MPLS Traffic Engineering Commands

This module describes the commands used to configure Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) on the Cisco ASR 9000 Series Router.

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 *Cisco ASR 9000 Series Aggregation Services Router MPLS Configuration Guide*.

adjustment-threshold (MPLS-TE)

To configure the tunnel bandwidth change 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*]

Syntax Description

percentage	Bandwidth change 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

Command Modes

MPLS-TE automatic bandwidth interface configuration

Command History

Release	Modification
Release 3.9.0	No modification.
Release 3.9.1	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 change threshold to trigger an adjustment:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# auto-bw
RP/0/RP0RSP0/CPU0:router:hostname(config-if-tunte-autobw)# adjustment-threshold 20 min 500
```

Related Commands

Command	Description
application (MPLS-TE), on page 17	Configures the application frequency, in minutes, for the applicable tunnel.

Command	Description
auto-bw (MPLS-TE), on page 28	Configures automatic bandwidth on a tunnel interface and enters MPLS-TE automatic bandwidth interface configuration mode.
bw-limit (MPLS-TE), on page 51	Configures the minimum and maximum automatic bandwidth to set on a tunnel.
collect-bw-only (MPLS-TE), on page 69	Enables only the bandwidth collection without adjusting the automatic bandwidth.
overflow threshold (MPLS-TE), on page 152	Configures tunnel overflow detection.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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*

Syntax Description

weight	Administrative weight (cost) of the link. Range is 0 to 4294967295.

Command Default

weight: IGP Weight (default OSPF 1, ISIS 10)

Command Modes

MPLS-TE interface configuration

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

To use MPLS 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 set the cost to 20:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# interface POS 0/7/0/0
```

```
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# admin-weight 20
```

Related Commands

Command	Description
interface (MPLS-TE), on page 101	Enables MPLS-TE on an interface and enters MPLS-TE interface configuration mode.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
path-selection metric (interface), on page 173	Specifies an MPLS-TE tunnel path-selection metric type.

affinity

To configure an affinity (the properties the 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** | **ignore** | **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.
ignore	Ignore affinity attributes.
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

Interface configuration

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.
Release 5.2.2	Support was added to start a 5 minute timer to allow reoptimization when affinity failure occurs.

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 time frame, 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. Note that, 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

Specifies that a link is considered for constrained shortest path first (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

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

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

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.

Ignore

Ignores affinity attributes while considering links for CSPF.

You set one 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 GigabitEthernet0/4/1/3 from the **interface** command. The sample output from the show mpls traffic-eng link-management interfaces, on page 263 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/RP0RSP0/CPU0:router:hostname# configure
```

```
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# affinity include red orange
```

This example shows how to configure a tunnel to ignore the affinity attributes on links.

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# affinity ignore
```

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# affinity include red
```

```
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# affinity exclude red
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# affinity exclude blue
```

Related Commands

Command	Description
affinity-map, on page 15	Assigns a numerical value to each affinity name.
attribute-names, on page 21	Configures attribute names for the interface.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
show mpls traffic-eng affinity-map, on page 218	Displays the color name-to-value mappings configured on the router.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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*}

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 255.

Command Default

No default behavior or values

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	The following command syntax was enhanced: • The *affinity value* argument range was changed to 1 to 80000000. • The **bit-position** keyword and *value* argument were added. • Sample output was added to show how to configure the value for the bit position.
Release 5.1.1	The bit-position value range was changed to 1 to 255 that enables to assign up to 256 names for extended admin groups (EAGs).

Usage Guidelines

Note 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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# affinity-map red 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# affinity-map red2 bit-position 15
```

Related Commands

Command	Description
affinity, on page 10	Configures affinity (the properties that the tunnel requires in its links) for an MPLS-TE tunnel.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
show mpls traffic-eng affinity-map, on page 218	Displays the color name-to-value mappings configured on the router.

