total of all RSVP reservations on HundredGigE interface 0/0/0/3 to 5000 Kbps:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# bandwidth 5000
```

Examples

The following example shows how to allocate a percentage of total bandwidth to bc0 and bc1 pools:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# bandwidth percentage bc0 100 bc1 50
```

clear rsvp authentication

To eliminate RSVP security association (SA) before the lifetime expires, use the **clear rsvp authentication** command in XR EXEC mode.

clear rsvp authentication [*type interface-path-id*] [**destination** *IP address*] [**source** *IP address*]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
destination *IP address*	(Optional) Eliminates the RSVP security associations (SA) before their lifetimes expire. All SAs with this destination IP address are cleared.
source *IP address*	(Optional) Eliminates the RSVP security associations (SA) before their lifetimes expire. All SAs with this source IP address are cleared.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **clear rsvp authentication** command for the following reasons:

- To eliminate security associations before their lifetimes expire
- To free up memory
- To resolve a problem with a security association being in an indeterminate state

You can delete all RSVP security associations if you do not enter an optional filter (interface, source, or destination IP address).

If you delete a security association, it is recreated as needed.

Task ID

Task ID	Operations
mpls-te	execute

Examples

The following example shows how to clear each SA:

```
RP/0/RP0/CPU0:router# clear rsvp authentication
```

The following example shows how to clear each SA with the destination address 10.0.0.1:

```
RP/0/RP0/CPU0:router# clear rsvp authentication destination 10.0.0.1
```

The following example shows how to clear each SA with the source address 172.16.0.1:

```
RP/0/RP0/CPU0:router# clear rsvp authentication source 172.16.0.1
```

The following example shows how to clear each SA with the interface:

```
RP/0/RP0/CPU0:router# clear rsvp authentication HundredGigE 0/0/0/3
```

The following example shows how to clear each SA on the interface, destination address 10.0.0.1, and source address 172.16.0.1:

```
RP/0/RP0/CPU0:router# clear rsvp authentication HundredGigE 0/0/0/3 destination 10.0.0.1
source 172.16.0.1
```

clear rsvp counters all

To clear (set to zero) all RSVP message and event counters that are being maintained by the router, use the **clear rsvp counters all** command in XR EXEC mode.

clear rsvp counters all [*type interface-path-id*]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to clear all message and event counters:

```
RP/0/RP0/CPU0:router# clear rsvp counters all
```

clear rsvp counters authentication

To eliminate RSVP counters for each security association (SA), use the **clear rsvp counters authentication** command in XR EXEC mode.

clear rsvp counters authentication [*type interface-path-id*] [**destination** *IP address*][**source** *IP address*]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
destination *IP address*	(Optional) Eliminates authentication-related statistics for each security association (SA) with this destination IP address.
source *IP address*	(Optional) Eliminates authentication-related statistics for each security association (SA) with this source IP address.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute

Examples

The following example shows how to clear authentication counters for each SA:

```
RP/0/RP0/CPU0:router# clear rsvp counters authentication
```

The following example shows how to clear authentication counters for each SA with the destination address 10.0.0.1:

```
RP/0/RP0/CPU0:router# clear rsvp counters authentication destination 10.0.0.1
```

The following example shows how to clear authentication counters for each SA with the source address 172.16.0.1:

```
RP/0/RP0/CPU0:router# clear rsvp counters authentication source 172.16.0.1
```

The following example shows how to clear authentication counters for each SA with an interface.

```
RP/0/RP0/CPU0:router# clear rsvp counters authentication HundredGigE 0/0/0/3
```

The following example shows how to clear authentication counters for each SA on an interface, destination address 10.0.0.1, and source address 172.16.0.1:

```
RP/0/RP0/CPU0:router# clear rsvp counters authentication HundredGigE 0/0/0/3 destination
10.0.0.1 source 172.16.0.1
```

clear rsvp counters chkpt

To clear RSVP checkpoint counters, use the **clear rsvp counters chkpt** command in XR EXEC mode.

clear rsvp counters chkpt

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to clear all message and event counters:

```
RP/0/RP0/CPU0:router# clear rsvp counters chkpt
```

clear rsvp counters events

To clear (set to zero) all RSVP event counters that are being maintained by the router, use the **clear rsvp counters events** command in XR EXEC mode.

clear rsvp counters events [*type interface-path-id*]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **clear rsvp counters events** command to set all RSVP event counters to zero.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to clear all event counters:

```
RP/0/RP0/CPU0:router# clear rsvp counters events
```

clear rsvp counters messages

To clear (set to zero) all RSVP message counters that are being maintained by the router, use the **clear rsvp counters messages** command in XR EXEC mode.

clear rsvp counters messages [*type interface-path-id*]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **clear rsvp counters messages** command to set all RSVP message counters to zero.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set all RSVP message counters for an interface to zero:

```
RP/0/RP0/CPU0:router# clear rsvp counters messages HundredGigE0/0/0/3
```

clear rsvp counters oor

To clear internal RSVP counters on out of resources (OOR) events, use the **clear rsvp counters oor** command in XR EXEC mode.

clear rsvp counters oor [*type interface-path-id*]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **clear rsvp counters oor** command to set RSVP OOR counters to zero.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example show how to clear all RSVP message counters for HundredGigE interface 0/0/0/3 to zero:

```
RP/0/RP0/CPU0:router# clear rsvp counters oor HundredGigE0/0/0/3
```

clear rsvp counters prefix-filtering

To clear internal prefix-filtering related RSVP counters, use the **clear rsvp counters prefix-filtering** command in XR EXEC mode.

clear rsvp counters prefix-filtering {**interface** [*type* *interface-path-id*] | **access-list** [*aclname*]}

Syntax Description

interface	Clears RSVP prefix-filtering counters for all interfaces.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
access-list	Clears RSVP prefix-filtering counters for access control list.
aclname	(Optional) Name of the access list.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **clear rsvp counters prefix-filtering** command to set RSVP prefix-filtering related RSVP counters to zero.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set all RSVP message counters for HundredGigE interface 0/0/0/3 to zero:

```
RP/0/RP0/CPU0:router# clear rsvp counters prefix-filtering interface HundredGigE0/0/0/3
```

The following example shows how to set all RSVP prefix-filtering counters for access-list banks to zero:

```
RP/0/RP0/CPU0:router# clear rsvp counters prefix-filtering access-list banks
```

key-source key-chain (RSVP)

To specify the source of the key information to authenticate RSVP messages, use the **key-source key-chain** command in the appropriate RSVP authentication configuration mode. To remove the key source from the appropriate RSVP authentication configuration mode, use the **no** form of this command.

key-source key-chain *key-chain-name*
no key-source key-chain *key-chain-name*

Syntax Description

key-chain-name	Name of the keychain. The maximum number of characters is 32.

Command Default

The default value is none, which means that the key source is not specified.

Command Modes

RSVP authentication configuration

RSVP interface authentication configuration

RSVP neighbor authentication configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

- RSVP authentication is enabled regardless of whether or not the specified keychain exists or has no available keys to use. If the specified keychain does not exist or there are no available keys in the keychain, RSVP authentication processing fails.
- The **key-source key-chain** command does not create a keychain but just specifies which keychain to use. You must configure a keychain first.
- The **no key-source key-chain** command does not necessarily disable the authentication.
- RSVP authentication supports only keyed-hash message authentication code (HMAC)-type algorithms.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows that the source of the key information is specified for the keychain mpls-keys in RSVP authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp authentication
RP/0/RP0/CPU0:router(config-rsvp-auth)# key-source key-chain mpls-keys
```

The following example shows that the source of the key information is specified for the keychain mpls-keys for a HundredGigE interface in RSVP authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# authentication
RP/0/RP0/CPU0:router(config-rsvp-if-auth)# key-source key-chain mpls-keys
```

The following example shows that the source of the key information is specified for the keychain mpls-keys in RSVP neighbor authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp neighbor 10.0.0.1 authentication
RP/0/RP0/CPU0:router(config-rsvp-nbor-auth)# key-source key-chain mpls-keys
```

life-time (RSVP)

To control how long RSVP maintains idle security associations with other trusted RSVP neighbors, use the **life-time** command in the appropriate RSVP authentication configuration mode. To disable the lifetime setting, use the **no** form of this command.

life-time *seconds*
no life-time *seconds*

Syntax Description

seconds	Length of time, in seconds, that RSVP maintains security associations with other trusted RSVP neighbors. Range is 30 to 86400.

Command Default

seconds: 1800 (30 minutes)

Command Modes

RSVP authentication configuration

RSVP interface authentication configuration

RSVP neighbor authentication configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **life-time (RSVP)** command to indicate when to end idle security associations with RSVP trusted neighbors.

By setting a larger lifetime, the router remembers the state for a long period time which provides better protection against a replay attack.

Use the **clear rsvp authentication** command to free security associations before their lifetimes expire.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure a lifetime of 2000 seconds for each SA in RSVP authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp authentication
RP/0/RP0/CPU0:router(config-rsvp-auth)# life-time 2000
```

The following example shows how to configure a lifetime of 2000 seconds for each SA in RSVP neighbor authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp neighbor 10.0.0.1 authentication
RP/0/RP0/CPU0:router(config-rsvp-nbor-auth)# life-time 2000
```

The following example shows how to configure a lifetime of 2000 seconds for each SA in RSVP interface authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# authentication
RP/0/RP0/CPU0:router(config-rsvp-if-auth)# life-time 2000
```

mpls traffic-eng lsp-oor

To set LSP out-of-resource (OOR) parameters, use the **mpls traffic-eng lsp-oor** command in XR Config mode. To remove LSP OOR parameter settings, use the **no** form of this command.

mpls traffic-eng lsp-oor [{ **green** | **red** | **yellow** } **action** { **accept reopt-lsp** | **admit lsp-min-bw** *value* | **flood** { **available-bw** *value* | **te-metric penalty** *value* } } | { **yellow** | **red** } { **transit-all** | **transit-unprotected** } **threshold** *value* | **green recovery-duration** *minutes*]

no mpls traffic-eng lsp-oor [{ **green** | **red** | **yellow** } **action** { **accept reopt-lsp** | **admit lsp-min-bw** *value* | **flood** { **available-bw** *value* | **te-metric penalty** } } | { **yellow** | **red** } { **transit-all** | **transit-unprotected** } **threshold** | **green recovery-duration**]

Syntax Description

{**green**|**red**|**yellow**}	(Optional) Specifies a color option for identifying specific actions noted with the **action** keyword. Here, *green* signifies *normal* state, *red* signifies *major* state, and *yellow* signifies *minor* state.
action {**accept reopt-lsp**|**admit lsp-min-bw** *value*|**flood** {**available-bw** *value*|**te-metric penalty** *value*}}	(Optional) Specifies one of the three actions for the selected state: • **accept reopt-lsp** – Accepts a reoptimized LSP sharing the same link in the selected state as the current LSP. If not enabled, reoptimized LSPs are rejected. • **admit lsp-min-bw** *value* – Accept LSPs with a bandwidth that is at least equal to the specified bandwidth. The default value is 0. • **flood te-metric penalty** *value* – Adds a penalty value to the TE metric of the links in the specified state. This metric is flooded for all links on the router. The default value is 0. • **flood available-bw** *value* – Specifies the percentage of available bandwidth for all links. The default value is 100%.

{**yellow**|**red**}{**transit-all**|**transit-protected**} **threshold** *value*	(Optional) Specifies a threshold value for mid-point (or transit) LSRs, for the yellow and red color options. • **transit-all** – Specifies that the threshold value be applied for all mid-point routers. • **transit-unprotected** – Specifies that the threshold value be applied for unprotected mid-point routers. • **threshold** *value* – Specifies the threshold value.
green recovery-duration *minutes*	(Optional) Specifies the time duration for an LSP action in the *green* state, after recovery. The default value is 0 minutes.

Command Default

LSP OOR parameters are disabled.

Command Modes

Global Configuration

Command History

Release	Modification
Release 7.3.2	This command was introduced.

Usage Guidelines

Use the **mpls traffic-eng lsp-oor .. action flood available-bw** *value* command form to lower the available bandwidth on the link, potentially reducing the number of states that would be possible to set up over the link.

Use the **mpls traffic-eng lsp-oor .. action flood te-metric penalty** *value* command form to add to the flooded TE metric (in the MPLS-TE topology). This serves as a deterrent for LERs to set up LSPs over this link.

Use the **mpls traffic-eng lsp-oor** .. **action admit lsp-min-bw** *value* command form to admit only new LSPs with signaled bandwidth that exceeds the bandwidth value. This restricts the number of new transit LSPs to only a few high bandwidth LSPs.

Use the **mpls traffic-eng lsp-oor** .. **action accept reopt-lsp** command form to recover the condition when LSPs run into *Yellow* or *Red* states, by allowing existing LSPs to re-optimize.

Use the **mpls traffic-eng lsp-oor** .. **green recovery-duration** *minutes* command form to determine how long the actions are taken in the LSP OOR *Green* state after recovery. In other words, moving from yellow state to green state or red state to green state.

The following example shows how to configure the time duration for an LSP action in the *green* state, after recovery

```
Router# configure
Router(config)# mpls traffic-eng lsp-oor green recovery-duration 10
Router(config)# commit
Router(config)# end
```

The following example shows the output for the **show mpls traffic-eng lsp-oor summary** command. The main counters track the current OOR state, OOR thresholds, transitions, and the number of LSPs rejected due to OOR.

```
Router# show mpls traffic-eng lsp-oor summary

Total Transit LSPs: 5001
Total Transit Unprotected LSPs: 0
LSP OOR Status: Yellow; Changed last at: Wed May 15 17:05:48 2019
LSP OOR Green State Parameters:
  Available Bandwidth percentage: 100%
  TE Metric Penalty: 0
  Minimum LSP Size: 0 kbps
  Accept Reopt: FALSE
  Transition duration: 0 minutes
  Statistics:
    Transitions 0; LSPs accepted 5001, rejected 0
    Reopt accepted 0, rejected 0
LSP OOR Yellow State Parameters:
  Available Bandwidth percentage: 0%
  TE Metric Penalty: 0
  Minimum LSP Size: 10000 kbps
  Accept Reopt: TRUE
  Transit LSP Threshold: 5000
  Transit Unprotected LSP Threshold: No limit
  Statistics:
    Transitions 1; LSPs accepted 0, rejected 999
    Reopt accepted 0, rejected 0
LSP OOR Red State Parameters:
  Available Bandwidth percentage: 0%
  TE Metric Penalty: 0
  Minimum LSP Size: 10000 kbps
  Accept Reopt: FALSE
  Transit LSP Threshold: 10000
  Transit Unprotected LSP Threshold: No limit
  Statistics:
    Transitions 0; LSPs accepted 0, rejected 0
    Reopt accepted 0, rejected 0
```

rsvp

To enable functionality for Resource Reservation Protocol (RSVP) and enter RSVP configuration commands, use the **rsvp** command in XR Config mode. To return to the default behavior, use the **no** form of this command.

rsvp
no rsvp

Syntax Description

This command has no keywords or arguments.

Command Default

No default behavior or values

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable RSVP functionality and enter the sub-mode for RSVP configuration commands:

```
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)#
```

rsvp interface

To configure RSVP on an interface, use the **rsvp interface** command in XR Config mode. To disable RSVP on that interface, use the **no** form of this command.

rsvp interface *type interface-path-id*
no rsvp interface *type interface-path-id*

Syntax Description

type	Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.

Command Default

RSVP is enabled by default on an interface under the following conditions. (Enabling RSVP on an interface means that interface can be used by RSVP to send and receive RSVP messages).

- RSVP is configured on that interface using the **rsvp interface** command.
- MPLS is configured on that interface.

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

When RSVP is enabled on an interface by any of the three methods mentioned in the above section, the default bandwidth is 0. Use the bandwidth command in RSVP interface configuration mode to configure the bandwidth on an interface.

If the interface bandwidth is 0, RSVP can be used only to signal flows that do not require bandwidth on this interface.

The **rsvp interface** command enables the RSVP interface configuration mode.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable the RSVP interface configuration mode and to enable RSVP on this interface with 0 bandwidth:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
```

rsvp neighbor

To specify an RSVP neighbor, use the **rsvp neighbor** command in XR Config mode. To deactivate authentication for a neighbor, use the **no** form of this command.

rsvp neighbor *IP-address* **authentication**
no rsvp neighbor *IP-address* **authentication**

Syntax Description

IP-address	IP address of the neighbor. A single IP address of a specific neighbor; usually one of the neighbor's physical or logical (loopback) interfaces.
authentication	Configures RSVP authentication parameters.

Command Default

No default values or behaviors

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

RSVP neighbor configuration mode can be used only if you want to configure authentication for a particular neighbor.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enter RSVP neighbor authentication configuration mode for IP address 10.0.0.1:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp neighbor 10.0.0.1 authentication
RP/0/RP0/CPU0:router(config-rsvp-nbor-auth)#
```

show rsvp request

To list all the requests that RSVP knows about on a router, use the **show rsvp request** command in XR EXEC mode.

show rsvp request [**destination** *IP-address*] [**detail**] [**dst-port** *port-num*] [**session-type** { **lsp-p2p** }] [**source** *IP-address*] [**src-port** *port-num*]

Syntax Description

detail	(Optional) Displays multiline status for each path. If this keyword is not specified, only a single-line table entry is displayed.
destination *IP-address*	(Optional) Displays the entries that match the specified address.
dst-port *port-num*	(Optional) Displays destination port and tunnel information.
session-type	(Optional) Displays the entries that match the specified session type.
lsp-p2p	Displays the entries that are used for P2P sessions.
source *IP-address*	(Optional) Displays source address information.
src-port *port-num*	(Optional) Displays port and LSP ID information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

This command displays information about upstream reservations only; that is, reservations being sent to upstream hops. Information about downstream reservations (that is, incoming or locally created reservations) is available using the **show rsvp reservation** command.

Reservations are displayed in ascending order of destination IP address, destination port, source IP address, and source port.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp request** command:

```
RP/0/RP0/CPU0:router# show rsvp request
```

```
        Dest Addr DPort      Source Addr SPort Pro   OutputIF          Sty Serv Rate Burst

  ---------------- ----- ---------------- ----- --- ----------          --- ---- ---- -----

     192.168.40.40 2001     192.168.67.68     2   0  HundredGigE 0/0/0/3  SE LOAD    0
1K
```

The following is sample output from the **show rsvp request detail** command, which displays detailed information about all requests in the router. Requests are reservation states for the reservation messages sent upstream:

```
RP/0/RP0/CPU0:router# show rsvp request detail

  REQ:  IPv4-LSP Session addr: 192.168.40.40. TunID: 2001. LSPId: 2.
   Source addr: 192.168.67.68. ExtID: 192.168.67.68.
   Output interface: HundredGigE 0/0/0/3. Next hop: 192.168.67.68 (lih: 0x19700001).
   Flags: Local Receiver.
   Style: Shared-Explicit. Service: Controlled-Load.
   Rate: 0 bits/sec. Burst: 1K bytes. Peak: 0 bits/sec.
   MTU min: 0, max: 500 bytes.
   Policy:  Forwarding. Policy source(s): MPLS/TE.
   Number of supporting PSBs: 1
   Destination Add DPort       Source Add SPort Pro     Input IF            Rate Burst Prot

    192.168.40.40  2001        192.168.67.68 2   0    HundredGigE 0/0/0/3    0   1K    Off
   Number of supporting RSBs: 1
   Destination Add DPort       Source Add SPort Pro   Input IF Sty Serv Rate Burst
     192.168.40.40  2001       10.66.67.68  2   0      None SE LOAD     0    1K
```

This table describes the significant fields shown in the display.

Table 56: show rsvp request detail Command Field Descriptions

Field	Description
Number of supporting PSBs	Number of senders for this session (typically, 1).
Number of supporting RSBs	Number of reservations per session (typically, 1).
Policy	Admission control status.
Policy source	Entity performing the admission control.

show rsvp authentication

To display the database for the security association that RSVP has established with other RSVP neighbors, use the **show rsvp authentication** command in XR EXEC mode.

show rsvp authentication [*type interface-path-id*] [**destination** *IP-address*] [**detail**] [**mode** {**receive** | **send**}] [**neighbor** *IP-address*] [**source** *IP-address*]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
destination *IP-address*	(Optional) Displays the database for the security association (SA) for the destination IP address. The *IP address* argument is the IP address of the destination address.
detail	(Optional) Displays additional information about RSVP security SAs.
mode	(Optional) Specifies the SA type. An SA is used to authenticate either incoming (receive) or outgoing (send) messages.
receive	Displays SAs for incoming messages.
send	Displays SAs for outgoing messages.
neighbor *IP-address*	(Optional) Displays the RSVP authentication information for the neighbor IP address. The *IP-address* argument is the IP address of the neighbor. For the send SA, the neighbor address is the destination address. For receive, the neighbor address is the source address.
source *IP-address*	(Optional) Displays the database for the SA for the source IP address. The *IP-address* argument is the IP address of the source address.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following sample output displays information for RSVP authentication:

```
RP/0/RP0/CPU0:router# show rsvp authentication

  Codes: S - static, G - global, N - neighbor, I -interface, C - chain

  Source Address  Dest Address    Interface             Mode Key-Source Key-ID Code
  10.0.0.1          10.0.0.2      HundredGigE 0/0/0/3   Send mpls-keys    1    SGC
  10.0.0.2          10.0.0.1      HundredGigE 0/0/0/3   Recv mpls-keys    1    SGC
```

This table describes the significant fields shown in the display.

Table 57: show rsvp authentication Command Field Descriptions

Field	Description
Source Address	IP address of the sender. For Send mode, this is the local address (either the address of the Interface field or the local router ID). For Recv mode, this is the address of the RSVP neighbor.
Dest Address	IP address of the receiver. For Send mode, this is the address of the RSVP neighbor. For Recv mode, this is the local address (either the address of the Interface field or the local router ID).
Interface	Name of the interface over which the security association is being maintained.
Mode	Direction of the association for the following mode types: **Send** Authenticates messages that you forward. **Recv** Authenticates messages that you receive.
Key-Source	Key source identification string that is currently set to the configured keychain name.
Key-ID	The last successful key ID that is used for authentication and maps to the keychain ID configuration. If the value is too large to fit into the column, it is truncated and a (..) suffix is appended. Use the detail mode to see the non-truncated key ID.

Field	Description
Code	Code field has the following terms: **Static** Key is static and configured. **Global** Key is global-based. **Neighbor** Key is neighbor-based. **Interface** Key is interface-based. **Chain** Key is part of a keychain.

The following sample output shows detailed information about a Send mode SA that is followed by a Receive mode SA:

```
RP/0/RP0/CPU0:router# show rsvp authentication detail

  RSVP Authentication Information:
    Source Address:         10.0.0.1
    Destination Address:    10.0.0.2
    Neighbour Address:      10.0.0.2
    Interface:              HundredGigE 0/0/0/3
    Direction:              Send
    LifeTime:               1800 (sec)
    LifeTime left:          1305 (sec)
    KeyType:                Static Global KeyChain
    Key Source:             name1
    Key Status:             No error
    KeyID:                  1
    Digest:                 HMAC MD5 (16)
    Challenge:              Not supported
    TX Sequence:            5023969459702858020 (0x45b8b99b00000124)
    Messages successfully authenticated:    245
    Messages failed authentication:         0

  Receive Errors:
      Incomplete security association:      0
      Missing INTEGRITY object:             0
      Incorrect digest:                     0
      Digest type mismatch:                 0
      Duplicate sequence number:            0
      Out-of-range sequence number:         0
      Invalid message format:               0
```

This table describes the significant fields shown in the display.

Table 58: show rsvp authentication detail Command Field Descriptions

Field	Description
Source Address	IP address of the sender. For Send mode, this is the local address (either the address of the Interface field or the local router ID). For Recv mode, this is the address of the RSVP neighbor.
Destination Address	IP address of the receiver. For Send mode, this is the address of the RSVP neighbor. For Recv mode, this is the local address (either the address of the Interface field or the local router ID).
Neighbor Address	IP address of the RSVP neighbor with which the security association is being maintained.
Interface	Name of the interface over which the security association is being maintained.
Direction	Direction of the association for the following mode types: **Send** Authenticates messages that you forward. **Recv** Authenticates messages that you receive.
LifeTime	Configured expiration timer value.
LifeTime left	Number of seconds until the expiration timer expires.
KeyType	Keys that are used: **Static** Key is static and configured. **Global** Key is global-based. **Neighbor** Key is neighbor-based. **Interface** Key is interface-based. **Chain** Key is part of a keychain.
Key-Source	Key source identification string that is currently set to the configured keychain name.
Key Status	Last status reported from the key source.

Field	Description
Key-ID	Last successful key ID that is used for authentication and that maps to the keychain ID configuration. If the value is too large to fit into the column, it is truncated and a (..) suffix is appended. (Use the detail mode to see the non-truncated key ID.)
Digest	Digest algorithm that is used. The algorithms are either HMAC-MD5 or HMAC-SHA1.
Challenge	Current challenge status reported.
Tx Sequence	Last sequence number that was sent.
Messages successfully authenticated	Number of messages authenticated by using this SA.
Messages failed authentication	Number of messages that failed authentication using this SA.
Sequence Window Size	Maximum configured RX sequence number window.
Sequence Window Count	Currently used size of the RX sequence number window.
Incomplete security association	Number of messages that are dropped due to a key failure.
Incorrect digest	Number of messages that are dropped due to an incorrect digest.
Digest type mismatch	Number of messages that are dropped due to an incorrect digest length, which implies an algorithm mismatch.
Duplicate sequence number	Number of messages that are dropped due to a duplicate sequence number.
Out-of-range sequence number	Number of messages that are dropped due to a sequence number range (window-size) checking.
Invalid message format	Number of messages that are dropped due to formatting errors, such as incorrect objects.

show rsvp counters

To display internal RSVP counters, use the **show rsvp counters** command in XR EXEC mode mode.

show rsvp counters {**messages** [*type* *interface-path-id* | **summary**] | **events** | **database**}

Syntax Description

messages	Displays a historical count of the number of messages RSVP has received and sent on each interface along with a summation.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
summary	(Optional) Displays the aggregate counts of all interfaces.
events	Displays the number of states expired for lack of refresh and a count of received No Acknowledgements (NACKs).
database	Displays counters on RSVP database, including number of paths, session, and so on.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

In message counters, bundle messages are counted as single bundle messages. The component messages are not counted separately.

The **messages** keyword shows the counters for all the interfaces. In addition, the aggregate summary is shown by using both the **messages** and **summary** keywords.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp counters messages** command for HundredGigE 0/0/0/3:

```
RP/0/RP0/CPU0:router# show rsvp counters messages HundredGigE 0/0/0/3

    HundredGigE0/0/0/3      Recv     Xmit  Recv                Xmit
      Path                  24        1    Resv                   0        0
      PathError              0        0    ResvError              0        0
      PathTear               5        1    ResvTear               0        0
      ResvConfirm            0        0    Ack                   34        0
      Bundle                 0             Hello                  0        0
      SRefresh           10118        0    OutOfOrder             0
      Retransmit                      0    Rate Limited                    0
```

This table describes the significant fields shown in the display.

Table 59: show rsvp counters messages Command Field Descriptions

Field	Description
Path	Number of Path messages sent downstream or received from an upstream node.
PathError	Number of PathError messages received from a downstream neighbor or sent to an upstream neighbor.
PathTear	Number of PathTear messages sent downstream, or messages received, from upstream neighbors.
ResvConfirm	Number of ResvConfirm messages received from an upstream neighbor or sent to a downstream neighbor.
Bundle	Number of Bundle messages containing RSVP messages sent and received by the neighbor.
SRefresh	Number of Summary Refresh messages sent to and received by a neighbor to refresh the path and reservation states.
Retransmit	Number of messages retransmitted to ensure reliable messaging (related to refresh reduction).
Resv	Number of Reservation messages received from a downstream neighbor or sent to an upstream neighbor to reserve resources.
ResvError	Number of Reservation Error messages received from a upstream neighbor or sent to a downstream neighbor.
ResvTear	Number of Reservation Tear messages received from a downstream neighbor or sent to an upstream neighbor to tear down RSVP flows.
Ack	Number of Acknowledgement messages sent and received by a neighbor acknowledging receipt of a message.
Hello	Number of Hello messages sent to and received by a neighbor.
OutOfOrder	Number of messages received that are out of order.
Rate Limited	Number of RSVP packets affected by rate limiting.

The following is sample output from the **show rsvp counters database** command:

```
RP/0/RP0/CPU0:router# show rsvp counters database

  Sessions: 0
  Locally created and incoming paths: 0
  Outgoing paths: 0
  Locally created and incoming Reservations: 0
  Outgoing Reservations: 0
  Interfaces: 4
```

This table describes the significant fields shown in the display.

Table 60: show rsvp counters database Command Field Descriptions

Field	Description
Sessions	RSVP sessions.
Locally created and incoming paths	Path states created by : • A local application on the node. • Path message received from the network.
Outgoing paths	Outgoing path states.
Locally created and incoming Reservations	Reservations created by : • A local application on the node. • Path message received from the network.
Outgoing Reservations	Outgoing reservation (request) states.
Interfaces	Known RSVP interfaces.

show rsvp counters oor

To display internal RSVP counters on out of resources (OOR) events, use the **show rsvp counters oor** command in XR EXEC mode.

show rsvp counters oor [*type interface-path-id* | **summary**]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces**command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
summary	(Optional) Displays a summary of OOR events.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp counters oor** command:

```
RP/0/RP0/CPU0:router# show rsvp counters oor

  HundredGigE 0/0/0/3    Rejected
      Path                  24
  HundredGigE 0/0/0/4    Rejected
      Path                  31
  All RSVP Interfaces    Rejected
      Path                  55
```

This table describes the significant fields shown in the display.

Table 61: show rsvp counters oor Command Field Descriptions

Field	Description
Path	Number of Path messages received on the interface that were rejected due to oor conditions.

show rsvp counters prefix-filtering

To display internal prefix-filtering related RSVP counters, use the **show rsvp counters prefix-filtering** command in XR EXEC mode.

show rsvp counters prefix-filtering interface [*type interface-path-id* | **summary**] **access-list** [*aclname*]

Syntax Description

interface	Displays RSVP prefix-filtering counters for all interfaces.
type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
summary	(Optional) Displays a summary of RSVP prefix-filtering counters on all interfaces.
access-list	Displays RSVP prefix-filtering counters for the access control list.
aclname	(Optional) Name of the access control list.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Counters do not increment if you have not configured an access control list for prefix-filtering.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp counters prefix-filtering** command:

```
RP/0/RP0/CPU0:router# show rsvp counters prefix-filtering interface

  Routed        Fwd        Local        Drop         Def-Drop       Def-Proc      Total
```

```
  Path            4                                                   4
  PathTear        0                                                   0
  ResvConfirm     0                                                   0
  Total           4                                                   4


HundredGigE0/0/0/3      Fwd        Local        Drop         Def-Drop       Def-Proc     Total

  Path                        1            0              219              2          222
  PathTear                    0            0               31              0           31
  ResvConfirm                 0            0                0              0            0
  Total                       1            0              219              2          253


HundredGigE0/0/0/3   Fwd        Local        Drop         Def-Drop       Def-Proc       Total

  Path                        0            0                0              1            1
  PathTear                    0            0                0              0            0
  ResvConfirm                 0            0                0              0            0
  Total                       0            0                0              1            1

  ALL RSVP
  Interfaces    Fwd        Local        Drop         Def-Drop       Def-Proc       Total
  Path            4            1            0              219              3          227
  PathTear        0            0            0               31              0           31
  ResvConfirm     0            0            0                0              0            0
  Total           4            1            0              250              3          258
```

The following is sample output from the **show rsvp counters prefix-filtering interface** *type interface-path-id*command:

```
RP/0/RP0/CPU0:router# show rsvp counters prefix-filtering interface  HundredGigE 0/0/0/3


HundredGigE0/0/0/3      Fwd        Local        Drop         Def-Drop       Def-Proc     Total

  Path                        1            0              219              2          222
  PathTear                    0            0               31              0           31
  ResvConfirm                 0            0                0              0            0
  Total                       1            0              250              2          253
```

The following is sample output from the **show rsvp counters prefix-filtering interface summary** command:

```
RP/0/RP0/CPU0:router# show rsvp counters prefix-filtering interface summary

  ALL RSVP
  Interfaces    Fwd        Local        Drop         Def-Drop       Def-Proc       Total
  Path            4            1            0              219              3          227
  PathTear        0            0            0               31              0           31
  ResvConfirm     0            0            0                0              0            0
  Total           4            1            0              250              3          258
```

The following is sample output from the **show rsvp counters prefix-filtering access-list banks**command:

```
RP/0/RP0/CPU0:router# show rsvp counters prefix-filtering access-list banks

  ACL: banks            Forward          Local          Drop           Total
```

```
Path                    0               0               0               0
PathTear                0               0               0               0
ResvConfirm             0               0               0               0
Total                   0               0               0               0
```

This table describes the significant fields shown in the display.

Table 62: show rsvp counters prefix-filtering interface and summary CommandField Descriptions

Field	Description
Fwd	Number of messages forwarded to the next router. **Note** The messages are counted against the *routed* interface only because RSVP has no record of what interface the messages will be forwarded to.
Local	Number of messages not forwarded (because they are locally destined).
Drop	Number of messages dropped.
Def-Drop	Number of messages dropped when an access control list match returns an implicit deny. (Results when RSVP is configured to drop implicit deny messages.)
Def-Proc	Number of messages processed by RSVP when an access control list match returns an implicit deny.
Path	Number of Path messages.
PathTear	Number of Path Tear messages.
ResvConfirm	Number of ResvConfirm messages.

show rsvp fast-reroute

To display RSVP Fast-Reroute (FRR) information, use the **show rsvp fast-reroute** command in EXEC mode.

show rsvp fast-reroute [**destination** *IP -address*] [**dst-port** *port*] [**session-type** { **lsp-p2p**}] [**source** *IP-address*] [**src-port** *source-port*] [**summary**]

Syntax Description

destination *IP-address*	(Optional) Displays the entries that match the specified address.
dst-port *port*	(Optional) Displays the port address of the destination router.
session-type	(Optional) Displays the entries that match the specified session type.
lsp-p2p	Displays the entries that are used for P2P sessions.
source *IP-address*	(Optional) Displays the IP address of the source network.
src-port *source-port*	(Optional) Displays the port number of the source router.
summary	(Optional) Displays summarized information about the FRR database.

Command Default

None

Command Modes

EXEC

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This is sample output from the **show rsvp fast-reroute** command:

```
RP/0/RP0/CPU0:router# show rsvp fast-reroute

  Type            Destination          TunID          Source           PSBs           RSBs
  --------      ---------------     -----------    ------------       ---------      -------

  LSP4            10.10.10.10            1          10.20.20.20        Ready          Ready
```

This table describes the significant fields shown in the display.

Table 63: show rsvp fast-reroute Command Field Descriptions

Field	Description
Type	Type of session.
Destination	Destination address of session.
TunID	Tunnel ID number.
Source	Source address of session.
PSBs	PSB FRR[27] state.
RSBs	RSB FRR state.

[27] Fast reroute.

This is sample output from the **show rsvp fast-reroute summary** command:

```
RP/0/RP0/CPU0:router# show rsvp fast-reroute summary

  States            Total          Ready          Act-Wait           Active
  PSBs                1              1              0                  0
  RSBs                1              1              0                  0
```

This table describes the significant fields shown in the display.

Table 64: show rsvp fast-reroute summary Command Field Descriptions

Field	Description
States	FRR[28] state.
Total	Total number of path and reservation states.
Ready	Number of states in FRR ready state. No FRR processing has been done on these states.
Act-Wait	Number of states in “Active Wait” FRR state. • For PSBs, this indicates that after FRR the path message has not yet been sent. • For RSBs, this indicates that after FRR, the reservation message has not yet been received.
Active	Number of states in “Active” FRR state. • For PSBs, this indicates that after FRR the path message has been sent. • For RSBs, this indicates that after FRR, the reservation message has been received.

[28] Fast reroute.

show rsvp graceful-restart

To display the local graceful-restart information for RSVP, use the **show rsvp graceful-restart** command in XR EXEC mode.

show rsvp graceful-restart [**neighbors**] [*IP-address*] [**detail**]

Syntax Description

neighbors	(Optional) Displays single-line status for each neighbor. If this keyword is not specified, only a multiline table entry is displayed showing local graceful-restart information.
IP-address	(Optional) Address of the neighbor you are displaying. Displays a specific neighbor with that destination address only. If this keyword is not specified, all neighbors are displayed.
detail	(Optional) Displays multiline status for each neighbor. If this keyword is not specified, only a single-line table entry is displayed.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Graceful-restart neighbors are displayed in ascending order of neighbor IP address.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp graceful-restart** command:

```
RP/0/RP0/CPU0:router# show rsvp graceful-restart

  Graceful restart: enabled  Number of global neighbors: 1
  Local MPLS router id: 192.168.55.55
  Restart time: 60 seconds  Recovery time: 120 seconds
  Recovery timer: Not running
  Hello interval: 5000 milliseconds Maximum Hello miss-count: 4
```

This table describes the significant fields shown in the display.

Table 65: show rsvp graceful-restart Command Field Descriptions

Field	Description
Graceful restart	Indicates whether graceful restart is configured locally.
Number of global neighbors	Number of neighbors identified by a unique router ID.
Local MPLS router id	Local router ID used for the MPLS applications.
Restart time	Amount of time after a loss in hello messages within which RSVP hello session is reestablished. This setting is manually configurable.
Recovery time	Local recovery time advertised to neighbors. This is dynamically computed based on the number of LSPs established and is the time used by neighbors to refresh states in the event of a failure.
Recovery timer	Countdown timer which, upon expiry, causes un-refreshed data forwarding states to be deleted (usually beginning with a value that is equivalent to the sum of the restart and recovery times).
Hello interval	Interval at which hello messages are sent to neighbors.
Maximum hello miss-count	Number of hellos from a neighbor that can be missed before declaring hellos down.

The following is sample output from the **show rsvp graceful-restart neighbors** command, which displays information about graceful restart neighbors in the router:

```
RP/0/RP0/CPU0:router# show rsvp graceful-restart neighbors

  Neighbor          App  State Recovery       Reason                Since  LostCnt
  --------------- ----- ------ -------- ------------ -------------------- --------
  192.168.77.77 MPLS     UP     DONE          N/A  19/12/2016 17:02:25        0
```

This table describes the significant fields shown in the display.

Table 66: show rsvp graceful-restart neighbors Command Field Descriptions

Field	Description
Neighbor	Router ID of a global neighbor.
App	Application type of a global neighbor (MPLS).
State	State of the hello session to a global neighbor (up, down, INIT).
Recovery	State at which the local node is recovering a global neighbor.
Reason	Last reason for which communication has been lost for a global neighbor. If none has occurred, this field is marked as N/A.
Since	Time at which the current hello state for a global neighbor has been established.

Field	Description
LostCnt	Number of times hello communication has been lost with a global neighbor.

The following is sample output from the **show rsvp graceful-restart neighbors detail** command, which displays detailed information about all graceful restart neighbors:

```
RP/0/RP0/CPU0:router# show rsvp graceful-restart neighbors detail

  Neighbor: 192.168.77.77 Source: 192.168.55.55 (MPLS)
    Hello instance for application MPLS
      Hello State: UP        (for 00:20:52)
      Number of times communications with neighbor lost: 0
      Reason: N/A
    Recovery State: DONE
    Number of Interface neighbors: 1
      address: 192.168.55.0
    Restart time: 120 seconds  Recovery time: 120 seconds
    Restart timer: Not running
    Recovery timer: Not running
    Hello interval: 5000 milliseconds  Maximum allowed missed Hello messages: 4
```

This table describes the significant fields shown in the display.

Table 67: show rsvp graceful-restart neighbors detail Command Field Descriptions

Field	Description
Neighbor	Router ID of a global neighbor.
Source	Local router ID and application type.
Hello State	State of the hello instance for the global neighbor (up, down, or init) and duration of the current state.
Number of times communications with neighbor lost	Number of times hello communication has been lost with a global neighbor.
Reason	Last reason indicating why communication was lost for a global neighbor. If none has occurred, this field is marked as N/A.
Recovery State	State at which the local node is recovering a global neighbor.
Number of Interface neighbors	Number of interfaces belonging to a global neighbor.
Address	IP address of the interface neighbor.
Recovery timer	Remote recovery time for a global neighbor.
Hello interval	Interval at which hello messages are sent by the remote global neighbor.
Maximum allowed missed Hello messages	Number of hellos that can be missed by the remote global neighbor before declaring hellos down.

show rsvp hello instance

To display the RSVP hello instances, use the **show rsvp hello instance** command in XR EXEC mode.

show rsvp hello instance [*Hostname* `or` *IP-address*] [**detail**]

Syntax Description

Hostname or *IP-address*	(Optional) Address of the neighbor you are displaying. If this argument is not specified, all neighbors are displayed.
detail	(Optional) Displays multiline status for each hello instance. If this keyword is not specified, only a single-line table entry is displayed.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Hello instances are displayed in ascending order of neighbor IP address.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp hello instance** command, which displays brief information about all hello instances in the router:

```
RP/0/RP0/CPU0:router# show rsvp hello instance

  Neighbor         Type    State    Interface    LostCnt
  ---------------- ------  -------- ------------ --------
  192.168.77.77    ACTIVE  UP       None         0
```

This table describes the significant fields shown in the display.

Table 68: show rsvp hello instance Command Field Descriptions

Field	Description
Neighbor	Router ID of a global neighbor hosting the hello instance.
Type	Hello instance type (active or passive). Active type indicates that a node is sending hello requests and passive indicates that a node is sending hello acknowledgements.

Field	Description
State	State of the hello session to a global neighbor (up, down, or init).
Interface	Interface for interface bound hello's used for FRR[29]. Hello instances bound to a global neighbor show Interface as None. Hellos used for FRR are currently not supported.
LostCnt	Number of times hello communication has been lost with a global neighbor.

[29] Fast reroute.

The following is sample output from the **show rsvp hello instance** command, which displays detailed information about all hello instances in the router:

```
RP/0/RP0/CPU0:router# show rsvp hello instance detail

  Neighbor: 192.168.77.77 Source: 192.168.55.55 (MPLS)
    State: UP        (for 00:07:14)
    Type: ACTIVE   (sending requests)
    I/F: None
    Hello interval (msec) (used when ACTIVE)
    Configured: 5000
    Src_instance 0x484b01, Dst_instance 0x4d4247
    Counters:
    Communication with neighbor lost:
      Num of times: 0    Reasons:
        Missed acks:             0
        New Src_Inst received:   0
        New Dst_Inst received:   0
        I/f went down:           0
        Neighbor disabled Hello: 0
    Msgs Received:   93
      Sent:       92
      Suppressed: 87
```

This table describes the significant fields shown in the display.