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*

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 3.9.0	No modification.
Release 3.9.1	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# auto-bw
RP/0/RP0RSP0/CPU0:router:hostname(config-if-tunte-autobw)# application 1000
```

Related Commands

Command	Description
adjustment-threshold (MPLS-TE), on page 6	Configures the tunnel-bandwidth change threshold to trigger an adjustment.
auto-bw (MPLS-TE), on page 28	Configures automatic bandwidth on a tunnel interface and enters MPLS-TE automatic bandwidth configuration mode.

Command	Description
bw-limit (MPLS-TE), on page 51	Configures the minimum and maximum automatic bandwidth to set on a tunnel.
collect-bw-only (MPLS-TE), on page 69	Enables only the bandwidth collection without adjusting the automatic bandwidth.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
overflow threshold (MPLS-TE), on page 152	Configures tunnel overflow detection.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# interface POS 0/7/0/0
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# attribute-flags 0x0101
```

Related Commands

Command	Description
admin-weight, on page 8	Overrides the IGP administrative weight of the link.
affinity, on page 10	Configures affinity (the properties that the tunnel requires in its links) for an MPLS-TE tunnel.
attribute-names, on page 21	Configures the attribute names for the interface.
interface (MPLS-TE), on page 101	Enables MPLS-TE on an interface and enters MPLS-TE interface configuration mode.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.

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*

Syntax Description

attribute name	Attribute name expressed using alphanumeric or hexidecimal 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 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.
Release 5.1.1	Support was added to assign up to 32 names per attribute-set and index for extended admin groups. The **index** *index-value* keyword and argument were added to support extended admin groups (EAG) configuration.

Usage Guidelines

The name-to-value mapping must represent a single bit of a 256-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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# interface pos 0/2/0/1
```

```
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# attribute-name red
```

Related Commands

Command	Description
affinity, on page 10	Configures affinity (the properties that the tunnel requires in its links) for an MPLS-TE tunnel.
attribute-flags, on page 19	Configures attribute flags for the interface.
interface (MPLS-TE), on page 101	Enables MPLS-TE on an interface and enters MPLS-TE interface configuration mode.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.

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 specify an attribute set for LSP diversity for GMPLS UNI, use the **attribute-set** command in MPLS-TE configuration mode.

attribute-set xro *attribute-set-name*

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 signalled.
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 4.2.0	This command was introduced. The **sub-pool** keyword is not supported.
Release 4.2.1	Support for configuring attribute-set for auto-backup tunnels was added. The **policy-class** keyword was added for auto-mesh attribute-set.
Release 4.3.0	The **xro** keyword was added in support of GMPLS UNI feature.
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.

Task ID

Task ID	Operation
mpls-te	read, write
ouni	read, write

This example shows how to configure an attribute-set to a TE interface for an auto-backup tunnel:

```
RP/0/RP0RSP0/CPU0:router:hostname# config
RP/0/RP0RSP0/CPU0:router:hostname(config)#  mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# interface GigabitEthernet 0/1/0/3
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# auto-tunnel backup
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if-auto-backup)#  attribute-set ab
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# config
RP/0/RP0RSP0/CPU0:router:hostname(config)#  mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#  auto-tunnel mesh
RP/0/RP0RSP0/CPU0:router:hostname(config-te-auto-mesh)#  group 1
RP/0/RP0RSP0/CPU0:router:hostname(config-te-mesh-group)#  attribute-set am1
RP/0/RP0RSP0/CPU0:router:hostname(config-te-mesh-group)#  destination-list dl1
```

This example shows how to configure the attribute-set for auto-backup tunnels:

```
RP/0/RP0RSP0/CPU0:router:hostname# config
RP/0/RP0RSP0/CPU0:router:hostname(config)#  mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#  attribute-set auto-backup ab
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# affinity 0x1 mask 0x1
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# priority 3 3
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# policy-class 6
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# logging events lsp-status
reoptimize
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# logging events lsp-status state
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# policy-class default
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# record-route
```

This example shows how to configure the attribute-set for auto-mesh tunnels:

```
RP/0/RP0RSP0/CPU0:router:hostname# config
RP/0/RP0RSP0/CPU0:router:hostname(config)#  mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#  attribute-set auto-mesh mesh1
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# affinity include red blue
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# affinity include-strict yellow
 green
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# affinity exclude orange
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# affinity exclude-all
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# config
RP/0/RP0RSP0/CPU0:router:hostname(config)#  mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#  attribute-set path-option myset
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# affinity 0x3 mask 0x3
RP/0/RP0RSP0/CPU0:router:hostname(config-te-attribute-set)# signalled-bandwidth 2000
```

The following example shows how to configure attribute set attr01:

```
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# attribute-set xro attr01
RP/0/RP0RSP0/CPU0:router:hostname(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
```

Related Commands

Command	Description
affinity-map, on page 15	Assigns a numerical value to each affinity name.
attribute-names, on page 21	Configures attribute names for the interface.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
show mpls traffic-eng affinity-map, on page 218	Displays the color name-to-value mappings configured on the router.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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

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 3.9.0	No modification.
Release 3.9.1	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, we recommend 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 as soon as 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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# auto-bw
RP/0/RP0RSP0/CPU0:router:hostname(config-if-tunte-autobw)#
```

Related Commands

Command	Description
adjustment-threshold (MPLS-TE), on page 6	Configures the tunnel-bandwidth change threshold to trigger an adjustment.
application (MPLS-TE), on page 17	Configures the application frequency, in minutes, for the applicable tunnel.
bw-limit (MPLS-TE), on page 51	Configures the minimum and maximum automatic bandwidth to set on a tunnel.
collect-bw-only (MPLS-TE), on page 69	Enables only the bandwidth collection without adjusting the automatic bandwidth.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
overflow threshold (MPLS-TE), on page 152	Configures tunnel overflow detection.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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*

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 3.9.0	No modification.
Release 3.9.1	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# auto-bw collect frequency 100
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.

Command	Description
mpls traffic-eng auto-bw apply (MPLS-TE), on page 122	Configures the highest bandwidth available on a tunnel without waiting for the current application period to end.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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**] [**metric** *value*]

Syntax Description

include-ipv6	(Optional) Announces the MPLS-TE tunnel to IS-IS IGP for IPv6 routing.
metric *value*	(Optional) Specify the MPLS-TE tunnel metric that the Interior Gateway Protocol (IGP) enhanced Shortest Path First (SPF) calculation uses.

Syntax Description

This command has no arguments or keywords.

Command Default

Announces IPv4 tunnel

Command Modes

Interface configuration

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.
Release 5.1.1	The **include-ipv6** and **metric** keywords were added to support MPLS-TE tunnel announcements to IS-IS.

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 35 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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# autoroute announce
```

Related Commands

Command	Description
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.

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*

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 5.1.1	This command was introduced.

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/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#interface tunnel-te 10
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# autoroute destination 192.168.1.2
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# autoroute destination 192.168.2.2
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# autoroute destination 192.168.3.2
RP/0/RP0RSP0/CPU0:router:hostname(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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	The absolute value range is defined from 1 to 2147483647.

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 32 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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# autoroute metric relative -1
```

Related Commands

Command	Description
autoroute announce, on page 32	Instructs the IGP to use the tunnel (if it is up) in its enhanced SPF calculation.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
show mpls traffic-eng autoroute, on page 222	Displays the tunnels announced to the IGP, including interface, destination, and bandwidth.

auto-tunnel pcc

To enable auto-tunnel stateful PCE client configuration mode, use the **auto-tunnel pcc** command in MPLS TE configuration mode. To disable auto-tunnel stateful PCE client configuration, use the **no** form of this command.

auto-tunnel pcc

This command has no keywords or arguments.

Command Default

Auto-tunnel stateful PCE client mode is disabled.