Table 69: show rsvp hello instance detail Command Field Descriptions

Field	Description
Neighbor	Router ID of a global neighbor.
Source	Local router ID and application type.
State	State of the hello instance for the global neighbor (up, down or init) and duration of the current state.
Type	Hello instance type (active or passive). Active type indicates that a node is sending hello requests and passive indicates that a node is sending hello acks.
I/F	Interface for interface bound hellos. Hello instances for Graceful restart show interface as None.

show rsvp hello instance interface-based

To display the RSVP hello instances on a specific interface, use the **show rsvp hello instance interface-based** command in XR EXEC mode.

show rsvp hello instance interface-based [*IP-address*] [**detail**]

Syntax Description

IP-address	(Optional) Address of the neighboring interface. you are displaying. If this argument is not specified, all neighbors are displayed.
detail	(Optional) Displays detailed information for the specified interface.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Hello instances are displayed in ascending order of neighbor IP address.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp hello instance interface-based** command, which displays detailed information about hello instances on a specific interface:

```
RP/0/RP0/CPU0:router# show rsvp hello instance interface-based 10.10.10.10

  Neighbor         Type    State    Interface    LostCnt
  ---------------- ------  -------- ------------ --------
  10.10.10.10      ACTIVE  UP       None         0
```

This table describes the significant fields shown in the display.

Table 70: show rsvp hello instance interface-based Command Field Descriptions

Field	Description
Neighbor	Router ID of a global neighbor hosting the hello instance.
Type	Hello instance type (active or passive). Active type indicates that a node is sending hello requests and passive indicates that a node is sending hello acknowledgements.

Field	Description
State	State of the hello session to a global neighbor (up, down, or init).
Interface	Interface for interface bound hellos used for FRR[30]. For hello instances bound to a global neighbor, interface will be displayed as none.
LostCnt	Number of times hello communication has been lost with a global neighbor.

[30] Fast reroute.

show rsvp interface

To display information about all interfaces with RSVP enabled, use the **show rsvp interface** command in System Admin EXEC mode.

show rsvp interface [*type interface-path-id*] [**detail**]

Syntax Description

type	(Optional) Interface type. For more information, use the question mark (?) online help function.
interface-path-id	Physical interface or a virtual interface. **Note** Use the **show interfaces** command to see a list of all possible interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (?) online help function.
detail	(Optional) Displays multiline status for each interface. If this keyword is not specified, only a single-line table entry is displayed.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Usage Guidelines

Use the **show rsvp interface** command to display various configuration settings such as the list of neighbors and their refresh reduction capabilities.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp interface** command, which displays brief information about the RSVP-configured interfaces running in prestandard DS-TE mode:

```
RP/0/RP0/CPU0:router# show rsvp interface HundredGigE 0/0/0/3

Thu Oct 22 20:35:07.737 UTC
INTERFACE: HundredGigE 0/0/0/3 (ifh=0x4000300).
 BW (bits/sec): Max=750M. MaxFlow=750M.
                Allocated=0 (0%).
                BC0=750M. BC1=0.
```

The following is sample output from the **show rsvp interface** command, which displays brief information about the RSVP-configured interfaces for the GigabitEthernet interface type:

```
RP/0/RP0/CPU0:router# show rsvp interface HundredGigE 0/0/0/3

Thu Oct 22 20:35:42.323 UTC
Interface                  MaxBW (bps) MaxFlow (bps) Allocated (bps)      MaxSub (bps)
---------- ----------- ------------- -------------------- ------------
HundredGigE 0/0/0/3          750M          750M             0 (  0%)            0
```

This following is sample output from the **show rsvp interfaces detail** command running in standard DS-TE mode:

```
RP/0/RP0/CPU0:router# show rsvp interface HundredGigE 0/0/0/3 detail

Thu Oct 22 20:35:11.638 UTC
INTERFACE: HundredGigE 0/0/0/3 (ifh=0x4000300).
 VRF ID: 0x60000000 (Default).
 BW (bits/sec): Max=750M. MaxFlow=750M.
                Allocated=0 (0%).
                BC0=750M. BC1=0.
 Signalling: No DSCP marking. No rate limiting.
 States in: 0. Max missed msgs: 4.
 Expiry timer: Not running. Refresh interval: 45s.
 Normal Refresh timer: Not running. Summary refresh timer: Running.
 Refresh reduction local: Enabled. Summary Refresh: Enabled (1472 bytes max).
 Reliable summary refresh: Disabled. Bundling: Enabled. (1500 bytes max).
 Ack hold: 400 ms, Ack max size: 1500 bytes. Retransmit: 900ms.
 Neighbor information:
    Neighbor-IP    Nbor-MsgIds States-out  Refresh-Reduction Expiry(min::sec)
 -------------- -------------- ---------- ------------------ ----------------
        10.0.0.1               0          6             Enabled 14::56
    10.10.10.10               0          0             Enabled 14::33
```

This table describes the significant fields shown in the display.

Table 71: show rsvp interface detail Command Field Descriptions

Field	Description
Bandwidth	Configured values on the interface and currently allocated bandwidth.
Ack hold	Time, in milliseconds, before RSVP responds with an acknowledgment.
Neighbor-IP	Address of peer that RSVP is exchanging messages on that interface.
Nbor-msglds	Message IDs received from the neighbor (corresponding to the number of LSPs with reliable messaging).
States-out	States (including paths or reservations) sent on this interface to the neighbor.
Refresh Reduction	Neighbor Refresh Reduction capability.
Expiry	Time a neighbor entry in the interface database expires if there is no activity on this interface with the corresponding neighbor.

show rsvp neighbor

To display information about RSVP neighbors, use the **show rsvp neighbor** command in XR EXEC mode.

show rsvp neighbor [**detail**]

Syntax Description

detail	(Optional) Displays detailed information about RSVP neighbors.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **show rsvp interface** command to display various configuration settings such as the list of neighbors and their refresh reduction capabilities.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp neighbor** command using the **detail** keyword:

```
RP/0/RP0/CPU0:router# show rsvp neighbor detail

  Global Neighbor: 10.10.10.10
  Interface Neighbor: 10.0.0.1
  Interface: HundredGigE0/0/0/3
  Refresh Reduction: "Enabled" or "Disabled".
  Remote epoch: 0xXXXXXXXX
  Out of order messages: 0
  Retransmitted messages: 0
  Interface Neighbor: 172.16.0.1
  Interface: HundredGigE0/0/0/3
  Refresh Reduction: "Enabled" or "Disabled".
  Remote epoch: 0xXXXXXXXX
  Out of order messages: 0
  Retransmitted messages: 0
```

show rsvp reservation

To display all reservations that RSVP knows about on a router, use the **show rsvp reservation** command in XR EXEC mode.

show rsvp reservation [**destination** *IP address*] [**detail**] [**dst-port** *port-num*] [**session-type** { **lsp-p2p** }] [**source** *IP-address*] [**src-port** *port-num*]

Syntax Description

detail	(Optional) Displays multiline status for each reservation. If the **detail** keyword is not specified, only a single-line table entry is displayed.
destination *IP-address*	(Optional) Displays the entries that match the specified address.
dst-port *port-num*	(Optional) Displays destination port and tunnel ID information.
session-type	(Optional) Displays the entries that match the specified session type.
lsp-p2p	Displays the entries that are used for P2P sessions.
source *IP-address*	(Optional) Displays source address information.
src-port *port-num*	(Optional) Displays source port and LSP ID information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show rsvp reservation** command displays information about downstream reservations only (that is, reservations received on this device or created by application program interface (API) calls). Upstream reservations or requests are displayed using the **show rsvp request** command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp reservation** command:

```
RP/0/RP0/CPU0:router# show rsvp reservation

        Dest Addr DPort      Source Addr SPort Pro   Input IF Sty Serv Rate Burst
 ---------------- ----- ---------------- ----- --- ---------- --- ---- ---- -----
    192.168.40.40  2001   192.168.67.68     2   0       None  SE LOAD     0    1K
```

```
     192.168.67.68  2000     10.40.40.40    15   0  HundredGigE 0/0/0/3  SE LOAD     0
1K
```

The following example displays detailed information about all reservations in the router:

```
RP/0/RP0/CPU0:router# show rsvp reservation detail

  RESV: IPv4-LSP Session addr: 192.168.40.40. TunID: 2001. LSPId: 2.
   Source addr: 192.168.67.68. ExtID: 192.168.67.68.
   Input adjusted interface: None. Input physical interface: None.
   Next hop: 0.0.0.0 (lih: 0x0).
   Style: Shared-Explicit. Service: Controlled-Load.
   Rate: 0 bits/sec. Burst: 1K bytes. Peak: 0 bits/sec.
   MTU min: 40, max: 500 bytes.
   Flags: Local Receiver.
   State expires in 0.000 sec.
   Policy:  Accepted. Policy source(s): MPLS/TE.
   Header info: RSVP TTL=255. IP TTL=255. Flags: 0x0. TOS=0xff.
   Resource:
    Labels: Local downstream: 3.

  RESV: IPv4-LSP Session addr: 192.168.67.68. TunID: 2000. LSPId: 15.
   Source addr: 192.168.40.40. ExtID: 10.10.40.40.
   Input adjusted interface: HundredGigE 0/0/0/3. Input physical interface: HundredGigE
0/0/0/3.
   Next hop: 10.66.67.68 (lih: 0x8DE00002).
   Style: Shared-Explicit. Service: Controlled-Load.
   Rate: 0 bits/sec. Burst: 1K bytes. Peak: 0 bits/sec.
   MTU min: 0, max: 500 bytes.
   Flags: None.
   State expires in 361.184 sec.
   Policy:  Accepted. Policy source(s): MPLS/TE.
   Header info: RSVP TTL=254. IP TTL=254. Flags: 0x1. TOS=0xff.
   Resource:
    Labels: Outgoing downstream: 3.
```

This table describes the significant fields shown in the display.

Table 72: show rsvp reservation detail Command Field Descriptions

Field	Description
Input adjusted interface	Interface to reflect the path's outgoing interface.
Input physical interface	Interface where the reservation was received.
Next hop	Address of the downstream node that sent the reservation to this node.
Lih	Logical interface handle sent in the hop object of path returned to us in the reservation to figure out what interface the path was sent on.
Flags	Indicates path state, including as Local Repair, Local Sender (LSP[31] ingress node), and others.
Policy	Admission control status.
Policy source	Entity performing the admission control on the LSP.
Header info	RSVP header information as described in RFC 2205.

[31] Link-state packet

show rsvp sender

To display all path states that RSVP knows about on this router, use the **show rsvp sender** command in XR EXEC mode mode.

show rsvp sender [**destination** *IP-address*] [**detail**] [**dst-port** *port-num*] [**session-type** { **lsp-p2p** }] [**source** *IP-address*] [**src-port** *port-num*]

Syntax Description

detail	(Optional) Displays multiline status for each path. If the **detail** keyword is not specified, only a single-line table entry is displayed.
destination *IP-address*	(Optional) Displays the entries that match the specified address.
dst-port *port-num*	(Optional) Displays destination port and tunnel ID information.
session-type	(Optional) Displays the entries that match the specified session type.
lsp-p2p	Displays the entries that are used for P2P sessions.
source *IP-address*	(Optional) Displays source address information.
src-port *port-num*	(Optional) Displays source port and LSP ID information.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **show rsvp sender** command displays information about path states.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp sender**command:

```
RP/0/RP0/CPU0:router# show rsvp sender

  Dest Addr         DPort    Source Addr SPort   Pro  Input IF            Rate Burst Prot
  ---------------- ----- ---------------- ----- --- ------------         ---- ----- ----
  10.40.40.40     2001      10.66.67.68     2   0    HundredGigE0/0/0/3    0    1K  Off
  10.66.67.68     2000      10.40.40.40    15   0    None                  0    1K  Off
```

This table describes the significant fields shown in the display.

Table 73: show rsvp sender Command Field Descriptions

Field	Description
DProt	Destination port number and tunnel-id.
Dest Address	Destination and session address of LSP[32].
SPort	Source port and LSP ID.
Source Addr	Address of the ingress node of the LSP.
Input IF	Interface on which the Path message was received.

[32] Link-state packet

The following example displays detailed information about all paths in the system:

```
RP/0/RP0/CPU0:router# show rsvp sender detail

  PATH: IPv4-LSP Session addr: 10.66.67.68. TunID: 1. LSPId: 25.
   Source addr: 10.40.40.40. ExtID: 10.40.40.40.
   Prot: Off. Backup tunnel: None.
   Setup Priority: 7, Reservation Priority: 0
   Rate: 0 bits/sec. Burst: 1K bytes. Peak: 0 bits/sec.
   Min unit: 40 bytes, Max unit: 500 bytes
   Flags: Bidirectional.
   State expires in 370.154 sec.
   Policy:  Accepted. Policy source(s): Default.
   Header info: RSVP TTL=254. IP TTL=254. Flags: 0x1. TOS=0xc0.
   Input interface: HundredGigE 0/0/0/3. Previous hop: 10.40.40.40 (lih: 0x40600001).
   Resource:
    Labels: Outgoing upstream: 3.
   Class-Type: None.
   Explicit Route (Incoming):
       Strict, 10.66.67.68(interface-path-id 5)
       Strict, 10.66.67.68/32
```

This table describes the significant fields shown in the display.

Table 74: show rsvp sender detail Command Field Descriptions

Field	Description
Prot	LSP configured as a protected tunnel.
Backup tunnel	Name of the backup tunnel assigned to protect this LSP[33].
Flags	Path state, including as local repair, local sender (LSP ingress node), and others.
Policy	Admission control status for Path message in the incoming direction.
Policy source	Entity doing the admission control, such as COPS or MPLS-TE[34].
Header info	RSVP header information as described in RFC 2205.

Field	Description
Input interface	Interface on which the path was received. At ingress mode, it is None.
Previous hop	Address of the upstream peer who sent us the Path message. May be the interface address or node-id depending on LSP (packet or optical).
Lih	Logical interface handle received in the hop object of the path.
Output interface	Interface on which the path was forwarded to the downstream neighbor
Policy	Admission control status for the path in the outgoing direction.
Explicit route	Explicit route specified in the explicit-route object of the Path message.

[33] Link-state packet
[34] MPLS-Traffic Engineering

show rsvp session

To list all sessions that RSVP knows about on this router, use the **show rsvp session** command in XR EXEC mode.

show rsvp session [**destination** *IP-address*] [**detail**] [**dst-port** *port-num*] [**session-type** { **lsp-p2p** }] [**tunnel-name** *tunnel-name*]

Syntax Description

detail	(Optional) Displays multiline status for each path. If the **detail** keyword is not specified, only a single-line table entry is displayed.
destination *IP-address*	(Optional) Displays the entries that match the specified address.
dst-port *port-num*	(Optional) Displays destination port and tunnel ID information.
session-type	(Optional) Displays the entries that match the specified session type.
lsp-p2p	Displays the entries that are used for P2P sessions.
tunnel-name *tunnel-name*	(Optional) Displays status for the session matching the specified tunnel-name.

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Sessions are displayed in ascending order of destination IP address, destination port, and source IP address.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following is sample output from the **show rsvp session** command:

```
RP/0/RP0/CPU0:router# show rsvp session

  Type    Session Addr  Port  Proto/ExtTunID  PSBs  RSBs  Reqs
  ---- --------------- ----- --------------- ----- ----- -----
  LSP4     10.40.40.40  2001     10.66.67.68     1     1     1
  LSP4     10.66.67.68  2000     10.40.40.40     1     1     0
```

This table describes the significant fields shown in the display.

Table 75: show rsvp session Command Field Descriptions

Field	Description
Type	Type of data flow (Traffic-Engineering LSP (LSP4 or IPV4 session).
Session Addr	Destination address of the data packets and also tail of the LSP.
Port	Destination port or tunnel ID in case of TE tunnels.
Proto/ExtTunID	Source address of TE tunnels or protocol as in the case of IPV4 sessions.
PSBs	Number of path state blocks for this session.
RSBs	Number of reservation state blocks pertaining to incoming or local reservations for this session.
Reqs	Number of requests. State data structure representing reservations sent up-stream.

The following is sample output for the **show rsvp session detail** command:

```
RP/0/RP0/CPU0:router# show rsvp session detail

  SESSION: IPv4-LSP Addr: 10.66.67.68, TunID: 1, ExtID: 10.40.40.40
   PSBs: 1, RSBs: 1, Requests: 0
   LSPId: 1
   Tunnel Name: newhead_t1
    RSVP Path Info:
     InLabel: No intf, No label
     Incoming Address: Unknown
     Explicit Route:
       Strict, 10.66.67.68(interface-path-id 5)
       Strict, 10.66.67.68/32
     Record Route: None
     Tspec: avg rate=0, burst=1K, peak rate=0
    RSVP Resv Info:
     OutLabel: HundredGigE0/0/0/3, 5
     FRR OutLabel: No intf, No label
     Record Route:
       Node-id 10.66.67.68, interface index 5
     Fspec: avg rate=0, burst=1K, peak rate=0
```

This table describes the significant fields shown in the display.

Table 76: show rsvp session detail Command Field Descriptions

Field	Description
TunID	Tunnel identifier and the destination port of the LSP[35].
ExtID	Ingress node address of LSP.
Tunnel Instance	Source port of the LSP (with the ExtId forming the source parameters).
Tunnel Name	Name of the tunnel and LSP.

Field	Description
InLabel	Incoming interface and label info for the LSP in the upstream direction. At the egress node, using penultimate hop popping at the egress node, (implicit-null) appears as *No Label*.
Incoming Address	Address of the ingress interface.
Explicit Route	Explicit route specified in the explicit-route object of the Path message.
Record Route	Record route object in either the path or reservation message.
Tspec	Traffic parameters.
OutLabel	Outgoing interface and label sent downstream.
FRR OutLabel	For FRR[36], displays the backup tunnel and Merge-point label.
Fspec	Flow spec parameters for specified QoS.

[35] Link-state packet.
[36] Fast reroute.

signalling dscp (RSVP)

To give all RSVP signaling packets sent out on a specific interface higher priority in the network by marking them with a particular Differentiated Service Code Point (DSCP), use the **signalling dscp** command in RSVP interface configuration submode. To return to the default behavior, use the **no** form of this command.

signalling dscp *dscp*
no signalling *dscp*

Syntax Description

dscp	DSCP priority number. Range is 0 to 63.

Command Default

No default behavior or values

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

DSCP marking improves signaling setup and teardown times.

Usually, when a router receives Path messages for a particular state marked with a DSCP value, it sends out Path messages for that state marked with the same DSCP value. This command overrides that DSCP persistence and ensures that all messages sent out a particular interface are marked with a specified DSCP.

Though this command controls RSVP signaling packets, it has no effect on ordinary IP or MPLS data packets traveling along the path created or reserved by this RSVP session.

DSCP persistence operates on a per-state basis, but this command operates on a per-interface basis. So, if some incoming message (for example, multicast Path) with DSCP 10 causes two outgoing messages on interfaces A and B, usually both are sent with DSCP 10. If **signalling dscp 5** is configured for RSVP on interface A, the Path messages being sent out interface A is marked with DSCP 5, but the Path messages being sent out of interface B are marked with DSCP 10.

There is a difference between **signalling dscp 0** and **no signalling dscp** commands. The first command instructs RSVP to explicitly set the DSCP value to 0 on all packets sent out of this interface. The second command removes any override on the packets being sent out of this interface, and allows the DSCP of received packets that created this state to persist on packets forwarded out of this interface.

The RFC specifies a standard mapping from the eight IP precedence values to eight values in the 64-value DSCP space. You can use those special DSCP values to specify IP precedence bits only.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to mark all RSVP packets going out on a HundredGigE interface with DSCP value 20.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling dscp 20
```

The following example shows how to disable DSCP marking of signaling packets going out on a HundredGigE interface.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# no signalling dscp
```

signalling graceful-restart

To enable or disable RSVP signaling graceful restart, use the **signalling graceful-restart** command in RSVP configuration mode. To return to the default behavior, use the **no** form of this command.

signalling graceful-restart [**recovery-time** *time* | **restart-time** *time*]
no signalling graceful-restart

Syntax Description

recovery-time	(Optional) Configures the recovery time that is advertised in the Restart Cap object in the Hello messages.
time	Time, in seconds, for the neighbor to wait for the node to recover (replay) existing states after the Hello session is reestablished before initiating TEARs. Range is 0 to 3600.
restart-time	(Optional) Configures the restart time that is advertised in the Restart Cap object in hello messages.
time	Time, in seconds, after a control-plane restart that RSVP can start exchanging hello messages. Range is 60 to 3600. Default is 120.

Command Default

RSVP signaling graceful restart is disabled.

Command Modes

RSVP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **signalling graceful-restart** command provides a mechanism that helps minimize the negative effects on MPLS and Optical User Network Interface (O-UNI) traffic for the following types of faults. This is an implementation of the fault handling section of the IETF standard RFC 3473:

Control-channel-failure

Disruption of communication channels between 2 nodes when the communication channels are separated from the data channels.

Node-failure

Control plane of a node fails, but the node preserves its data forwarding states.

The **signalling graceful-restart** command instigates the exchange of RSVP hello messages between the router and its neighbor nodes. After the hello messages are established with a given neighbor, RSVP can detect these types of faults when they occur.

If no hello messages are received from a neighbor within a certain number of hello intervals, a node assumes that communication with the neighbor has been lost. The node waits the amount of time advertised by the last restart time communicated by the neighbor, before invoking procedures for recovery from communication loss.