Command Modes

MPLS TE configuration

Command History

Release	Modification
Release 5.1.1	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to enable auto-tunnel stateful PCE client configuration mode:

```
RP/0/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#auto-tunnel pcc
RP/0/RP0RSP0/CPU0:router:hostname(config-te-auto-pcc)#
```

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

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 4.0.0	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/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# auto-tunnel backup
```

Related Commands

Command	Description
clear mpls traffic-eng auto-tunnel backup unused, on page 56	Clears the unused automatic backup tunnels.
mpls traffic-eng *interface-path-id* auto-tunnel backup	Configures the automatic backup tunnel for a specific interface.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

Command	Description
tunnel-id (auto-tunnel backup), on page 363	Configures range of tunnel interface numbers for automatic backup tunnels.

auto-tunnel p2mp

To enable auto-tunnel P2MP configuration mode, use the auto-tunnel p2mp command in MPLS-TE configuration mode. To disable auto-tunnel p2mp configuration, use the no form of this command.

auto-tunnel p2mp

This command has no keywords or arguments.

Command Default

P2MP auto-tunnel configuration is disabled.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 5.1	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 enable P2MP auto-tunnel configuration:

```
RP/0/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#auto-tunnel p2mp
RP/0/RP0RSP0/CPU0:router:hostname(config-te-auto-p2mp)#
```

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**}}

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# backup-bw global-pool unlimited
```

or

```
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 2
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# backup-bw sub-pool 1000
```

or

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 2
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# backup-bw 1000 class-type 1
```

Related Commands

Commands	Description
backup-path tunnel-te, on page 44	Assigns one or more backup tunnels to a protected interface.

Commands	Description
fast-reroute, on page 85	Enables FRR protection for an MPLS-TE tunnel.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.

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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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 PoS interface 0/7/0/0 using tunnel 100 and tunnel 150:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# interface POS 0/7/0/0
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# backup-path tunnel-te 100
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# backup-path tunnel-te 150
```

Related Commands

Command	Description
backup-bw, on page 41	Configures backup bandwidth for bandwidth protection.
fast-reroute, on page 85	Enables FRR protection for an MPLS-TE tunnel.
interface (MPLS-TE), on page 101	Enables MPLS-TE on an interface and enters MPLS-TE interface configuration mode.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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* | **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.
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 6.2.2	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# bandwidth-accounting
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-bw-account)# adjustment-factor 85
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-bw-account)# application-interval 90
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-bw-account)# sampling-interval 30
RP/0/RP0RSP0/CPU0:router:hostname(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
	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 5.2.0	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*}

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 3.9.0	No modification.
Release 3.9.1	This command was introduced.
Release 5.0.0	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/RP0RSP0/CPU0:router:hostname# configure
```

```
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# auto-bw
RP/0/RP0RSP0/CPU0:router:hostname(config-if-tunte-autobw)# bw-limit min 30 max 80
```

Related Commands

Command	Description
adjustment-threshold (MPLS-TE), on page 6	Configures the tunnel-bandwidth change threshold to trigger an adjustment.
application (MPLS-TE), on page 17	Configures the application frequency, in minutes, for the applicable tunnel.
auto-bw (MPLS-TE), on page 28	Configures automatic bandwidth on a tunnel interface and enters MPLS-TE automatic bandwidth interface configuration mode.
collect-bw-only (MPLS-TE), on page 69	Enables only the bandwidth collection without adjusting the automatic bandwidth.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
overflow threshold (MPLS-TE), on page 152	Configures tunnel overflow detection.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

capabilities (MPLS-TE)

To enable stateful PCE capabilities, use the **capabilities** command in MPLS-TE stateful PCE configuration mode. To disable the stateful PCE capabilities, use the **no** form of this command.

capabilities {**instantiation** | **update**}

Syntax Description

instantiation	Enables stateful instantiate capability.
update	Enables stateful update capability.

Command Default

Stateful PCE capabilities are disabled.

Command Modes

MPLS-TE Stateful PCE

Command History

Release	Modification
Release 5.1.1	This command was introduced.

Usage Guidelines

When the stateful-client configuration is added to the node, it will close all existing PCEP peer connections, and add the stateful capabilities TLV to the OPEN object it exchanges during PCEP session establishment.

When the stateful-client configuration is removed from the node, it will delete all PCE instantiated tunnels, close all existing PCEP connections, and no longer add the stateful capabilities TLV to the OPEN object it exchanges during PCEP session establishment.

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to enable stateful-client instantiation capabilities:

```
RP/0/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#pce stateful-client
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-pce-stateful)#capabilities instantiation
```

This example shows how to enable stateful-client update capabilities:

```
RP/0/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#pce stateful-client
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-pce-stateful)#capabilities update
```

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.9.0	No modification.
Release 3.9.1	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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# clear mpls traffic-eng auto-bw tunnel-te 0

RP/0/RP0RSP0/CPU0:router:hostname# 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
```

Related Commands

Command	Description
clear mpls traffic-eng counters signaling, on page 61	Clears the automatic bandwidth configuration in a tunnel.
show mpls traffic-eng tunnels auto-bw brief, on page 333	Displays the list of automatic-bandwidth-enabled tunnels, and indicates if the current signaled bandwidth of the tunnel is identical to the bandwidth that is applied by the automatic bandwidth.

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 Global Configuration modeXR Config 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

Global Configuration

Command History

Release	Modification
Release 4.0.0	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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels unused
```

The following example shows how to clear the unused backup automatic tunnels:

```
RP/0/RP0RSP0/CPU0:router:hostname# clear mpls traffic-eng auto-tunnel backup unused all
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels unused
```

Related Commands

Command	Description
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 4.1.1	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 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 EXEC modeXR EXEC mode.

clear mpls traffic-eng counters auto-tunnel mesh

This command has no arguments or keywords.

Command Default

None

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 4.1.1	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 is sample output from the **clear mpls traffic-eng counters auto-tunnel mesh** command:

```
RP/0/RP0RSP0/CPU0:router:hostnameclear 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 4.0.0	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/RP0RSP0/CPU0:router:hostname# clear mpls traffic-eng counters auto-tunnel backup
```

Related Commands

Command	Description
show mpls traffic-eng counters auto-tunnel backup	Displays the MPLS-TE automatic tunnel backup counters.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

clear mpls traffic-eng counters global

To clear the internal MPLS-TE tunnel counters, use the **clear mpls traffic-eng counters global** command in EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# clear mpls traffic-eng counters signaling all
```

Related Commands

Command	Description
show mpls traffic-eng counters signaling, on page 234	Displays tunnel signaling statistics.

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 4.2.0	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/RP0RSP0/CPU0:router:hostname# clear mpls traffic-eng counters signaling all
```

Related Commands

Command	Description
show mpls traffic-eng counters signaling, on page 234	Displays tunnel signaling statistics.

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# clear mpls traffic-eng link-management statistics
```

clear mpls traffic-eng pce

To clear the path computation element (PCE) statistics, use the **clear mpls traffic-eng pce** command in EXEC modeXR EXEC mode.

clear mpls traffic-eng pce [**peer ipv4** *address*]

Syntax Description

peer	(Optional) Clears the statistics for one peer.
ipv4 *address*	(Optional) Configures the IPv4 address for PCE.

Command Default

Clears statistics for all the PCE peers.

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.

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 statistics for the PCE:

```
RP/0/RP0RSP0/CPU0:router:hostname# clear mpls traffic-eng pce
```

Related Commands

Command	Description
show mpls traffic-eng pce peer, on page 275	Displays the status of the PCE peer address and state.

clear pbr counters interface

To clear the counters maintained for Policy Based Routing (PBR) for a specified interface, use the **clear pbr counters interface** command in EXEC modeXR EXEC mode.

clear pbr counters 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

EXEC modeXR EXEC mode

Command History

Release	Modification
Release 4.3.1	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read

Example

The following example shows how to clear the counters maintained for PBR for a specified interface:

```
RP/0/RP0RSP0/CPU0:router:hostname# clear pbr counters interface tunnel-te 25000
```