The configured restart time is important in case of recovery from failure. The configured value should accurately reflect the amount of time within which, after a control-plane restart, RSVP can start exchanging hello messages.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable RSVP signalling graceful restart:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)# signalling graceful-restart
```

The following example shows how to set the restart time:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)# signalling graceful-restart restart-time 200
```

The following example shows how to reset the restart time to the default of 120 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)# no signalling graceful-restart restart-time
```

signalling hello graceful-restart interface-based

To enable RSVP to accept interface-based hello requests from the neighbor on an interface and send a Hello Acknowledgment to it, use the **signalling hello graceful-restart interface-based** command in RSVP configuration mode. To return to the default behavior, use the **no** form of this command.

signalling hello graceful-restart interface-based
no signalling hello graceful-restart interface-based

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable interface-based graceful restart:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 66
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling hello graceful-restart interface based
```

signalling hello graceful-restart refresh interval

To configure the interval at which RSVP graceful-restart hello messages are sent to each neighbor, use the **signalling hello graceful-restart refresh interval** command in RSVP configuration mode. To return to the default behavior, use the **no** form of this command.

signalling hello graceful-restart refresh interval *refresh-interval*
no signalling hello graceful-restart refresh interval

Syntax Description

refresh-interval	Interval, in milliseconds, at which RSVP graceful-restart hello messages are sent to each neighbor. Range is 3000 to 30000.

Command Default

refresh interval: 5000

Command Modes

RSVP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **signalling hello graceful-restart refresh interval** command determines how often hello messages are sent to each neighbor. If the interval is made short, the hello messages are sent more frequently. Although a short interval may help detect failures quickly, it also results in increased network traffic. Optimizations in the RSVP hello mechanism exist to reduce the number of hello messages traveling over the network.

When an RSVP hello message is received, the receiving node acknowledges the hello and restarts its hello timer to the neighbor. By doing this, a hello is transmitted to the neighbor only if a hello is not received before the hello refresh interval has expired.

If two neighboring nodes do not have the same hello interval, the node with the larger hello interval has to acknowledge its neighbor's (more frequent) hellos. For instance, if node A has a hello interval of 5 seconds, and node B has a hello interval of 10 seconds, node B still has to send hello messages every 5 seconds.

The hello backoff mechanism is an optimization that is tailored to minimize the number of hello messages from a neighbor that either does not have graceful restart enabled, or that fails to come back up during the restart interval. The restart interval is provided by the neighbor in the restart cap object.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example sets the hello graceful-restart refresh interval to 4000 msecs:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp
```

```
RP/0/RP0/CPU0:router(config-rsvp)# signalling hello graceful-restart refresh interval 4000
```

signalling prefix-filtering access-list

To specify the extended access control list to use for prefix filtering of RSVP Router Alert messages, use the **signalling prefix-filtering access-list** command in RSVP configuration mode. To return to the default behavior, use the **no** form of this command.

signalling prefix-filtering access-list *access list name*
no signalling prefix-filtering access-list *access list name*

Syntax Description

access list name	Extended access-list name as a string (maximum 32 characters).

Command Default

No default behavior or values

Command Modes

RSVP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The extended access control list containing the source and destination prefixes used for packet filtering is configured separately.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure the access control list name banks for prefix-filtering of RSVP Router Alert messages:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)# signalling prefix-filtering access-list banks
```

The following example shows how to disable RSVP prefix-filtering of RSVP Router Alert messages:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)# no signalling prefix-filtering access-list banks
```

signalling prefix-filtering default-deny-action

To configure RSVP to drop RSVP Router Alert messages when an access control list match returns an implicit deny, use the **signalling prefix-filtering default-deny-action** command in RSVP configuration mode. To return to the default behavior, use the **no** form of this command.

signalling prefix-filtering default-deny-action drop
no signalling prefix-filtering default-deny-action drop

Syntax Description

drop	Specifies when RSVP router alert messages are dropped.

Command Default

Performs normal RSVP processing of Path, Path Tear, and ResvConfirm message packets.

Command Modes

RSVP configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure RSVP Router Alert messages when an access control list match returns an implicit deny:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)# signalling prefix-filtering default-deny-action drop
```

signalling rate-limit

To limit the rate of RSVP signaling messages being sent out a particular interface, use the **signalling rate-limit** command in RSVP interface configuration mode. To return to the default behavior, use the **no** form of this command.

signalling rate-limit[**rate** *messages*] [**interval** *interval-length*]
no signalling rate-limit [**rate** *messages*] [**interval** *interval-length*]

Syntax Description

rate *messages*	(Optional) Configures the number of messages sent per scheduling interval. Range is 1 to 500 messages.
interval *interval-length*	(Optional) Specifies the length, in milliseconds, between scheduling intervals. Range is 250 to 2000.

Command Default

messages: 100

interval-length: 1,000 (1 second)

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the rate-limiting feature with caution. Limiting the rate of RSVP signaling has the advantage of avoiding an overload of the next hop router's input queue, because such overloads would cause the next hop router to drop RSVP messages. However, reliable messaging and rapid retransmit usually enable the router to recover very rapidly from message drops; so rate limiting might not be necessary.

If the rate is set too low, it causes slower convergence times. This command limits all RSVP messages except acknowledgments (ACK) and SRefresh messages. The command does not let you make a router generate messages faster than its inherent limit. (That limit differs among router models.)

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable rate-limiting:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling rate-limit
```

The following example shows how to limit the rate to 50 messages per second:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling rate-limit rate 50
```

The following example shows how to set a limit at 40 messages for every 250 milliseconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling rate-limit rate 40 interval 250
```

The following example shows how to restore the rate to the default of 100 messages per second:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# no signalling rate-limit rate
```

The following example shows how to disable rate-limiting:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# no signalling rate-limit
```

signalling refresh interval

To change the frequency with which a router updates the network about the RSVP state of a particular interface, use the **signalling refresh interval** command in RSVP interface configuration mode. To return to the default behavior, use the **no** form of this command.

signalling refresh interval *seconds*
no signalling refresh interval

Syntax Description

seconds	Number of seconds the router waits to update the network about the RSVP state of an interface, in seconds. Range is 10 to 180. Default is 45.

Command Default

seconds: 45

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

RSVP relies on a soft-state mechanism to maintain state consistency in the face of network losses. That mechanism is based on continuous refresh messages to keep a state current. Each RSVP router is responsible for sending periodic refresh messages to its neighbors.

The router attempts to randomize network traffic and reduce metronomic burstiness by jittering the actual interval between refreshes by as much as 50 percent. As a result, refreshes may not be sent at exactly the interval specified. However, the average rate of refreshes are within the specified refresh interval.

Lengthening the interval reduces the refresh load of RSVP on the network but causes downstream nodes to hold state longer. This reduces the responsiveness of the network to failure scenarios. Shortening the interval improves network responsiveness but expands the messaging load on the network.

The reliable messaging extension, implemented through the **signalling refresh reduction reliable** command, may cause new or changed messages to be temporarily refreshed at a more rapid rate than specified to improve network responsiveness.

The use of reliable messaging with rapid retransmit substantially improves network responsiveness in case of transient message loss; if the refresh interval is changed when using the reliable messaging feature, it is more useful to lengthen the interval than to shorten it.

The summary refresh extension, implemented through the **signalling refresh reduction summary** command, provides a lower-cost mechanism to refresh RSVP state. The router uses the same refresh interval between successive refreshes of a single state when using summary refresh and when using ordinary message-based refresh.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to specify a refresh interval of 30 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 2
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling refresh interval 30
```

The following example shows how to restore the refresh interval to the default value of 45 seconds:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 2
RP/0/RP0/CPU0:router(config-rsvp-if)# no signalling refresh interval
```

signalling refresh missed

To specify the number of successive refresh messages that can be missed before the RSVP deems a state to be expired (resulting in the state to be torn down), use the **signalling refresh missed** command in RSVP interface configuration mode. To return to the default behavior, use the **no** form of this command.

signalling refresh missed *number*
no signalling refresh missed

Syntax Description

number	Number of successive missed refresh messages. Range is 1 to 8. Default is 4.

Command Default

number: 4

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Decreasing the missed-message number improves RSVP responsiveness to major failures like router failure or link faults, but decreases the resilience of RSVP resulting in packet drops or temporary network congestion. The latter condition makes RSVP too sensitive.

Increasing the missed-message number increases the resilience of RSVP to such transient packet loss, but decreases the RSVP responsiveness to more intransient network failures such as router failure or link fault.

The default value of 4 provides a balance of resilience and responsiveness factors.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to specify a missed refresh limit of six (6) messages:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 2
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling refresh missed 6
```

The following example shows how to return the missed refresh limit to the default value of four (4):

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 2
RP/0/RP0/CPU0:router(config-rsvp-if)# no signalling refresh missed
```

window-size (RSVP)

To specify the maximum number of RSVP authenticated messages that can be received out of sequence, use the **window-size** command in RSVP authentication configuration mode, RSVP interface authentication configuration mode, or RSVP neighbor authentication configuration mode. To disable the window size, use the **no** form of this command.

window-size *N*
no window-size

Syntax Description

N Size of the window to restrict out-of-sequence messages. Range is 1 to 64. Default is 1. All out-of-sequence messages are dropped.

Command Default

N: 1

Command Modes

RSVP authentication configuration

RSVP interface authentication configuration

RSVP neighbor authentication configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **window-size** command to specify the maximum number of authenticated messages that are received out of sequence. All RSVP authenticated messages include a sequence number that is used to prevent replays of RSVP messages.

With a default window size of one message, RSVP rejects any out-of-order or out-of-sequence authenticated messages because they are assumed to be replay attacks. However, sometimes bursts of RSVP messages become reordered between RSVP neighbors. If this occurs on a regular basis, and you can verify that the node sending the burst of messages is trusted, you can use the window-size option to adjust the burst size such that RSVP does not discard such reordered bursts. RSVP checks for duplicate messages within these bursts.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure the size of the window to 33 in RSVP neighbor authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp neighbor 10.0.0.1 authentication
RP/0/RP0/CPU0:router(config-rsvp-nbor-auth)# window-size 33
```

The following example shows how to configure the size of the window to 33 in RSVP authentication configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp authentication
RP/0/RP0/CPU0:router(config-rsvp-auth)# window-size 33
```

The following example shows how to configure the size of the window to 33 in RSVP interface authentication configuration mode by using the **rsvp interface** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# authentication
RP/0/RP0/CPU0:router(config-rsvp-if-auth)# window-size 33
```

signalling refresh reduction summary

To configure RSVP summary refresh message size on an interface, use the **signalling refresh reduction summary** command in RSVP interface configuration mode. To return to the default behavior, use the **no** form of this command.

signalling refresh reduction summarymax-size *bytes*
no signalling refresh reduction summary max-size *bytes*

Syntax Description

max-size *bytes*	Specifies the maximum size, in bytes, of a single RSVP summary refresh message. Range is 20 to 65000.

Command Default

bytes: 4096

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

Use the **signalling refresh reduction summary** command to specify the maximum size of the summary refresh messages sent. Message size is verified using the **show rsvp interface detail** command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to change the summary message maximum size on an interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 2
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling refresh reduction summary max-size 6000
```

The following example shows how to return the summary message maximum size to the default value on an interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 2
RP/0/RP0/CPU0:router(config-rsvp-if)# no signalling refresh reduction summary max-size 6000
```

signalling refresh reduction reliable

To configure the parameters of reliable messaging, use the **signalling refresh reduction reliable** command in RSVP interface configuration mode. To return to the default behavior, use the **no** form of this command.

signalling refresh reduction reliable {**ack-max-size** *bytes* | **ack-hold-time** *milliseconds* | **retransmit-time** *milliseconds* | **summary-refresh**}
no signalling refresh reduction reliable {**ack-max-size** *bytes* | **ack-hold-time** *milliseconds* | **retransmit-time** *milliseconds* | **summary-refresh**}

Syntax Description

ack-max-size	Specifies the maximum size of the RSVP component within a single acknowledgment message.
bytes	Number of bytes that define the maximum size of an RSVP component. Range is 20 to 65000.
ack-hold-time	Specifies the maximum amount of time a router holds an acknowledgment before sending it, in an attempt to bundle several acknowledgments into a single acknowledgment message.
milliseconds	Number of milliseconds that define the acknowledgment hold time. Range is 100 to 5000.
retransmit-time	Specifies the amount of time the router initially waits for an acknowledgment message before resending the RSVP message.
milliseconds	Number of milliseconds that define the retransmit time. Range is 100 to 10000.
summary-refresh	Enables the use of reliable transmission for RSVP summary refresh messages.

Command Default

ack-max-size *bytes*: 4096

ack-hold-time *milliseconds*: 400 (0.4 seconds)

retransmit-time *milliseconds*: 900 (0.9 seconds)

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

For reliable messaging to work properly, configure the retransmit time on the send router (A) and acknowledgment hold time on the peer router (B). (Vice versa for messages in reverse direction.)

The retransmit time must be greater than the acknowledgment hold time, so that the acknowledgment message has time to get back to the sender before the message retransmits. We recommend that the retransmit-time interval be at least twice the acknowledgment hold-time interval. If the retransmit-time value is smaller than the acknowledgment hold-time value, then router A retransmits the message even though router B may have received the message and is waiting for an acknowledgment hold time to time out to send the acknowledgment. This causes unnecessary network traffic.

Reducing the value of **ack-max-size** causes more acknowledgment messages to be issued, with fewer acknowledgments contained within each acknowledgment message. However, reducing the acknowledgment-max-size does not speed up the rate at which acknowledgment messages are issued because their frequency is still controlled by the time values (acknowledgment hold time and retransmit time).

To use reliable messaging for summary refresh messages, use the **rsvp interface** *interface-name* and **signalling refresh reduction summary** commands.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the maximum acknowledgment message size to 4096 bytes on a HundredGigE interface.

```
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling refresh reduction reliable ack-max-size
4096
```

The following example shows how to return the maximum acknowledgment message size to the default of 1000 bytes on a HundredGigE interface.

```
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# no rsvp signalling refresh reduction reliable
```

The following example shows how to set the acknowledgment hold time to 1 second.

```
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling refresh reduction reliable ack-hold-time
1000
```

The following example shows how to return the acknowledgment hold time to the default of 0.4 second.

```
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# no signalling refresh reduction reliable ack-hold-time
```

The following example shows how to set the retransmit timer to 2 seconds.

```
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling refresh reduction reliable retransmit-time
 2000
```

The following example shows how to return the retransmit timer to the default of 0.9 seconds.

```
RP/0/RP0/CPU0:router(config)# rsvp interface HundredGigE 0/0/0/3
```

```
RP/0/RP0/CPU0:router(config-rsvp-if)# no signalling refresh reduction reliable
```

The following example shows how to enable the use of reliable transmission for RSVP summary refresh messages.

```
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling refresh reduction reliable summary-refresh
```

signalling refresh reduction reliable retransmit-time (RSVP configuration)

To set the global RSVP message retransmission interval for all directly connected neighbors at once or remote neighbors connected through a backup tunnel, use the **signalling refresh reduction reliable retransmit-time** command in the RSVP configuration mode. To remove the configuration, use the **no** form of this command.

signalling refresh reduction reliable retransmit-time { **all** | **backup-only** } *milliseconds*
no signalling refresh reduction reliable retransmit-time

Syntax Description

{**all**|**backup-only**}	Specifies that the retransmission interval be applied to all RSVP interfaces or only backup tunnel interfaces.
milliseconds	Number of milliseconds that defines the retransmission interval. Choose a value between 100 and 30000 milliseconds.

Command Default

The default RSVP message retransmission interval is 2100 milliseconds (2.1 seconds).

Command Modes

RSVP configuration

Command History

Release	Modification
Release 24.1.1	This command was introduced.

Examples

In this example, an RSVP message retransmission interval of 4000 milliseconds is set for all RSVP interfaces:

```
Router(config)# rsvp
Router(config-rsvp)# signalling refresh reduction reliable retransmit-time all 4000
Router(config-rsvp)# interface hundredGigE 0/0/0/0
Router(config-rsvp-if)# bandwidth 200000
Router(config-rsvp-if)# signalling refresh interval 180
Router(config-rsvp-if)# signalling refresh reduction bundle-max-size 1400
Router(config-rsvp-if)# exit
Router(config-rsvp)# commit
```

In this example, an RSVP message retransmission interval of 5000 milliseconds is set for all backup tunnels during FRR:

```
Router(config)# rsvp
Router(config-rsvp)# signalling refresh reduction reliable retransmit-time backup-only 5000

Router(config-rsvp)# interface hundredGigE 0/0/0/0
Router(config-rsvp-if)# bandwidth 200000
Router(config-rsvp-if)# signalling refresh interval 180
Router(config-rsvp-if)# signalling refresh reduction bundle-max-size 1400
Router(config-rsvp-if)# exit
Router(config-rsvp)# commit
```

signalling refresh reduction disable

To disable RSVP refresh reduction on an interface, use the **signalling refresh reduction disable** command in RSVP interface configuration mode. To return to the default behavior, use the **no** form of this command.

signalling refresh reduction disable
no signalling refresh reduction disable

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The following features of the IETF refresh reduction standard RFC 2961 are enabled with this command:

- Setting the refresh-reduction-capable bit in message headers
- Message-ID usage
- Reliable messaging with rapid retransmit, acknowledgment (ACK), and NACK messages
- Summary refresh extension

Because refresh reduction relies on cooperation of the neighbor, the neighbor must also support the standard. If the router detects that a neighbor is not supporting the refresh reduction standard (either through observing the refresh-reduction-enabled bit in messages received from the next hop, or by sending a Message-ID object to the next hop and receiving an error), refresh reduction is not used on this link. That information is obtained through use of the **show rsvp interface detail** command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to disable RSVP refresh reduction on an interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 2
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling refresh reduction disable
```

The following example shows how to enable RSVP refresh reduction on the interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 2
RP/0/RP0/CPU0:router(config-rsvp-if)# no signalling refresh reduction disable
```

signalling refresh reduction bundle-max-size

To configure the maximum size of a single RSVP bundle message, use the **signalling refresh reduction bundle-max-size** command in RSVP interface configuration mode.

signalling refresh reduction bundle-max-size *size*

Syntax Description

size	Maximum size, in bytes, of a single RSVP bundle message. Range is 512 to 65000.

Command Default

size: 4096

Command Modes

RSVP interface configuration

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the maximum bundle size of a single RSVP bundle message to 4000:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# rsvp interface tunnel-te 2
RP/0/RP0/CPU0:router(config-rsvp-if)# signalling refresh reduction bundle-max-size 4000
```



MPLS OAM Commands

Note All commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router that is introduced from Cisco IOS XR Release 6.3.2. References to earlier releases in Command History tables apply to only the Cisco NCS 5500 Series Router.

Note

- Starting with Cisco IOS XR Release 6.6.25, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 560 Series Routers.
- Starting with Cisco IOS XR Release 6.3.2, all commands applicable for the Cisco NCS 5500 Series Router are also supported on the Cisco NCS 540 Series Router.
- References to releases before Cisco IOS XR Release 6.3.2 apply to only the Cisco NCS 5500 Series Router.
- Cisco IOS XR Software Release 7.0.1 specific updates are not applicable for the following variants of Cisco NCS 540 Series Routers:
  - N540-28Z4C-SYS-A
  - N540-28Z4C-SYS-D
  - N540X-16Z4G8Q2C-A
  - N540X-16Z4G8Q2C-D
  - N540X-16Z8Q2C-D
  - N540-12Z20G-SYS-A
  - N540-12Z20G-SYS-D
  - N540X-12Z16G-SYS-A
  - N540X-12Z16G-SYS-D

This module describes Multiprotocol Label Switching (MPLS) label switched path (LSP) verification commands. These commands provide a means to detect and diagnose data plane failures and are the first set of commands in the MPLS Operations, Administration, and Maintenance (OAM) solution.

For detailed information about MPLS concepts, configuration tasks, and examples, see .

- address-family ipv4, on page 533
- address-family ipv4 reply, on page 534
- address-family ipv6 reply, on page 536
- clear mpls oam counters, on page 538
- echo disable-vendor-extension, on page 539
- echo lsp-properties-timeout, on page 540
- echo revision, on page 541
- mpls oam, on page 542
- ping mpls ipv4, on page 543
- ping mpls traffic-eng, on page 548
- ping mpls traffic-eng tunnel-tp, on page 551
- ping pseudowire (AToM), on page 556
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- ping pseudowire multisegment, on page 563
- show mpls oam, on page 567
- show mpls oam database, on page 569
- traceroute mpls ipv4, on page 570
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- traceroute mpls traffic-eng, on page 578
- traceroute pseudowire multisegment, on page 581
- traceroute mpls traffic-eng tunnel-te (P2P), on page 583
- traceroute mpls traffic-eng tunnel-tp, on page 586

address-family ipv4

To configure the IPv4 address family parameters for MPLS OAM, use the **address-family ipv4** command in MPLS OAM configuration mode.

address-family ipv4 { **apply-group** *group-name* | **exclude-group** *group-name* | **reply ip-header-source** *source-ip* }

Syntax Description

apply-group *group-name*	Applies configuration from the specified group.
exclude-group *group-name*	Excludes the specified group from applying configuration.
reply ip-header-source *source-ip*	Configures the reply parameters for the specified IPv4 source ip address.

Command Default

None

Command Modes

MPLS OAM configuration mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

This example displays the **address-family ipv4** command parameters.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/CPU0:router(config-oam)# address-family ipv4 ?

  apply-group        Apply configuration from a group
  exclude-group      Exclude apply-group configuration from a group
  reply              Configure reply parameters for MPLS OAM address family
  <cr>
```

address-family ipv4 reply

To configure the reply parameters for MPLS OAM IPv4 address family, use the **address-family ipv4 reply** command in MPLS OAM configuration mode.

address-family ipv4 reply **ip-header-source** *source-ip-address*

Syntax Description

ip-header-source *source-ip-address*	Configures the specified MPLS OAM IPv4 source IP address in the reply node.

Command Default

None

Command Modes

MPLS OAM configuration mode

Command History

Release	Modification
Release 24.3.1	This command was introduced.

Usage Guidelines

Use the **address-family ipv4 reply ip-header-source** *source-ip-address* command if an explicit source ip is required in the MPLS OAM reply packets when route policies block packets with non-routed source addresses. By default, the MPLS OAM packets use the local interface address as the source.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

This example configures the specified MPLS OAM IPv4 source IP address in the reply node.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/CPU0:router(config-oam)# address-family ipv4 reply ip-header-source 1.1.1.4
RP/0/RP0/CPU0:router(config-oam)# commit
```

This example verifies the above MPLS OAM source IPv4 address configuration in the reply node.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/CPU0:router(config-oam)# show running-config mpls oam

Thu Jun 20 13:43:28.855 IST
mpls oam
 address-family ipv4
```

```
 reply ip-header-source 1.1.1.4
!
```

address-family ipv6 reply

To configure the reply parameters for MPLS OAM IPv6 address family, use the **address-family ipv6 reply** command in MPLS OAM configuration mode.

address-family ipv6 reply **ip-header-source** *source-ip-address*

Syntax Description

ip-header-source *source-ip-address*	Configures the specified MPLS OAM IPv6 source IP address in the reply node.

Command Default

None

Command Modes

MPLS OAM configuration mode

Command History

Release	Modification
Release 24.3.1	This command was introduced.

Usage Guidelines

Use the **address-family ipv6 reply ip-header-source** *source-ip-address* command if an explicit source ip is required in the MPLS OAM reply packets when route policies block packets with non-routed source addresses. By default, the MPLS OAM packets use the local interface address as the source.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

This example configures the specified MPLS OAM IPv6 source IP address in the reply node.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/CPU0:router(config-oam)# address-family ipv6 reply ip-header-source 192::4
RP/0/RP0/CPU0:router(config-oam)# commit
```

This example verifies the above MPLS OAM source IPv6 address configuration in the reply node.

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/CPU0:router(config-oam)# show running-config mpls oam

Thu Jun 20 13:55:12.142 IST
```

```
mpls oam
 address-family ipv6
  reply ip-header-source 192::4
 !
```

clear mpls oam counters

To clear MPLS OAM counters, use the **clear mpls oam counters** command in XR EXEC mode.

clear mpls oam counters {**global** | **interface** [*type* *interface-path-id*] | **packet**}

Syntax Description

global	Clears global counters.
interface	Clears counters on a specified interface.
type	Interface type. For more information, use the question mark (**?**) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (**?**) online help function.
packet	Clears global packet counters.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	execute
mpls-ldp	execute
mpls-static	execute

Examples

The following example shows how to clear all global MPLS OAM counters:

```
RP/0/RP0/CPU0:router# clear mpls oam counters global
```

echo disable-vendor-extension

To disable sending the vendor extension type length and value (TLV) in the echo request, use the **echo disable-vendor extension** command in MPLS OAM configuration mode. To return to the default behavior, use the **no** form of this command.

echo disable-vendor-extension
no echo disable-vendor-extension

Syntax Description

This command has no arguments or keywords.

Command Default

The default value is 4.

Command Modes

MPLS OAM configuration mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following example shows how to disable inclusion of the vendor extensions TLV in the echo requests:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/CPU0:router(config-oam)# echo disable-vendor-extension
```

echo lsp-properties-timeout

To configure the timeout for LSP properties request in the echo configuration, use the **echo lsp-properties-timeout** command in MPLS OAM configuration mode. To return to the default behavior, use the **no** form of this command.

echo lsp-properties-timeout *timeout*
no echo lsp-properties-timeout

Syntax Description

lsp-properties-timeout *timeout*	Specifies the timeout interval, in milliseconds. Range is 500 to 10000. Default is 2000 ms.

Command Default

The default timeout value is 2 seconds (2000 ms).

Command Modes

MPLS OAM configuration mode

Command History

Release	Modification
Release 26.2.1	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following example shows how to configure timeout for LSP properties request in the echo configuration:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/CPU0:router(config-oam)# echo lsp-properties-timeout 2000
```

echo revision

To set the echo packet revision, use the **echo revision** command in MPLS OAM configuration mode. To return to the default behavior, use the **no** form of this command.

echo revision {**1** | **2** | **3** | **4** }
no echo revision

Syntax Description

1 | **2** | **3** | **4**	Draft revision number: • 1: RFC-ietf-mpls-lsp-ping-03 (initial) • 2: RFC-ietf-mpls-lsp-ping-03 (rev 1) • 3: RFC-ietf-mpls-lsp-ping-03 (rev 2) • 4: RFC-ietf-mpls-lsp-ping-09 (initial)

Command Default

The default echo revision is 4 (in RFC 9).

Command Modes

MPLS OAM configuration mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following example shows how to set the echo packet default revision:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/CPU0:router(config-oam)# echo revision 1
```

mpls oam

To enable MPLS OAM LSP verification, use the **mpls oam** command in XR Config mode. To return to the default behavior, use the **no** form of this command.

mpls oam
no mpls oam

Syntax Description

This command has no arguments or keywords.

Command Default

By default, MPLS OAM functionality is disabled.

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **mpls oam** command and OAM functionality is described in the RFC 4379.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples

The following example shows how to enable MPLS OAM:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/CPU0:router(config-oam)#
```

ping mpls ipv4

To check MPLS host reachability and network connectivity by specifying the destination type as a Label Distribution Protocol (LDP) IPv4 address, use the **ping mpls ipv4** command in XR EXEC mode.

ping mpls ipv4 *address/mask* [**destination** *start-address end-address increment*] [**dsmap**] [**exp** *exp-bits*] [**force-explicit-null**] [**interval** *min-send-delay*] [**output interface** *type interface-path-id* [**nexthop** *nexthop-address*]][**pad** *pattern*][**repeat** *count*] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **no-reply** | **router-alert**} | **reply pad-tlv**}] [**revision** *version*] [**size** *packet-size*] [**source** *source-address*] [**sweep** *min value max value increment*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**] [**fec-type** {**bgp** | **generic** | **ldp**}]

Syntax Description

address/mask	Address prefix of the target and number of bits in the target address network mask.
destination *start address end address address increment*	(Optional) Specifies a network 127/8 address to be used as the destination address in the echo request packet. ***start address*** Start of the network address. ***end address*** Start of the ending network address. ***address increment*** Incremental value of the network address, which is expressed as a decimal number value or IP address.
dsmap	(Optional) Indicates that a downstream mapping (DSMAP) type length and value should be included in the LSP echo request.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.
output interface	(Optional) Specifies the output interface where echo request packets are sent.

type	Interface type. For more information, use the question mark (**?**) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information, use the question mark (**?**) online help function.
nexthop	(Optional) Specifies the nextop as an IP address.
nexthop-iaddress	(Optional) IP address for the next hop.
pad *pattern*	(Optional) Specifies the pad pattern for an echo request.
repeat *count*	(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *dscp-value*	Specifies the differentiated service codepoint value for an MPLS echo reply.
reply mode [**ipv4** | **router-alert** | **no-reply**]	Specifies the reply mode for the echo request packet. **no-reply** Do not reply **ipv4** Reply with an IPv4 UDP packet (this is the default) **router-alert** Reply with an IPv4 UDP packet with the IP router alert set
reply pad-tlv	Indicates that a pad TLV should be included.
revision *version*	(Optional) Specifies the Cisco extension TLV versioning field: • 1 RFC-ietf-mpls-lsp-ping-03 (initial) • 2 RFC-ietf-mpls-lsp-ping-03 (rev 1) • 3 RFC-ietf-mpls-lsp-ping-03 (rev 2) • 4 RFC-ietf-mpls-lsp-ping-09 (initial)
size *packet size*	(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.

source *source-address*	(Optional) Specifies the source address used in the echo request packet.
sweep *min value max value interval*	(Optional) Specifies a range of sizes for the echo packets sent. ***min value*** Minimum or start size for an echo packet (range is 100 to 17986) ***max value*** Maximum or end size for an echo packet(range is 100 to 17986) ***interval*** Number used to increment an echo packet size(range is 1 to 8993)
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.
fec-type	(Optional) Specifies FEC type to be used. **bgp** Use FEC type as BGP **generic** Use FEC type as generic **ldp** Use FEC type as LDP

Command Default

exp *exp bits*: 0

interval *min-send-delay*: 0

repeat *count* : 5

reply-mode: IPv4

timeout *timeout* : 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **output interface** keyword specifies the output interface on which the MPLS echo request packets are sent. If the specified output interface is not part of the LSP, the packets are not transmitted.

In cases where the sweep keyword is used, values larger than the outgoing interface's MTU are not transmitted.

The **ping** command sends an echo request packet to an address, and then awaits a reply. Ping output can help you evaluate path-to-host reliability, delays over the path, and whether the host can be reached or is functioning.

Note The **ping mpls** command is not supported on optical LSPs. If an optical LSP is encountered along the LSP's path, it is treated as a physical interface.

For detailed configuration information about the MPLS **ping** command, see *Cisco ASR 9000 Series Router Cisco IOS XR System Monitoring Configuration Guide for the CRS-1 Router Cisco XR 12000 Series Router*.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples

The following example shows the destination type as a label distribution protocol (LDP) prefix and specifies a range of sizes for the echo packets sent:

```
RP/0/RP0/CPU0:router# ping mpls ipv4 140.140.140.140/32 verbose sweep 100 200 15 repeat 1

  Sending 1, [100..200]-byte MPLS Echos to 140.140.140.140/32,
        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 rx label,
    '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.
  !    size 100, reply addr 196.100.1.26, return code 3
  !    size 115, reply addr 196.100.1.26, return code 3
  !    size 130, reply addr 196.100.1.26, return code 3
  !    size 145, reply addr 196.100.1.26, return code 3
  !    size 160, reply addr 196.100.1.26, return code 3
  !    size 175, reply addr 196.100.1.26, return code 3
  !    size 190, reply addr 196.100.1.26, return code 3

  Success rate is 100 percent (7/7), round-trip min/avg/max = 5/6/8 ms
```

The following example shows the destination type as a label distribution protocol (LDP) prefix and specifies FEC type as generic and verbose option:

```
RP/0/RP0/CPU0:router# ping mpls ipv4 11.11.11.11/32 fec-type generic output interface
gigabitEthernet 0/0/0/3
nexthop 172.40.103.2 verbose

Sending 5, 100-byte MPLS Echos to 11.11.11.11/32,
      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 rx label,
  '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.

!      size 100, reply addr 11.101.11.11, return code 3
!      size 100, reply addr 11.101.11.11, return code 3
!      size 100, reply addr 11.101.11.11, return code 3
!      size 100, reply addr 11.101.11.11, return code 3
!      size 100, reply addr 11.101.11.11, return code 3

Success rate is 100 percent (5/5), round-trip min/avg/max = 3/4/6 ms
```

ping mpls traffic-eng

To specify the destination type as an MPLS-TE tunnel and tunnel interface, use the **ping mpls traffic-eng** command in XR EXEC mode.

ping mpls traffic-eng tunnel *tunnel-ID* [**dsmap**] [**exp** *exp-bits*] [**force-explicit-null**] [**interval** *min-send-delay*] [**pad** *pattern*] [**repeat** *count*] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **no-reply** | **router-alert**} | **reply pad-tlv**}] [**revision** *version*] [**size** *packet-size*] [**source** *source-address*] [**sweep** *min-value max-value increment*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**]

Syntax Description

tunnel *tunnel-ID*	Specifies the destination type as an MPLS traffic engineering (TE) tunnel and the tunnel interface number. The range for the tunnel interface number is from 0 to 65535.
dsmap	(Optional) Indicates that a downstream mapping (DSMAP) type length and value should be included in the LSP echo request.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.
pad *pattern*	(Optional) Specifies the pad pattern for an echo request.
repeat *count*	(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
reply mode [**ipv4** | **router-alert** | **no-reply**]	(Optional) Specifies the reply mode for the echo request packet. **no-reply** Do not reply **ipv4** Reply with an IPv4 UDP packet (this is the default) **router-alert** Reply with an IPv4 UDP packet with the IP router alert set
reply pad-tlv	(Optional) Indicates that a pad TLV should be included.

revision *version*	(Optional) Specifies the Cisco extension TLV versioning field: • 1 draft-ietf-mpls-lsp-ping-03 (initial) • 2 draft-ietf-mpls-lsp-ping-03 (rev 1) • 3 draft-ietf-mpls-lsp-ping-03 (rev 2) • 4 draft-ietf-mpls-lsp-ping-09 (initial)
size *packet-size*	(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
sweep *min-value max-value interval*	(Optional) Specifies a range of sizes for the echo packets sent. ***min-value*** Minimum or start size for an echo packet (range is 100 to 17986) ***max-value*** Maximum or end size for an echo packet(range is 100 to 17986) ***interval*** Number used to increment an echo packet size(range is 1 to 8993)
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits*: 0

interval *min-send-delay*: 0

repeat *count*: 5

reply-mode: IPv4

timeout *timeout* : 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **output interface** keyword specifies the output interface on which the MPLS echo request packets are sent. If the specified output interface is not part of the LSP, the packets are not transmitted.

In cases where the **sweep** keyword is used, values larger than the outgoing interface's MTU are not transmitted.

The **ping** command sends an echo request packet to an address, and then awaits a reply. Ping output can help you evaluate path-to-host reliability, delays over the path, and whether the host can be reached or is functioning.

Note The **ping mpls traffic-eng** command is not supported on optical LSPs. If an optical LSP is encountered along the LSP's path, it is treated as a physical interface.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples

The following example shows how to check connectivity by using the **ping mpls traffic-eng** command when a TE tunnel 10 is present. Return code, reply address, and packet size are displayed due to the **verbose** keyword.

```
RP/0/RP0/CPU0:router# ping mpls traffic-eng tunnel 10 repeat 1 verbose

  Sending 1, 100-byte MPLS Echos to tunnel-te10,
        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 rx label,
    'P' - no rx intf label prot, 'p' - premature termination of LSP,
    'R' - transit router, 'X' - unknown return code, 'x' - return code 0

  Type escape sequence to abort.
  !    size 100, reply addr 196.100.1.18, return code 3

  Success rate is 100 percent (1/1), round-trip min/avg/max = 15/15/15 ms
```

ping mpls traffic-eng tunnel-tp

To specify the destination type as an MPLS-TP tunnel and tunnel interface, use the **ping mpls traffic-eng tunnel-tp**command in XR EXEC mode.

ping mpls traffic-eng tunnel-tp *tunnel-id* [**ddmap**] [**destination** *start-address end-address increment*] [**dsmap**] [**encap** {**cv-ip** | **cv-non-ip** | **ip**}] [**exp** *exp-bits*] [**flags** {**fec** | **reverse-verification** }] [**interval** *min-send-delay*][**lsp** {**active** | **protect** | **working**}][**pad** *pattern*][**repeat** *count*] [**reply** {**dscp** *dscp-value* | **mode** {**control-channel** | **no-reply** } | **pad-tlv**}] [**size** *packet-size*] [**source** *source-address*] [**sweep** *min value max value increment*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**]

Syntax Description

tunnel-tp *tunnel-ID*	Specifies the destination type as an MPLS Transport Profile (MPLS-TP) tunnel and the tunnel interface number. The range for the tunnel interface number is 0 to 65535.
ddmap	(Optional) Indicates that a downstream detailed mapping (DDMAP) TLV should be included in the LSP echo request.
destination *start-address end-address increment*	Specifies a network 127/8 address to be used as the destination address in the echo request packet. ***start address*** Start of the network address. ***end address*** Start of the ending network address. ***address increment*** Incremental value of the network address, which is expressed as a decimal number value or IP address.
dsmap	(Optional) Indicates that a downstream mapping (DSMAP) type length and value should be included in the LSP echo request.
encap { **cv-ip** | **cv-non-ip** | **ip** }	(Optional) Specifies the MPLS-TP encapsulation type to use. **cv-ip** Use IP encapsulation with GACH channel 0x0021. **cv-non-ip** Use non-IP encapsulation with GACH channel 0x0025. **ip** Use IP encapsulation.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.

flags { **fec** | **reverse-verification** }	(Optional) Specifies the flag options to use. **fec** Request forwarding equivalent class (FEC) stack checking is to be performed at transit routers. **reverse-verification** Request reverse path connectivity verification.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.
lsp { **active** | **protect** | **working** }	(Optional) Specifies the LSP to use. **active** Active MPLS-TP tunnel. **protect** Protect MPLS-TP tunnel. **working** Working MPLS-TP tunnel. **Note** Use this option to identify error in the LSP path if the MPLS-TP tunnel is not up.
pad *pattern*	(Optional) Specifies the pad pattern for an echo request.
repeat *count*	(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
mode [**control-channel** | **no-reply**]	(Optional) Specifies the reply mode for the echo request packet. **control-channel** Send reply through a control channel. **no-reply** Do not reply.
pad-tlv	(Optional) Indicates that a pad TLV should be included.
size *packet-size*	(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.
source *source-address*	(Optional) Specifies the source address used in the echo request packet.

sweep *min-value max-value interval*	(Optional) Specifies a range of sizes for the echo packets sent. ***min-value*** Minimum or start size for an echo packet (range is 100 to 17986) ***max-value*** Maximum or end size for an echo packet(range is 100 to 17986) ***interval*** Number used to increment an echo packet size(range is 1 to 8993)
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits*: 0

interval *min-send-delay*: 0

repeat *count*: 5

timeout *timeout* : 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

In cases where the **sweep** keyword is used, values larger than the outgoing interface's MTU are not transmitted.

The **ping** command sends an echo request packet to an address, and then waits for a reply. Ping output helps you evaluate path-to-host reliability, delays over the path. It also helps you determine whether the host is reachable or is functioning.

Task ID

Task ID	Operation
mpls-te	read, write
mpls-ldp	read, write

Examples

The following sample output is from the **ping mpls traffic-eng tunnel-tp** command using the non-IP-ACH encapsulation:

```
RP/0/RP0/CPU0:router# ping mpls traffic-eng tunnel-tp 1 encap cv-non-ip

Sending 5, 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 rx label,
  '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 (5/5), round-trip min/avg/max = 3/11/45 ms
```

The following sample output is from the **ping mpls traffic-eng tunnel-tp** command using the non-IP-ACH encapsulation and verbose option:

```
RP/0/RP0/CPU0:router# ping mpls traffic-eng tunnel-tp 1 encap cv-non-ip

Sending 5, 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 rx label,
  '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.

!      size 100, reply node id 12.12.12.3, global id 0, return code 3
!      size 100, reply node id 12.12.12.3, global id 0, return code 3
!      size 100, reply node id 12.12.12.3, global id 0, return code 3
!      size 100, reply node id 12.12.12.3, global id 0, return code 3
!      size 100, reply node id 12.12.12.3, global id 0, return code 3

Success rate is 100 percent (5/5), round-trip min/avg/max = 3/3/4 ms
```

The following sample output is from the **ping mpls traffic-eng tunnel-tp** command using the non-IP-ACH encapsulation and DSMAP/DDMAP option:

```
RP/0/RP0/CPU0:router# ping mpls traffic-eng tunnel-tp 1 encap cv-non-ip

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 rx label,
```

```
  '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.

L      size 100, reply node id 12.12.12.3, global id 0, return code 8
 Echo Reply received from Node ID 12.12.12.3, Global ID 0
  DSMAP 0, Ingress Link ID 3, Egress Link ID 4
    Depth Limit 0, MRU 1500 [Labels: 1100 Exp: 0]


Success rate is 0 percent (0/1)
```

ping pseudowire (AToM)

To verify connectivity between provider edge (PE) LSRs in an Any Transport over MPLS (AToM) setup, use the **ping pseudowire** command in XR EXEC mode.

ping [**mpls**] **pseudowire** *remote-PE -address pw-id* [**exp** *exp-bits*] [**interval** *min-send-delay*] [**pad** *pattern*] [**repeat** *count*] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **no-reply** | **router-alert** | **control-channel**} | **reply pad-tlv**}] [**size** *packet-size*] [**source** *source-address*] [**sweep** *min-value max-value increment*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**]

Syntax Description

mpls	(Optional) Verifies the Labeled Switch Path (LSP).
remote-PE address	IP address of the remote PE LSR.
pw-id	Pseudowire ID that identifies the pseudowire in which MPLS connectivity is being verified. The pseudowire is used to send the echo request packets. The range is from 1 to 4294967295.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.
pad *pattern*	(Optional) Specifies the pad pattern for an echo request.
repeat *count*	(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.

reply mode {**ipv4** | **router-alert** | **no-reply** | **control-channel**}	(Optional) Specifies the reply mode for the echo request packet. **no-reply** Do not reply **ipv4** Reply with an IPv4 UDP packet (the default) **router-alert** Reply with an IPv4 UDP packet with the IP router alert set **control-channel** Force the use of a VCCV control channel. Reply using an application for a defined control channel. This applies only to pseudowires in which VCCV is used in the reply path. This is the default choice for pseudowire ping.
reply pad-tlv	(Optional) Indicates that a reply pad TLV should be included.
size *packet-size*	(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
sweep *min-value max-value interval*	Specifies a range of sizes for the echo packets sent. ***min-value*** Minimum or start size for an echo packet (range is 100 to 17986) ***max-value*** Maximum or end size for an echo packet(range is 100 to 17986) ***interval*** Number used to increment an echo packet size(range is 1 to 8993)
timeout *timeout*	(Optional) Specifies the timeout interval in seconds. Range is 0 to 3600. Default is 2 seconds.
ttl *value*	(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp bits*: 0

interval *min-send-delay*: 0

repeat *count*: 5

reply-mode: IPv4

timeout *timeout* : 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.
Release 6.3.2	Supports segment routing and SR-TE policy preferred path as transport to reach remote PE. **Note** Label distribution protocol (LDP) is required to signal PW up, but is not required as transport.

Usage Guidelines

In cases in which the **sweep** keyword is used, values larger than the outgoing interface's MTU are not transmitted.

The **ping** command sends an echo request packet to an address, and then awaits a reply. Ping output can help you evaluate path-to-host reliability, delays over the path, and whether the host can be reached or is functioning.

Note The **ping mpls** command is not supported on optical LSPs. If an optical LSP is encountered along the LSP's path, it is treated as a physical interface.

AToM VCCV allows the sending of control packets inband of an AToM pseudowire (PW) from the originating provider edge (PE) router. The transmission is intercepted at the destination PE router, instead of being forwarded to the customer edge (CE) router. This lets you use MPLS LSP ping to test the pseudowire section of AToM virtual circuits (VCs).

The no interactive version of the **ping pseudowire (AToM)** command is supported.

The control word setting is either enabled along the entire path between the Terminating-Provider Edge (T-PE) or it is completely disabled. If the control word configuration is enabled on one segment and disabled on another segment, the multisegment pseudowire does not come up.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples

The following example shows how the **ping mpls pseudowire** command is used to verify PE to PE connectivity in which the remote PE address is 150.150.150.150. Only one echo request packet is sent and the remote PE is to answer using IPv4 instead of the control channel.

```
RP/0/RP0/CPU0:router# ping mpls pseudowire 150.150.150.150 21 repeat 1 reply mode ipv4

  Sending 1, 100-byte MPLS Echos to 150.150.150.150 VC: 21,
        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 rx label,
    '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 = 23/23/23 ms
```

ping mpls traffic-eng tunnel-te (P2P)

To specify the destination type as an MPLS-TE tunnel and tunnel interface, use the **ping mpls traffic-eng tunnel-te** command in XR EXEC mode.

ping mpls traffic-eng tunnel-te *tunnel-ID* {**destination** *start-address end-address increment*}[**dsmap**] [**exp** *exp-bits*] [**force-explicit-null**] [**interval** *min-send-delay*] [**lsp** {**active** | **path-protect**}][**pad** *pattern*] [**repeat** *count*] [**reply** {**dscp** *dscp-value* | **mode** {**ipv4** | **no-reply** | **router-alert**} | **pad-tlv**}] [**revision** *version*] [**size** *packet-size*] [**source** *source-address*] [**sweep** *min-value max-value increment*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**]

Syntax Description

tunnel-te *tunnel-ID*	Specifies the destination type as an MPLS traffic engineering (TE) tunnel and the tunnel interface number. The range for the tunnel interface number is 0 to 65535.
destination *start-address end-address increment*	Specifies a network 127/8 address to be used as the destination address in the echo request packet. ***start address*** Start of the network address. ***end address*** Start of the ending network address. ***address increment*** Incremental value of the network address, which is expressed as a decimal number value or IP address.
dsmap	Specifies a **downstream mapping** type length and value which should be included in the LSP echo request.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.
lsp { **active**		**path-protect**}	(Optional) Specifies the LSP to use.
pad *pattern*	(Optional) Specifies the pad pattern for an echo request.
repeat *count*	(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.

mode [**ipv4** | **router-alert** | **no-reply**]	(Optional) Specifies the reply mode for the echo request packet. **no-reply** Do not reply **ipv4** Reply with an IPv4 UDP packet (this is the default) **router-alert** Reply with an IPv4 UDP packet with the IP router alert set
reply pad-tlv	(Optional) Indicates that a pad TLV should be included.
revision *version*	(Optional) Specifies the Cisco extension TLV versioning field: • 1 RFC-ietf-mpls-lsp-ping-03 (initial) • 2 RFC-ietf-mpls-lsp-ping-03 (rev 1) • 3 RFC-ietf-mpls-lsp-ping-03 (rev 2) • 4 RFC-ietf-mpls-lsp-ping-09 (initial)
size *packet-size*	(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
sweep *min-value max-value interval*	(Optional) Specifies a range of sizes for the echo packets sent. ***min-value*** Minimum or start size for an echo packet (range is 100 to 17986) ***max-value*** Maximum or end size for an echo packet(range is 100 to 17986) ***interval*** Number used to increment an echo packet size(range is 1 to 8993)
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).

verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits*: 0

interval *min-send-delay*: 0

repeat *count*: 5

reply-mode: IPv4

timeout *timeout* : 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **output interface** keyword specifies the output interface on which the MPLS echo request packets are sent. If the specified output interface is not part of the LSP, the packets are not transmitted.

In cases where the **sweep** keyword is used, values larger than the outgoing interface's MTU are not transmitted.

The **ping** command sends an echo request packet to an address, and then waits for a reply. Ping output helps you evaluate path-to-host reliability, delays over the path. It also helps you determine whether the host is reachable or is functioning.

Task ID

Task ID	Operation
mpls-te	read, write
mpls-ldp	read, write

ping pseudowire multisegment

To verify the ping over the multisegment pseudowire, use the **ping pseudowire multisegment** command in XR EXEC mode.

ping [**mpls**] **pseudowire multisegment** *end-address pw-id* [**destinationfec** *sender-address remote-address pw-id-address*] [**exp** *exp-bits*] [**interval** *min-send-delay*] [**pad** *pattern*] [**repeat** *count*] [**segment-count** *segment-number*] [**reply** {**dscp** *dscp-value* | **mode** {**ipv4** | **no-reply** | **router-alert** | **control-channel**} | **pad-tlv**}] [**size** *packet-size*] [**source** *source-address*] [**sweep** *min value max value increment*] [**timeout** *timeout*] [**verbose**]

Syntax Description

mpls	(Optional) Verifies the Label Switched Path (LSP).
end-address	Target end address.
pw-id	Virtual circuit of the pseudowire ID that identifies the pseudowire in which MPLS connectivity is being verified. The pseudowire sends the echo request packets. Range is from 1 to 4294967295.
destinationfec *sender-address remote-address pw-id-address*	(Optional) Specifies the destination for the Forwarding Equivalence Class (FEC) . ***sender-address*** Sender-PE (S-PE) address for the destination FEC. The S-PE address is placed in the S-PE address field of the FEC 128 Pseudowire (RFC 4379). ***remote-address*** Remote address (S-PE address for the partial ping) for the destination FEC. The address is placed in the remote PE address of the FEC 128 Pseudowire (RFC 4379). **pw-id-address** Pseudowire ID of the pseudowire segment to the remote T-PE address (S-PE address for the partial ping).
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
interval *min-send-delay*	(Optional) Specifies a send interval between requests (in milliseconds). Range is 0 to 3600000. Default is 0.
pad *pattern*	(Optional) Specifies the pad pattern for an echo request.
repeat *count*	(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.

reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
reply mode {**ipv4** | **router-alert** | **no-reply** | **control-channel**}	(Optional) Specifies the reply mode for the echo request packet. **no-reply** Do not reply **ipv4** Reply with an IPv4 UDP packet (the default) **router-alert** Reply with an IPv4 UDP packet with the IP router alert set **control-channel** Force the use of a VCCV control channel. Reply using an application for a defined control channel. This applies only to pseudowires in which VCCV is used in the reply path. This is the default choice for pseudowire ping.
segment-count	(Optional) Specifies the segment count for the FEC destination of the multisegment pseudowire . The segment count is used for the pseudowire label for the TTL value.
segment-number	(Optional) Value of the segment count. Range is 1 to 255.
pad-tlv	(Optional) Indicates that a pad TLV should be included.
size *packet-size*	(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.
sweep *min value max value interval*	Specifies a range of sizes for the echo packets sent. ***min value*** Minimum or start size for an echo packet (range is 100 to 17986) ***max value*** Maximum or end size for an echo packet (range is 100 to 17986) ***interval*** Number used to increment an echo packet size(range is 1 to 8993)

source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeout*	(Optional) Specifies the timeout interval in seconds. Range is 0 to 3600. Default is 2 seconds.
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits* : 0

interval *min-send-delay* : 0

repeat *count*: 5

reply-mode: ipv4

size *packet-size* : 100

timeout *timeout* : 2 seconds

Command Modes

XR Config mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The partial ping works only if the **destinationfec** keyword is used.

The control word setting is either enabled along the entire path between the Terminating-Provider Edge (T-PE) or it is completely disabled. If the control word configuration is enabled on one segment and disabled on another segment, the multisegment pseudowire does not come up.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

The following example shows the local pseudowire segment from T-PE1 is set to S-PE1 80.80.80.80 and the pseudowire ID is set to 100. The last pseudowire segment of the multisegment pseudowire is from S-PE1 80.80.80.80 to T-PE2 90.90.90.90 and the pseudowire ID is set to 300.

```
RP/0/RP0/CPU0:router#  ping pseudowire multisegment 80.80.80.80 100  destinationfec
80.80.80.80 90.90.90.90 300 segment-count 2

Sending 5, 100-byte MPLS Echos to 80.80.80.80 VC: 100, 90.90.90.90 VC: 300
      timeout is 2 seconds, send interval is 0 msec, PW Label TTL is 2:

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 rx label,
  '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 (5/5), round-trip min/avg/max = 6/10/18 ms
```

show mpls oam

To display MPLS OAM information, use the **show mpls oam** command in XR EXEC mode.

show mpls oam {**client** | **counters** {**global** | **packet**} | **interface** *type* *interface-path-id*}

Syntax Description

client	Displays clients registered with LSPV server.
counters global	Displays LSP verification global counters.
counters packet	Displays LSP verification packet counters.
interface	Displays LSP verification information for a specific interface.
type	Interface type. For more information, use the question mark (**?**) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (**?**) online help function.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

The following example shows how to display MPLS OAM client information:

```
RP/0/RP0/CPU0:router# show mpls oam client

  Client Process: l2vpn_mgr Node: 0/0/SP Pid: 418014
  Client Process: te_control Node: 0/0/SP Pid: 639227
```

This table describes the significant fields shown in the display.

Table 77: show mpls oam client Command Field Descriptions

Field	Description
Client Process	Process of client.

show mpls oam database

To display MPLS OAM database information, use the **show mpls oam database** command in XR EXEC mode.

show mpls oam database { **requests** | **tt-requests**} [**detail**] [**handle** *handle-value*]

Syntax Description

requests	Displays request database
tt-requests	Displays tree trace request database
detail	(Optional) Displays displayed information.
handle	(Optional) Displays handle information.
handle-value	Generic handle value. Range is from 0 to 4294967295.

Command Default

No default behavior or values

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples

The following example shows how to display detailed MPLS OAM database information:

```
RP/0/RP0/CPU0:router# show mpls oam database request detail
```

traceroute mpls ipv4

To learn the routes that packets follow when traveling to their Label Distribution Protocol (LDP) IPv4 destination, use the **traceroute mpls** command in XR EXEC mode.

traceroute mpls ipv4*address/mask* [**destination** *start-address end-address address-increment*] [**exp** *exp-bits*] [**flags fec**] [**force-explicit-null**] [**output** {**interface** *type interface-path-id* [**nexthop** *nexthop-address*] | [**nexthop** *nexthop-address*]}] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **router-alert**}}] [**revision** *version*] [**source** *source-address*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**] [**fec-type** {**bgp** | **generic** | **ldp**}]

Syntax Description

address/mask	Specifies the destination type as a label distribution protocol (LDP) prefix. Address prefix of the target and number of bits in the target address network mask.
destination *start-address end-address address-increment*	Specifies a network 127 address to be used as the destination address in the echo request packet. ***start address*** Start of the network address. ***end address*** End of the network address. ***address increment*** Incremental value of the network address.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	(Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
output interface	(Optional) Specifies the output interface in which echo request packets are sent.
type	Interface type. For more information, use the question mark (**?**) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information, use the question mark (**?**) online help function.

nexthop	(Optional) Specifies the IP address for the next hop.
nexthop-address	(Optional) IP address for the next hop.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
reply mode { **ipv4** | **router-alert**}	(Optional) Specifies the reply mode for the echo request packet. **ipv4** Reply with IPv4 UDP packet (this is the default) **router-alert** Reply with IPv4 UDP packet with router alert
revision *version*	(Optional) Specifies the Cisco extension TLV versioning field: • 1 RFC-ietf-mpls-lsp-ping-03 (initial) • 2 RFC-ietf-mpls-lsp-ping-03 (rev 1) • 3 RFC-ietf-mpls-lsp-ping-03 (rev 2) • 4 RFC-ietf-mpls-lsp-ping-09 (initial)
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeoutt*	(Optional) Specifies the timeout interval, in seconds. Range is from 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the maximum number of hops (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.
fec-type	(Optional) Specifies FEC type to be used. **bgp** Use FEC type as BGP **generic** Use FEC type as generic **ldp** Use FEC type as LDP

Command Default

exp *exp-bits*: 0

reply mode: IPv4

timeout *timeout*: 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines



Note The **traceroute mpls** command is not supported on optical LSPs. If an optical LSP is encountered along the LSPs path, it is treated as a physical interface.

For detailed configuration information about MPLS LSP trace operations, see *System Monitoring Configuration Guide*.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples

The following example shows how to trace a destination:

```
RP/0/RP0/CPU0:router# traceroute mpls ipv4 140.140.140.140/32
destination 127.0.0.10 127.0.0.15 1


Tracing MPLS Label Switched Path to 140.140.140.140/32, 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 rx label,
  '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.

Destination address 127.0.0.10

  0 196.100.1.41 MRU 4470 [Labels: 19 Exp: 0]
L 1 196.100.1.42 MRU 4470 [Labels: 86 Exp: 0] 360 ms
  2 196.100.1.50 MRU 4470 [Labels: implicit-null Exp: 0] 8 ms
! 3 196.100.1.18 9 ms
```

The following example shows how to trace a destination with FEC type specified as generic and verbose option:

```
RP/0/RP0/CPU0:router# traceroute mpls ipv4 11.11.11.11/32 fec-type generic output interface
 gigabitEthernet 0/0/0/3
nexthop 172.40.103.2 verbose
```

```
Tracing MPLS Label Switched Path to 11.11.11.11/32, 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 rx label,
  '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.

  0 172.40.103.1 172.40.103.2 MRU 1500 [Labels: 16038 Exp: 0]
L 1 172.40.103.2 173.101.103.1 MRU 1500 [Labels: 16037 Exp: 0] 6 ms, ret code 8
L 2 173.101.103.1 11.101.11.11 MRU 1500 [Labels: implicit-null Exp: 0] 4 ms, ret code 8
! 3 11.101.11.11 6 ms, ret code 3
```

traceroute mpls multipath

To discover all possible paths of an LSP between the ingress and egress routers, use the **traceroute mpls multipath** command in XR EXEC mode.

traceroute mpls multipath ipv4 *address/mask* [**destination** *start-address*/*end-address address-increment*] [**exp** *exp-bits*] [**flags fec**] [**force-explicit-null**] [**hashkey ipv4 bitmap** *bit-size*] [**interval** *min-send-delay*] [**output** {**interface** *type interface-path-id* [**nexthop** *nexthop-address*] | [**nexthop** *nexthop-address*]}] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **router-alert**}}] [**retry-count** *count*] [**revision** *version*] [**source** *source-address*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**] [**fec-type** {**bgp** | **generic** | **ldp**}]

Syntax Description

ipv4	Specifies the destination type as a Label Distribution Protocol (LDP) IPv4 address.
address/mask	Address prefix of the target and number of bits in the target address network mask.
destination *start-address end-address address -increment*	(Optional) Specifies a network 127 address to be used as the destination address in the echo request packet. ***start-address*** Start of the network address. ***end-address*** End of the network address. ***address-increment*** Incremental value of the network address.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	(Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
hashkey ipv4 bitmap *bit-size*	(Optional) Allows user control of the hash key/multipath settings. Range is 0 to 256. The default is 32.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.
output interface	(Optional) Specifies the output interface where echo request packets are sent.
type	Interface type. For more information, use the question mark (**?**) online help function.

interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information, use the question mark (**?**) online help function.
nexthop	(Optional) Specifies the IP address for the next hop.
nexthop-address	(Optional) IP address for the next hop.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
reply mode [**ipv4** | **router-alert**]	(Optional) Specifies the reply mode for the echo request packet. **ipv4** Reply with IPv4 UDP packet (this is the default) **router-alert** Reply with IPv4 UDP packet with router alert
retry-count *count*	(Optional) Specifies the number of retry attempts during multipath LSP traceroute. A retry is attempted if an outstanding echo request • times out waiting for the corresponding echo reply. • fails to find a valid destination address set to exercise a specific outgoing path. Range is 0 to 10. Default is 3.
revision *version*	(Optional) Specifies the Cisco extension TLV versioning field: • 1 RFC-ietf-mpls-lsp-ping-03 (initial) • 2 RFC-ietf-mpls-lsp-ping-03 (rev 1) • 3 RFC-ietf-mpls-lsp-ping-03 (rev 2) • 4 RFC-ietf-mpls-lsp-ping-09 (initial)
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is from 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the maximum number of hops (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

fec-type	(Optional) Specifies FEC type to be used. **bgp** Use FEC type as BGP **generic** Use FEC type as generic **ldp** Use FEC type as LDP

Command Default

exp *exp-bits* : 0

hashkey ipv4 bitmap *bit-size*: 4

interval *min-send-delay*: 0

reply mode: IPv4

retry-count: 3

timeout *timeout* : 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

The **hashkey ipv4 bitmap** keyword and *bit-size* value control how many addresses are encoded in the DSMAP multipath field. Larger values allow more coverage of equal cost multiple paths throughout the network, but with more processing at the head, mid, and tail routers.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples

The following example shows how to specify the destination type as an LDP IPv4 prefix:

```
RP/0/RP0/CPU0:router# traceroute mpls multi ipv4 140.140.140.140/32 verbose
force-explicit-null

  Starting LSP Path Discovery for 140.140.140.140/32

  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 rx label,
  '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.

  LL!
  Path 0 found,
  output interface POS0/2/0/3 source 196.100.1.61 destination 127.0.0.1
  0 196.100.1.61 196.100.1.62 MRU 4470 [Labels: 18/explicit-null Exp: 0/0] multipaths 0
  L 1 196.100.1.62 196.100.1.10 MRU 4470 [Labels: 17/explicit-null Exp: 0/0] ret code 8
multipaths 1
  L 2 196.100.1.10 196.100.1.18 MRU 4470 [Labels: implicit-null/explicit-null Exp: 0/0] ret
 code 8 multipaths 1
  ! 3 196.100.1.1018, ret code 3 multipaths 0
  LL!
  Path 1 found,
  output interface GigabitEthernet0/3/0/0 source 196.100.1.5 destination 127.0.0.1
  0 196.100.1.5 196.100.1.37 6 MRU 1500 [Labels: 18/explicit-null Exp: 0/0] multipaths 0
  L 1 196.100.1.6 196.100.1.10 MRU 4470 [Labels: 17/explicit-null Exp: 0/0] ret code 8
multipaths 1
  L 2 10196.0100.21.5 1010 196.0100.21.10 18 MRU 4470 [Labels: implicit-null/explicit-null
 Exp: 0/0] ret code 8 multipaths 1
  ! 3 10196.0100.21.1018, ret code 3 multipaths 0

  Paths (found/broken/unexplored) (2/0/0)
  Echo Request (sent/fail) (6/0)
  Echo Reply (received/timeout) (6/0)
  Total Time Elapsed 80 ms
```

The following example shows how to specify the FEC type as LDP with verbose option:

```
RP/0/RP0/CPU0:router#  traceroute mpls multipath ipv4 11.11.11.11/32 fec-type ldp output
interface gigabitEthernet 0/0/0/3
nexthop 172.40.103.2 verbose

Starting LSP Path Discovery for 11.11.11.11/32

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 rx label,
  '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.

LL!
Path 0 found,
 output interface GigabitEthernet0/0/0/3 nexthop 172.40.103.2
 source 172.40.103.1 destination 127.0.0.0
  0 172.40.103.1 172.40.103.2 MRU 1500 [Labels: 16038 Exp: 0] multipaths 0
L 1 172.40.103.2 173.101.103.1 MRU 1500 [Labels: 16037 Exp: 0] ret code 8 multipaths 1
L 2 173.101.103.1 11.101.11.11 MRU 1500 [Labels: implicit-null Exp: 0] ret code 8 multipaths
 1
! 3 11.101.11.11, ret code 3 multipaths 0

Paths (found/broken/unexplored) (1/0/0)
 Echo Request (sent/fail) (3/0)
 Echo Reply (received/timeout) (3/0)
 Total Time Elapsed 21 ms
```

traceroute mpls traffic-eng

To specify the destination type as an MPLS traffic engineering (TE) tunnel, use the **traceroute mpls traffic-eng** command in XR EXEC mode.

traceroute mpls traffic-eng tunnel *tunnel-ID* [**destination** *start-address end-address address-increment increment-mask*] [**exp** *exp-bits*] [**flags fec**] [**force-explicit-null**] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **router-alert**}}] [**revision** *version*] [**source** *source-address*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**]

Syntax Description

tunnel	Specifies the MPLS-TE tunnel type.
tunnel-ID	Tunnel interface.
destination *start-address end-address address -increment increment-mask*	(Optional) Specifies a network 127 address to be used as the destination address in the echo request packet. ***start-address*** Start of the network address. ***end-address*** End of the network address. ***address-increment*** Incremental value of the network address. ***increment-mask*** Incremental mask of the network address.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	(Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
reply mode [**ipv4** | **router-alert**]	(Optional) Specifies the reply mode for the echo request packet. **ipv4** Reply with IPv4 UDP packet (this is the default) **router-alert** Reply with IPv4 UDP packet with router alert

revision *version*	(Optional) Specifies the Cisco extension TLV versioning field: • 1 RFC-ietf-mpls-lsp-ping-03 (initial) • 2 RFC-ietf-mpls-lsp-ping-03 (rev 1) • 3 RFC-ietf-mpls-lsp-ping-03 (rev 2) • 4 RFC-ietf-mpls-lsp-ping-09 (initial)
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is from 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the maximum number of hops (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits* : 0

reply mode: IPv4

timeout *timeout* : 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read
mpls-ldp	read

The following example shows how to specify the destination as a MPLS-TE tunnel:

```
RP/0/RP0/CPU0:router#  traceroute mpls traffic-eng tunnel 13

Tracing MPLS TE Label Switched Path on tunnel-te13, 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 rx label,
  '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.

 0 0.0.0.0 11.0.0.1 MRU 1500 [Labels: 16003 Exp: 0]
```

```
L 1 192.168.200.2 192.168.170.1 MRU 1500 [Labels: implicit-null Exp: 0] 110 ms
! 2 192.168.170.1 0.0.0.0 MRU 0 [No Label] 169 ms
```

traceroute pseudowire multisegment

To verify the Labeled Switch Path (LSP) for the multisegment pseudowire, use the **traceroute pseudowire multisegment** command in XR EXEC mode.

traceroute pseudowire multisegment *address pw-id* [**exp** *exp-bits*] [**flags fec**] [**reply** {**dscp** *dscp-value* | **mode** {**ipv4** | **no-reply** | **router-alert** | **control-channel**} | **pad-tlv**}] [**source** *source-address*] [**timeout** *timeout*] [**verbose**]

Syntax Description

address	Address of the next S-PE.
pw-id	Pseudowire ID of the pseudowire segment to the next S-PE.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	(Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
mode {**ipv4** | **router-alert** | **no-reply** | **control-channel**}	(Optional) Specifies the reply mode for the echo request packet. **no-reply** Do not reply **ipv4** Reply with an IPv4 UDP packet (the default) **router-alert** Reply with an IPv4 UDP packet with the IP router alert set **control-channel** Force the use of a VCCV control channel. Reply using an application for a defined control channel. This applies only to pseudowires in which VCCV is used in the reply path. This is the default choice for pseudowire ping.
pad-tlv	(Optional) Indicates that a pad TLV should be included.
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeout*	(Optional) Specifies the timeout interval in seconds. Range is 0 to 3600. Default is 2 seconds.
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits* : 0

reply-mode: ipv4

timeout *timeout* : 2 seconds

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read
mpls-ldp	read

The following example shows that the next pseudowire segment and traceroute go through each hop in which each hop is a S-PE or remote T-PE. The local segment from T-PE1 is set to S-PE1 80.80.80.80 and the pseudowire ID is set to 100. The last pseudowire segment of the multisegment pseudowire is from S-PE1 80.80.80.80 to T-PE2 90.90.90.90 and the pseudowire ID is set to 300.

```
RP/0/RP0/CPU0:router#  traceroute pseudowire multisegment 80.80.80.80 100

Tracing MS-PW to 80.80.80.80 VC: 100, 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 rx label,
  '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.

  0 1.2.1.2 MRU 1500 [Outgoing Labels: 20495 Exp: 0]
L 1 1.2.1.1 MRU 1500 [Outgoing Labels: 24587 Exp: 0] 13 ms
    local 70.70.70.70 remote 80.80.80.80 pw-id 100
! 2 1.4.1.1 9 ms
    local 80.80.80.80 remote 90.90.90.90 pw-id 300
```

traceroute mpls traffic-eng tunnel-te (P2P)

To specify the destination type as an MPLS traffic engineering (TE) tunnel for a point-to-point connection, use the **traceroute mpls traffic-eng tunnel-te (P2P)** command in XR EXEC mode.

traceroute mpls traffic-eng tunnel-te *tunnel-ID* [**destination** *start-address end-address address-increment increment-mask*] [**exp** *exp-bits*] [**flags fec**] [**force-explicit-null**] [**reply** {**dscp** *dscp-value* | **mode** {**ipv4** | **router-alert**}}] [**revision** *version*] [**source** *source-address*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**]

Syntax Description

tunnel-te	Specifies the MPLS-TE tunnel type.
tunnel-ID	Tunnel interface.
destination *start-address end-address address -increment increment-mask*	(Optional) Specifies a network 127 address to be used as the destination address in the echo request packet. ***start-address*** Start of the network address. ***end-address*** End of the network address. ***address-increment*** Incremental value of the network address. ***increment-mask*** Incremental mask of the network address.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	(Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
reply-mode [**ipv4** | **router-alert**]	(Optional) Specifies the reply mode for the echo request packet. **ipv4** Reply with IPv4 UDP packet (this is the default) **router-alert** Reply with IPv4 UDP packet with router alert

revision *version*	(Optional) Specifies the Cisco extension TLV versioning field: • 1 RFC-ietf-mpls-lsp-ping-03 (initial) • 2 RFC-ietf-mpls-lsp-ping-03 (rev 1) • 3 RFC-ietf-mpls-lsp-ping-03 (rev 2) • 4 RFC-ietf-mpls-lsp-ping-09 (initial)
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is from 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the maximum number of hops (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits* : 0

reply-mode: IPv4

timeout *timeout* : 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read
mpls-ldp	read

The following example shows how to specify the destination as a MPLS-TE tunnel:

```
RP/0/RP0/CPU0:router#  traceroute mpls traffic-eng tunnel-te 13

Tracing MPLS TE Label Switched Path on tunnel-te13, 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 rx label,
  '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.

 0 0.0.0.0 11.0.0.1 MRU 1500 [Labels: 16003 Exp: 0]
```

```
L 1 192.168.200.2 192.168.170.1 MRU 1500 [Labels: implicit-null Exp: 0] 110 ms
! 2 192.168.170.1 0.0.0.0 MRU 0 [No Label] 169 ms
```

traceroute mpls traffic-eng tunnel-tp

To learn the routes that packets follow when traveling to their destination, use the **traceroute mpls traffic-eng tunnel-tp**command in XR EXEC mode.

traceroute mpls traffic-eng tunnel-tp *tunnel-id* [**ddmap**] [**destination** *start-address end-address increment*] [**encap** {**cv-ip** | **cv-non-ip** | **ip**}] [**exp** *exp-bits*] [**flags** {**fec** | **reverse-verification** }] [**lsp** {**active** | **protect** | **working**}][**reply** {**dscp** *dscp-value* | **mode** {**control-channel** | **no-reply** } | **pad-tlv**}] [**source** *source-address*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**]

Syntax Description

tunnel-tp *tunnel-ID*	Specifies the destination type as an MPLS Transport Profile (MPLS-TP) tunnel and the tunnel interface number. The range for the tunnel interface number is 0 to 65535.
ddmap	(Optional) Indicates that a downstream detailed mapping (DDMAP) TLV should be included in the LSP echo request.
destination *start-address end-address increment*	Specifies a network 127/8 address to be used as the destination address in the echo request packet. ***start address*** Start of the network address. ***end address*** Start of the ending network address. ***address increment*** Incremental value of the network address, which is expressed as a decimal number value or IP address.
encap { **cv-ip** | **cv-non-ip** | **ip** }	(Optional) Specifies the MPLS-TP encapsulation type to use. **cv-ip** Use IP encapsulation with GACH channel 0x0021. **cv-non-ip** Use non-IP encapsulation with GACH channel 0x0025. **ip** Use IP encapsulation.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.

flags { **fec** | **reverse-verification** }	(Optional) Specifies the flag options to use. **fec** Request forwarding equivalent class (FEC) stack checking is to be performed at transit routers. **reverse-verification** Request reverse path connectivity verification.
lsp { **active** | **protect** | **working** }	(Optional) Specifies the LSP to use. **active** Active MPLS-TP tunnel. **protect** Protect MPLS-TP tunnel. **working** Working MPLS-TP tunnel. **Note** Use this option to identify error in the LSP path if the MPLS-TP tunnel is not up.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
mode [**control-channel**]	(Optional) Specifies the reply mode for the echo request packet. **control-channel** Send reply via a control channel.
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits*: 0

timeout *timeout* : 2

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 6.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write
mpls-ldp	read, write

Examples

The following sample output is from the **traceroute mpls traffic-eng tunnel-tp** command using the non-IP-ACH encapsulation:

```
RP/0/RP0/CPU0:router# traceroute mpls traffic-eng tunnel-tp 1 encap cv-non-ip

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 rx label,
  '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.

  0 Node ID 10.10.10.1, Global ID 0 MRU 1500 [Labels: 1000 Exp: 0]
L 1 Node ID 10.10.10.2, Global ID 0 MRU 1500 [Labels: 1100 Exp: 0] 3 ms
! 2 Node ID 12.12.12.3, Global ID 0 4 ms
```

The following sample output is from the **traceroute mpls traffic-eng tunnel-tp** command using the non-IP-ACH encapsulation and verbose option:

```
RP/0/RP0/CPU0:router# traceroute mpls traffic-eng tunnel-tp 1 encap cv-non-ip

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 rx label,
  '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.

  0 Node ID 10.10.10.1, Global ID 0 MRU 1500 [Labels: 1000 Exp: 0]
    Ingress Link ID 0, Egress Link ID 1
L 1 Node ID 10.10.10.2, Global ID 0 MRU 1500 [Labels: 1100 Exp: 0] 3 ms
```

```
    Ingress Link ID 2, Egress Link ID 3
! 2 Node ID 12.12.12.3, Global ID 0 4 ms
```



GMPLS UNI Commands

This module describes the commands used to configure UNI-C configuration for a GMPLS tunnel.

For detailed information about MPLS concepts, configuration tasks, and examples, see *MPLS Configuration Guide for Cisco NCS 5500 Series Routers*.

Note For Release 7.3.1, the GMPLS UNI feature is only available for the NCS 5500 Series platform. It is not available for the NCS 540 Series, and NCS 560 Series platforms.

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announce srlgs

To announce all SRLGs discovered through GMPLS signaling to RSI (Router Space Infrastructure), use the **announce srlgs** command in MPLS-TE GMPLS UNI controller mode. To disable announcing SRLGs to RSI, use the **no** form of this command.

announce srlgs

Syntax Description

This command has no arguments or keywords.

Command Default

None

Command Modes

MPLS-TE GMPLS UNI controller configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

The following example shows how to configure SRLG announcement:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls-uni)# controller dwdm 0/1/0/1
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)# announce srlgs
```

attribute-set xro

To specify an attribute set for LSP diversity for GMPLS UNI, use the **attribute-set xro** command in MPLS-TE configuration mode. To remove the settings, use the **no** form of this command.

attribute-set xro *attribute-set*

Syntax Description

attribute-set	Specifies the attribute set.

Command Default

No default behavior or values

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

An XRO attribute-set can be specified as part of the path-option, if required. An empty XRO attribute set results in the GMPLS tunnel being signaled with no exclusions, and therefore no XRO.

Examples

The following example shows how to configure attribute set attr01:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# attribute-set xro attr01
RP/0/RP0/CPU0:router(config-te-attribute-set)#
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.

controller dwdm (GMPLS)

To specify a controller for GMPLS UNI and enter configuration commands for the controller, use the **controller dwdm** command in the appropriate mode. To return to the default behavior, use the **no** form of this command.

controller dwdm *controller*

Syntax Description

controller	Specifies the controller in rack/slot/instance/port format.

Command Default

No default behavior or values

Command Modes

GMPLS-UNI configuration

LMP GMPLS-UNI configuration

RSVP configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The *controller* argument is the name of the GMPLS, LMP, or RSVP controller. This command forms a submode for the respective configuration.

Examples

The following example shows how to enter the GMPLS UNI sub-mode for a specified controller interface, starting from global configuration mode:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)#
```

The following example shows how to specify an LMP controller 0/4/0/0:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-ctrl)#
```

The following example shows how to specify RSVP controller 0/4/0/0:

```
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)# controller dwdm 0/1/0/0
RP/0/RP0/CPU0:router(config-rsvp-cntl)#
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.

Command	Description
gmpls optical-uni	Enables GMPLS optical UNI and enters configuration mode for UNI.

destination ipv4 unicast

To specify the destination of a GMPLS UNI tunnel, use the **destination ipv4 unicast** command in GMPLS-UNI controller tunnel-properties configuration sub-mode.

destination ipv4 unicast *address*

Syntax Description

address	Specifies the tunnel destination (IPv4 address).

Command Default

No default behavior or values

Command Modes

GMPLS-UNI controller tunnel-properties configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The destination can be either the optical router ID of the destination node or the optical address of the desired ingress interface to the destination node. Specifying the router-id means that the ingress interface is selected by the network.

Examples

The following example shows how to specify a tunnel destination (10.10.3.4), starting from global configuration mode:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)#tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#destination ipv4 unicast 10.10.3.4
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
gmpls optical-uni	Enables GMPLS UNI functionality and enters configuration mode for UNI.
controller dwdm (GMPLS)	Enters GMPLS UNI sub-mode for a controller.

dynamic

To enable the Dynamic LMP function on a UNI-C router, use the **dynamic** command in the LMP GMPLS-UNI neighbor configuration sub mode. To return to the default behavior, use the **no** form of this command.

dynamic

Syntax Description

This command has no arguments or keywords.

Command Default

The Dynamic LMP function is disabled.

Command Modes

LMP GMPLS-UNI neighbor configuration.

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The Dynamic LMP function validates LMP configuration consistency at the head-end and tail-end UNIs. Examples:

1. One end of a TE link is configured as an unnumbered interface, and the other end is configured with an IP address.
2. When configuring an unnumbered neighbor interface, entering the wrong neighbor interface ID.

Examples

The following example shows how to enable the Dynamic LMP function on a UNI-C router:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# neighbor N1
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-n1)# dynamic
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-n1)# commit
Tue Jul 9 09:22:31.558 UTC
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
gmpls optical-uni	Enables GMPLS optical UNI and enters configuration mode for UNI.

encoding-type (GMPLS-UNI)

To assign the LSP encoding type for the GMPLS-UNI tunnel, use the **encoding-type** command in the GMPLS-UNI controller tunnel-properties configuration sub-mode. To return to the default behavior, use the **no** form of this command.

encoding-type *type*

Syntax Description

encoding-type *type*	Specifies the GMPLS traffic encoding type.

Command Default

Lambda encoding type is enabled.

Command Modes

GMPLS-UNI controller tunnel-properties configuration.

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The **encoding-type** command is available in the GMPLS UNI tunnel and LMP neighbor configuration modes. Enable the same encoding type under both the modes.

Examples

The following example shows how to assign the LSP encoding type for the GMPLS UNI tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls-uni)# controller dwdm 1/0/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)# tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)# encoding-type lambda
RP/0/RP0/CPU0:router(config-te-gmpls-tun)# commit
Tue Jul 9 09:22:31.558 UTC
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
gmpls optical-uni	Enables GMPLS optical UNI and enters configuration mode for UNI.

encoding-type (LMP)

To assign the LSP encoding type for LMP neighbor configuration, use the **encoding-type** command in the LMP controller neighbor configuration mode. To return to the default behavior, use the **no** form of this command.

encoding-type *type*

Syntax Description

encoding-type *type*	Specifies the LSP encoding type for LMP neighbor configuration.

Command Default

Lambda encoding type is enabled.

Command Modes

LMP controller neighbor configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The **encoding-type** command is available in the GMPLS UNI tunnel and LMP neighbor configuration modes. Enable the same encoding type under both the modes.

Examples

The following example shows how to assign the LSP encoding type for LMP neighbor configuration:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# controller dwdm 1/0/0/0
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# link-id ipv4 unicast 10.0.0.2
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# neighbor N1
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# link-id ipv4 unicast 10.0.0.4
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# switching-type lsc
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# encoding-type lambda
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# commit
Tue Jul 9 09:22:31.558 UTC
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
gmpls optical-uni	Enables GMPLS optical UNI and enters configuration mode for UNI.

exclude (MPLS-TE)

To specify exclusions for an attribute set for LSP diversity for MPLS-TE, use the **exclude** command in MPLS-TE attribute set configuration mode. To remove exclusions, use the **no** form of this command.

exclude { **best-effort** | **strict** } **lsp** **source** *address* **destination** *address* **tunnel-id** *ID* **extended-tunnel-id** *ID* [**lsp-id** *ID*]

Syntax Description

best-effort	Specifies that the condition is met if possible.
strict	Specifies that the condition must be met.
lsp	Specifies that an LSP address will follow the **lsp** keyword.
source *address*	Specifies the source IPv4 address of the LSP from which a diverse path is required.
destination *address*	Specifies the destination address of the LSP from which a diverse path is required.
tunnel-id *ID*	Specifies the tunnel ID of the LSP from which a diverse path is required.
extended-tunnel-id *ID*	Specifies the extended tunnel ID (IPv4 address) of the LSP from which a diverse path is required.
lsp-id *lsp-id*	(Optional) Specifies the numeric LSP ID of the LSP from which a diverse path is required.

Command Default

No default behavior or values

Command Modes

MPLS-TE attribute-set configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

An XRO attribute-set can be specified as part of the path-option, if required. An empty XRO attribute set results in the GMPLS tunnel being signaled with no exclusions, and therefore no XRO.

Multiple LSP exclusions can be configured in the attribute-set. If this is done, multiple exclusions will be added to the path message. If the lsp-id is specified, only the LSP with the specified lsp-id will be excluded. If it is omitted, all LSPs matching the specified session (source, destination, tunnel-id, extended tunnel-id) will be excluded.

Examples

The following example shows how to configure exclusions for the attribute set attrset01:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
```

```
RP/0/RP0/CPU0:router(config-mpls-te)# attribute-set xro attrset01
RP/0/RP0/CPU0:router(config-te-attribute-set)# exclude best-effort lsp source 10.10.1.2
destination 10.20.4.4 tunnel-id 17 extended-tunnel-id 10.10.1.2 lsp-id 17
RP/0/RP0/CPU0:router(config-te-attribute-set)#
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
attribute-set	Specifies an attribute set for LSP diversity for MPLS-TE.

gmpls optical-uni

To enable GMPLS UNI feature, use the **gmpls optical-uni** command in the appropriate mode. To return to the default behavior, use the **no** form of this command.

gmpls optical-uni

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS-TE configuration

LMP configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The LMP submode enables GMPLS-UNI LMP functionality and acts as a container for other GMPLS-UNI LMP configuration commands.

Examples

The following example shows how to enable GMPLS-UNI, starting from global configuration mode:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls)#
```

The following example shows how to enable GMPLS UNI and enter LMP configuration mode:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls)#
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
lmp	Enables GMPLS LMP functionality and enters configuration mode for LMP.

g-pid

To assign a Generalized PID (G-PID) on the UNI-C router, use the **g-pid** command in the GMPLS-UNI controller tunnel-properties configuration sub-mode. To return to the default behavior, use the **no** form of this command.

g-pid *value*

Syntax Description

g-pid *value*	Specifies the G-PID value.

Command Default

A G-PID value of 37, assigned for Lambda switching over optic fiber technology.

Command Modes

GMPLS-UNI controller tunnel-properties configuration.

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The G-PID value identifies the payload carried by the LSP.

Examples

The following example shows how to configure the G-PID value:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls-uni)# controller dwdm 1/0/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)# tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)# g-pid 37
RP/0/RP0/CPU0:router(config-te-gmpls-tun)# commit
Tue Jul 9 09:22:31.558 UTC
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
gmpls optical-uni	Enables GMPLS optical UNI and enters configuration mode for UNI.

hello (GMPLS-UNI)

To configure LMP hello message and hello expiry message intervals, use the **hello** command in the LMP GMPLS-UNI neighbor configuration sub mode. To return to the default behavior, use the **no** form of this command.

hello *interval expiry-interval*

Syntax Description

interval	Specifies the LMP hello message interval.
expiry-interval	Specifies the LMP hello expiry message interval. **Note** Ensure that the LMP hello expiry message interval is at least thrice the interval of the LMP hello message.

Command Default

Interval of LMP hello messages between two LMP enabled routers is 2000 ms. An LMP hello expiry message is sent after a 6000 ms duration.

Command Modes

LMP GMPLS-UNI neighbor configuration.

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

An LMP hello message is sent every 2000 ms from an LMP enabled router to LMP peers. If an LMP enabled router does not receive an LMP hello message from a peer device for a 6000 ms duration, an LMP hello expiry message is sent to other LMP routers. If the LMP fast keep-alive mechanism is not used, both message intervals should be set to zero.

Examples

The following example shows how set the hello message and hello expiry message intervals:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# neighbor N1
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-n1)# dynamic
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-n1)# hello 3000 10000
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-n1)# commit
Tue Jul 9 09:22:31.558 UTC
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.

Command	Description
gmpls optical-uni	Enables GMPLS optical UNI and enters configuration mode for UNI.

ipcc routed (LMP)

To specify the Link Management Protocol neighbor IPCC configuration for GMPLS UNI, use the **ipcc routed** command in the neighbor sub-mode for LMP GMPLS-UNI controller configuration mode. To return to the default behavior, use the **no** form of this command.

ipcc routed

Syntax Description

This command has no keywords or arguments.

Command Default

No default behavior or values

Command Modes

LMP GMPLS-UNI controller neighbor configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how to specify the IPCC configuration for the GMPLS-UNI controller 0/0/0/3, neighbor UN02:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# neighbor UN02
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-UN02)# ipcc routed
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-UN02)#
```

Related Commands

Command	Description
lmp	Enables GMPLS LMP functionality and enters configuration mode for LMP.
neighbor (LMP)	Specifies an LMP neighbor for GMPLS and enters configuration mode for the neighbor.

link-id ipv4 unicast (LMP)

To specify the optical interface address for an LMP link for a GMPLS UNI controller, use the **link-id ipv4 unicast** command in GMPLS-UNI controller configuration mode. To return to the default behavior, use the **no** form of this command.

link-id ipv4 unicast *address*

Syntax Description

address	Specifies the optical unicast IPv4 address.

Command Default

No default behavior or values

Command Modes

LMP GMPLS-UNI controller configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

This command specifies the local optical address for the link. It can be used as a tunnel destination at the tail UNI-C if the ingress link to the tail is to be specified.

Examples

The following example shows how to specify the link ID:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-ctrl)# link-id ipv4 unicast 10.10.4.2
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-ctrl)#
```

Related Commands

Command	Description
lmp	Enables GMPLS LMP functionality and enters configuration mode for LMP.
controller (LMP)	Specifies the LMP controller for GMPLS UNI and enters configuration mode for the controller.

lmp

To enable functionality for GMPLS UNI LMP and enter LMP configuration commands, use the **lmp** command in XR Config mode. To return to the default behavior, use the **no** form of this command.

lmp

Syntax Description

This command has no keywords or arguments.

Command Default

No default behavior or values

Command Modes

XR Config mode

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how to enable LMP functionality and enter the sub-mode for LMP configuration commands:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)#
```

logging events lsp-status state (GMPLS)

To specify the tunnel state logging configuration for GMPLS UNI, use the **logging events lsp-status state** command in GMPLS-UNI controller tunnel-properties configuration sub-mode. To return to the default behavior, use the **no** form of this command.

logging events lsp-status state

Syntax Description

This command has no keywords or arguments.

Command Default

No default behavior or values

Command Modes

GMPLS-UNI controller tunnel-properties configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how to specify the tunnel state logging configuration for controller 0/4/0/0:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-ctrl)# tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)# logging events lsp-status state
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
controller dwdm (GMPLS)	Enters GMPLS UNI sub-mode for a controller.
tunnel-properties	Enters tunnel configuration mode for a GMPLS UNI controller.

mpls traffic-eng optical-uni reoptimize tunnel-id

To manually trigger the reoptimization of a GMPLS UNI tunnel, use the **mpls traffic-eng optical-uni reoptimize tunnel-id** command in XR Config mode.

mpls traffic-eng optical-uni reoptimize tunnel-id *number*

Syntax Description

number	MPLS-TE tunnel identification expressed as a number. The range is from 0 to 65535.

Command Default

No default behavior or values

Command Modes

Global configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how to manually reoptimize a GMPLS UNI tunnel with tunnel ID 100:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng optical-uni reoptimize tunnel-id 100
```

mtu (GMPLS-UNI)

To configure the maximum traffic limit (MTU) value on a GMPLS UNI controller interface, use the **mtu** command in GMPLS-UNI configuration sub-mode. To return to the default behavior, use the **no** form of this command.

mtu *value*

Syntax Description

mtu *value*	Specifies the MTU value for the controller interface.

Command Default

An MTU of 9212 bytes is configured on a GMPLS UNI controller interface.

Command Modes

GMPLS-UNI configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how to configure the MTU value on a GMPLS UNI controller interface:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls-uni)# controller dwdm 1/0/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)# mtu 9000
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)# commit
Tue Jul 9 09:22:31.558 UTC
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
gmpls optical-uni	Enables GMPLS optical UNI and enters configuration mode for UNI.

neighbor (LMP)

To specify an LMP neighbor for GMPLS and enter commands to configure the neighbor, use the **neighbor** command in the appropriate configuration mode. To return to the default behavior, use the **no** form of this command.

neighbor *name*

Syntax Description

name	Specifies the name of the LMP neighbor.

Command Default

No default behavior or values

Command Modes

LMP GMPLS-UNI configuration

LMP Controller configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

Under LMP controller configuration submode, this command specifies the neighbor reached via the controller. And, under the LMP GMPLS UNI submode, it creates a submode in which other properties of the neighbor can be specified. The name argument is the name of the configured neighbor.

Examples

The following example shows how to specify the neighbor UN01 for the GMPLS-UNI controller 0/0/0/3:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# neighbor UN01
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-UN01)# exit
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# controller dwdm 0/1/0/0
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# neighbor UN01
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)#
```

Related Commands

Command	Description
lmp	Enables GMPLS LMP functionality and enters configuration mode for LMP.
gmpls optical-uni	Enables GMPLS UNI functionality and enters configuration mode for UNI.

neighbor interface-id unnumbered

To specify the neighbor's optical interface ID of an LMP link for a GMPLS UNI controller, use the **neighbor interface-id unnumbered** command in GMPLS-UNI controller configuration mode. To return to the default behavior, use the **no** form of this command.

neighbor interface-id unnumbered *interface-id*

Syntax Description

interface-id	Specifies the optical interface ID of the neighbor.

Command Default

No default behavior or values

Command Modes

LMP GMPLS-UNI controller configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

For the interface ID on the command line, you can use the SNMP ifindex of the interface on the neighbor node.

Examples

The following example shows how to specify the optical interface ID (17) of an LMP neighbor:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-ctrl)# neighbor interface-id unnumbered 17
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-ctrl)#
```

Related Commands

Command	Description
lmp	Enables GMPLS LMP functionality and enters configuration mode for LMP.
controller dwdm (GMPLS)	Enters GMPLS UNI sub-mode for a controller.

neighbor link-id ipv4 unicast

To specify the neighbor's optical address of an LMP link for a GMPLS UNI controller, use the **neighbor link-id ipv4 unicast** command in GMPLS-UNI controller configuration mode. To return to the default behavior, use the **no** form of this command.

neighbor link-id ipv4 unicast *address*

Syntax Description

address	Specifies the IPv4 address of the neighbor.

Command Default

No default behavior or values

Command Modes

LMP GMPLS-UNI controller configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how to specify the optical IPv4 address (10.10.4.5) of an LMP neighbor for controller 0/4/0/0:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-ctrl)# neighbor link-id ipv4 unicast 10.10.4.5
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-ctrl)#
```

Related Commands

Command	Description
lmp	Enables GMPLS LMP functionality and enters configuration mode for LMP.
controller dwdm (GMPLS)	Enters GMPLS UNI sub-mode for a controller.

path-option (GMPLS)

To specify a path option for a GMPLS UNI tunnel, use the **path-option** command in GMPLS-UNI controller tunnel-properties configuration sub-mode. To remove a path option, use the **no** form of this command.

path-option 10 { **no-ero** | **explicit** { **name** *path-name* | **index** *index* } } [**xro-attribute-set** *name*] [**signaled-label dwdm wavelength** *channel*] [**lockdown**] [**verbatim**]

Syntax Description

10	Specifies the path option index. 10 is the only supported index in this release.
explicit	Specifies that LSP paths are IP explicit paths.
name *path-name*	Specifies the path name of the IP explicit path.
no-ero	Specifies that no ERO object is included in signalling.
xro-attribute-set	(Optional) Specifies the xro attribute set for the path option.
name	Specifies the name of the xro-attribute-set.
lockdown	(Optional) Indicates that the tunnel does not reoptimize without user intervention. This is the only supported behavior in this release.
signaled-label	(Optional) Sets a specific label for the path option.
dwdm	(Optional) Specifies that it is a DWDM label.
wavelength	(Optional) Specifies the DWDM wavelength to use.
channel	Specifies the channel number to use. The range is form 1 to 89.
verbatim	(Optional) Bypasses the topology check for explicit paths.

Command Default

No default behavior or values

Command Modes

GMPLS UNI controller tunnel-properties configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The path option index is no longer fixed at 10. It is now set by the user and distinguishes path options in the same manner as for packet tunnels. The path option index may be any value between 1 and 1000 (the same range as for packet tunnels).

The **verbatim** keyword is mandatory when an explicit path is referenced by a GMPLS UNI path option, but must not be present if the **no-ero** option is in use.

Examples

The following example shows how to specify the tunnel path option for controller 0/4/0/0, attribute set A01, starting from global configuration mode:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)#tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#path-option 10 no-ero xro-attribute-set A01
lockdown
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
gmpls optical-uni	Enables GMPLS UNI functionality and enters configuration mode for UNI.
controller dwdm (GMPLS)	Enters GMPLS UNI sub-mode for a controller.
tunnel-properties	Enters tunnel configuration mode for a GMPLS UNI controller.
attribute-set xro	Enters tunnel configuration mode for a GMPLS UNI controller.

record-route

To enable record-route functionality for the GMPLS UNI tunnel, use the **record-route** command in GMPLS-UNI controller tunnel-properties configuration sub-mode. To return to the default behavior, use the **no** form of this command

record-route

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

GMPLS-UNI controller tunnel-properties configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how enable record-route functionality, starting from global configuration mode:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)#tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#record-route
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#
```

Related Commands

Command	Description
controller dwdm (GMPLS)	Enters GMPLS UNI sub-mode for a controller.
tunnel-properties	Enters tunnel configuration mode for a GMPLS UNI controller.

router-id ipv4 unicast

To configure the LMP unicast or neighbor router ID for GMPLS, use the **router-id ipv4 unicast** command in the appropriate configuration mode. To return to the default behavior, use the **no** form of this command.

router-id ipv4 unicast *address*

Syntax Description

address	Specifies the GMPLS-UNI optical router-id (IPv4 address).

Command Default

No default behavior or values

Command Modes

LMP GMPLS UNI configuration

LMP GMPLS UNI neighbor configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how to specify a router ID (address 10.10.4.4) for GMPLS-UNI:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# router-id ipv4 unicast 10.10.4.4
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)
```

The following example shows how to specify the neighbor router ID 10.10.5.5 for GMPLS UNI:

```
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# neighbor UN01
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-UN01)# router-id ipv4 unicast 10.10.5.5
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-nbr-UN01)#
```

Related Commands

Command	Description
lmp	Enables GMPLS LMP functionality and enters configuration mode for LMP.
destination ipv4 unicast	Specifies the destination of a GMPLS optical UNI tunnel.
neighbor (LMP)	Specifies an LMP neighbor for GMPLS and enters configuration mode for the neighbor.

show mpls traffic-eng link-management optical-uni

To display a summary of the TE link management GMPLS-UNI states, use the **show mpls traffic-eng link-management optical-uni** command in XR EXEC mode.

show mpls traffic-eng link-management optical-uni [**controller** *controller*] [**tabular**]

Syntax Description

controller *controller*	(Optional) Displays information for the specified controller.
tabular	(Optional) Displays information in tabular format.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

To use this command, first enable the MPLS-TE application.

Example

The following command displays the TE GMPLS-UNI states for the specified controller .

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management optical-uni controller dwdm0/1/0/0

Thu Oct  4 14:52:46.147 ottawa

Optical interface: dwdm0/1/0/0
  Overview:
    IM state: Up
    OLM/LMP state: Up
    Optical tunnel state: up
  Connection:
    Tunnel role: Head
    Tunnel-id: 300
    Local optical router-id:  10.58.64.239
    Remote optical router-id: 10.58.40.40
    Upstream label:
      Optical label:
      Grid                : DWDM
      Channel spacing     : 50 GHz
      Identifier          : 0
      Channel Number      : 42
    Downstream label:
      Optical label:
      Grid                : DWDM
      Channel spacing     : 50 GHz
      Identifier          : 0
```

```
      Channel Number      : 42
  Admission Control:
    Upstream: Admitted (LSP ID: 77)
    Downstream: Admitted (LSP ID: 77)
  OLM/LMP adjacency information:
    Adjacency status: Up
    Local:
      node ID: 10.58.64.239
      link interface ID: 39
      link ID: 10.20.2.1
    Neighbor:
      node ID: 10.58.40.40 (crs1-239-nr)
      link interface ID: 2
      link ID: 10.20.2.2
      IPCC: Routed to 10.58.40.40
  Optical capabilities:
    Controller type: DWDM
    Channel spacing: 50 GHz
    Default channel: 58
    82 supported channels:
      -23, -22, -21, -20, -19, -18, -17, -16
      -15, -14, -13, -12, -11, -10, -9, -8
      -7, -6, -5, -4, -3, -2, -1, 0
      1, 2, 3, 4, 5, 6, 7, 8
      9, 10, 11, 12, 13, 14, 15, 16
      17, 18, 19, 20, 21, 22, 23, 24
      25, 26, 27, 28, 29, 30, 31, 32
      33, 34, 35, 36, 37, 38, 39, 40
      41, 42, 43, 44, 45, 46, 47, 48
      49, 50, 51, 52, 53, 54, 55, 56
      57, 58
RP/0/RP0/CPU0:crs239#
```

Example

The following command provides an overview of the TE GMPLS-UNI states in tabular format.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management optical-uni tabular
  System Information:
  Optical Links Count: 2 (Maximum Links Supported 100)

                  State          LMP          GMPLS tunnel
Interface      Admin  Oper    adjacency    role  tun-id  state
-------------------------------------------------------------
     PO0/1/0/0    up    up        up       Head       1     up
     PO0/1/0/1    up    up        up       Head       2     up
```

The following command displays the SRLGs configured locally on the DWDM controller and the collected SRLG and latency data for the tunnel.

```
RP/0/RP0/CPU0:router# show mpls traffic-eng link-management optical-uni
  System Information:
  Optical Links Count: 4 (Maximum Links Supported 100)

Optical interface: dwdm0/1/0/0
  Overview:
    IM state: Up
    OLM/LMP state: Up
    Optical tunnel state: up
```

```
  Connection:
    Tunnel role: Head
    Tunnel-id: 1, LSP-id: 2, Extended tunnel-id: 88.0.0.8
    Tunnel source: 88.0.0.8, destination: 10.0.1.2
    Optical router-ids: Local: 88.0.0.8, Remote: 99.0.0.9
    Label source: UNI-N
    Upstream label:
Optical label:
      Grid                : DWDM
      Channel spacing     : 50 GHz
      Identifier          : 0
      Channel Number      : 59
    Downstream label:
      Optical label:
      Grid                : DWDM
      Channel spacing     : 50 GHz
      Identifier          : 0
      Channel Number      : 59
    SRLG discovery: Enabled
    SRLG announcement: announced to TenGigE 0/1/0/0
  Admission Control:
    Upstream: Admitted (LSP ID: 2)
    Downstream: Admitted (LSP ID: 2)
  OLM/LMP adjacency information:
    Adjacency status: Up
    Local:
      node ID: 88.0.0.8
      link interface ID: 15
      link ID: 10.0.0.1
    Neighbor:
      node ID: 99.0.0.9 (gmpls2_uni)
      link interface ID: 3
      link ID: 10.0.0.2
      IPCC: Routed to 99.0.0.9
  Optical capabilities:
    Controller type: DWDM
    Channel spacing: 50 GHz
    Default channel: 59
    44 supported channels:
      -27, -25, -23, -21, -19, -17, -15, -13
      -11, -9, -7, -5, -3, -1, 1, 3
      5, 7, 9, 11, 13, 15, 17, 19
      21, 23, 25, 27, 29, 31, 33, 35
      37, 39, 41, 43, 45, 47, 49, 51
      53, 55, 57, 59
    Controller SRLGs:
      1, 2, 3, 4
```

signalled-name (GMPLS)

To specify the signalled name to apply to the GMPLS UNI tunnel, use the **signalled-name** command in GMPLS-UNI controller tunnel-properties configuration sub-mode. To return to the default behavior, use the **no** form of this command.

signalled-name *name*

Syntax Description

name	Specifies the signalled name to apply to the tunnel.

Command Default

No default behavior or values

Command Modes

GMPLS-UNI controller tunnel-properties configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how to specify a signalled name for the tunnel (tunname), starting from global configuration mode:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)#tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#signalled-name tunname
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#
```

Related Commands

Command	Description
controller dwdm (GMPLS)	Enters GMPLS UNI sub-mode for a controller.
tunnel-properties	Enters tunnel configuration mode for a GMPLS UNI controller.

signalling refresh out-of-band interval

To specify the out-of-band refresh interval for RSVP, use the **signalling refresh out-of-band interval** command in RSVP controller configuration mode. To return to the default behavior, use the **no** form of this command.

signalling refresh out-of-band interval *interval*

Syntax Description

interval	Specifies the refresh interval (180-86400 seconds).

Command Default

45 seconds

Command Modes

RSVP controller configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

This command applies only to the RSVP sessions associated with GMPLS-UNI tunnels.

Examples

The following example shows how to specify 200 seconds for the out-of-band interface refresh interval:

```
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-rsvp-ctrl)# signalling refresh out-of-band interval 200
RP/0/RP0/CPU0:router(config-rsvp-ctrl)#
```

Related Commands

Command	Description
rsvp	Enables RSVP functionality and enters configuration mode for RSVP.
controller (LMP)	Specifies the RSVP controller for GMPLS UNI and enters configuration mode for the controller.
signalling refresh out-of-band missed	Specifies the number of missed refresh messages allowed before states are deleted for optical tunnels.

signalling refresh out-of-band missed

To specify the number of missed refresh messages allowed before states are deleted for optical tunnels, use the **signalling refresh out-of-band missed** command in RSVP controller configuration mode. To return to the default behavior, use the **no** form of this command.

signalling refresh out-of-band missed *count*

Syntax Description

count	Number of missed refresh messages allowed before states are deleted for optical tunnels (1-48).

Command Default

The default value is 12.

Command Modes

RSVP controller configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

This command applies only to the RSVP sessions associated with GMPLS-UNI tunnels.

Examples

The following example shows how to specify a maximum of 10 messages for the number of allowed missed refresh messages:

```
RP/0/RP0/CPU0:router(config)# rsvp
RP/0/RP0/CPU0:router(config-rsvp)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-rsvp-ctrl)# signalling refresh out-of-band missed 10
RP/0/RP0/CPU0:router(config-rsvp-ctrl)#
```

Related Commands

Command	Description
rsvp	Enables RSVP functionality and enters configuration mode for RSVP.
controller (LMP)	Specifies the RSVP controller for GMPLS UNI and enters configuration mode for the controller.
signalling refresh out-of-band interval	Specifies the out-of-band refresh interval for RSVP.

switching-type (GMPLS-UNI)

To assign the GMPLS traffic switching type on the UNI-C router, use the **switching-type** command in the MPLS-TE GMPLS UNI controller configuration mode. To return to the default behavior, use the **no** form of this command.

switching-type *type*

Syntax Description

switching-type *type*	Specifies the GMPLS traffic switching type.

Command Default

Lambda-Switch Capable (LSC) switching type.

Command Modes

MPLS-TE GMPLS UNI controller configuration.

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The **switching-type** command is available in the GMPLS UNI tunnel and LMP neighbor configuration modes. Enable the same switching type under both the modes.

Examples

The following example shows how to assign the GMPLS traffic switching type for the GMPLS UNI tunnel:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls-uni)# controller dwdm 1/0/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)# tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)# encoding-type lambda
RP/0/RP0/CPU0:router(config-te-gmpls-tun)# exit
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)# switching-type lsc
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)# commit
Tue Jul 9 09:22:31.558 UTC
```

Related Commands

Command	Description
gmpls optical-uni	Enables GMPLS optical UNI and enters configuration mode for UNI.

switching-type (LMP)

To assign the GMPLS traffic switching type for LMP neighbor configuration, use the **switching-type** command in the LMP controller neighbor configuration mode. To return to the default behavior, use the **no** form of this command.

switching-type *type*

Syntax Description

switching-type *type*	Specifies the LSP switching type for the LMP neighbor configuration.

Command Default

Lambda-Switch Capable (LSC) type.

Command Modes

LMP controller neighbor configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

The **switching-type** command is available in the GMPLS UNI tunnel and LMP neighbor configuration modes. Enable the same switching type under both the modes.

Examples

The following example shows how to assign the GMPLS traffic switching type for LMP neighbor configuration:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# lmp
RP/0/RP0/CPU0:router(config-lmp)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni)# controller dwdm 1/0/0/0
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# link-id ipv4 unicast 10.0.0.2
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# neighbor N1
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# link-id ipv4 unicast 10.0.0.4
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# switching-type lsc
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# encoding-type lambda
RP/0/RP0/CPU0:router(config-lmp-gmpls-uni-cntl)# commit
Tue Jul 9 09:22:31.558 UTC
```

Related Commands

Command	Description
gmpls optical-uni	Enables GMPLS optical UNI and enters configuration mode for UNI.

tunnel-id (GMPLS)

To specify the ID of the GMPLS UNI tunnel, use the **tunnel-id** command in GMPLS-UNI controller tunnel-properties configuration sub-mode. To return to the default behavior, use the **no** form of this command.

tunnel-id *number*

Syntax Description

number	Specifies the tunnel ID.

Command Default

No default behavior or values

Command Modes

GMPLS-UNI controller tunnel-properties configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Examples

The following example shows how to specify a tunnel ID (5), starting from global configuration mode:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)#tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#tunnel-id 5
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#
```

Related Commands

Command	Description
controller dwdm (GMPLS	Enters GMPLS UNI sub-mode for a controller.
tunnel-properties	Enters tunnel configuration mode for a GMPLS UNI controller.

tunnel-properties

To configure tunnel-specific information for a GMPLS UNI controller, use the **tunnel-properties** command in GMPLS-UNI configuration sub-mode. To return to the default behavior, use the **no** form of this command.

tunnel-properties

Syntax Description

This command has no keywords or arguments.

Command Default

No default behavior or values

Command Modes

GMPLS-UNI configuration

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

This command designates the controller as a tunnel-head, rather than a tunnel tail. After the tunnel properties are configured, the incoming path messages are rejected and any existing tail-end tunnel is torn down.

Examples

The following example shows how to enter the sub-mode to configure tunnel-specific information for a GMPLS UNI controller:

```
RP/0/RP0/CPU0:router(config)# mpls traffic-eng
RP/0/RP0/CPU0:router(config-mpls-te)# gmpls optical-uni
RP/0/RP0/CPU0:router(config-te-gmpls)# controller dwdm 0/4/0/0
RP/0/RP0/CPU0:router(config-te-gmpls-cntl)#tunnel-properties
RP/0/RP0/CPU0:router(config-te-gmpls-tun)#
```

Related Commands

Command	Description
controller dwdm (GMPLS)	Enters GMPLS UNI sub-mode for a controller.



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