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

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 3.9.0	No modification.
Release 3.9.1	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 122 command in 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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# auto-bw
RP/0/RP0RSP0/CPU0:router:hostname(config-if-tunte-autobw)# collect-bw-only
```

Related Commands

Command	Description
adjustment-threshold (MPLS-TE), on page 6	Configures the tunnel-bandwidth change threshold to trigger an adjustment.
application (MPLS-TE), on page 17	Configures the application frequency, in minutes, for the applicable tunnel.
auto-bw (MPLS-TE), on page 28	Configures automatic bandwidth on a tunnel interface and enters MPLS-TE automatic bandwidth interface configuration mode.
bw-limit (MPLS-TE), on page 51	Configures the minimum and maximum automatic bandwidth to set on a tunnel.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
overflow threshold (MPLS-TE), on page 152	Configures tunnel overflow detection.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

delegation

To enable stateful path computation element (PCE) delegation on an interface, use the **delegation** command in the interface configuration mode. To remove this configuration, use the **no** form of this command.

delegation

This command has no keywords or arguments.

Command Default

No default behavior or values

Command Modes

Interface configuration

Command History

Release	Modification
Release 5.3.0	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read

Example

The following example shows how to enable PCE delegation on the tunnel-te interface:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)# interface tunnel-te 100
RP/0/0/CPU0:ios(config-if)#pce delegation
```

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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.
Release 5.0.0	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# destination 10.10.10.10
```

Related Commands

Command	Description
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# explicit-path identifier 200
RP/0/RP0RSP0/CPU0:router:hostname(config-expl-path)# disable
```

Related Commands

Command	Description
index exclude-address, on page 96	Specifies the next IP address to exclude from the explicit path.
index next-address, on page 99	Specifies path entries at a specific index.
show explicit-paths, on page 214	Displays the configured IP explicit paths.

disable (P2MP TE)

To disable the given destination for the Point-to-Multipoint (P2MP) tunnel interface, use the **disable** command in P2MP destination interface configuration mode. To return to the default behavior, use the **no** form of this command.

disable

Syntax Description

This command has no arguments or keywords.

Command Default

None

Command Modes

P2MP destination interface configuration

Command History

Release	Modification
Release 4.1.0	This command was introduced.

Usage Guidelines

If the **disable** command is not configured, the destination is enabled.

We recommend that you disable those destinations about which you have prior knowledge. This is because those destinations do not have valid MPLS-TE paths; therefore these destinations can be excluded from the P2MP tree computation.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to disable destination 140.140.140.140:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-mte 10
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# destination 140.140.140.140
RP/0/RP0RSP0/CPU0:router:hostname(config-if-p2mp-dest)# disable
```

Related Commands

Command	Description
destination (MPLS-TE), on page 72	Configures the destination address of a TE tunnel.
interface tunnel-mte, on page 104	Configures an MPLS-TE P2MP tunnel interface.

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

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 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# ds-te bc-model mam
```

Related Commands

Command	Description
ds-te mode, on page 79	Configures standard DS-TE mode.
ds-te te-classes, on page 81	Enters DS-TE te-class map configuration mode.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
show mpls traffic-eng ds-te te-class, on page 240	Displays the Diff-Serv TE-class map in use.

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

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 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# ds-te mode ietf
```

Related Commands

Command	Description
ds-te bc-model, on page 77	Enables a specific bandwidth constraint model (Maximum Allocation Model or Russian Doll Model) on the LSR.
ds-te te-classes, on page 81	Configures MPLS DS-TE TE-class maps.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
mpls traffic-eng fast-reroute promote, on page 124	Configures the router to assign new or more efficient backup MPLS-TE tunnels to protected MPLS-TE tunnels.
show mpls traffic-eng ds-te te-class, on page 240	Displays the Diff-Serv TE-class map in use.

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**}

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 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# ds-te te-classes te-class 7 class-type
0 priority 4
```

Related Commands

Command	Description
ds-te bc-model, on page 77	Enables a specific bandwidth constraint model (Maximum Allocation Model or Russian Doll Model) on the LSR.
ds-te mode, on page 79	Configures standard DS-TE mode.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
show mpls traffic-eng ds-te te-class, on page 240	Displays the Diff-Serv TE-class map in use.

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**]

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 4.0.0	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/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# interface pos 0/1/0/1
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# auto-tunnel backup
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if-auto-backup)#  exclude srlg preferred
```

Related Commands

Command	Description
auto-tunnel backup (MPLS-TE), on page 38	Builds automatic next-hop and next-next-hop tunnels, and enters auto-tunnel configuration mode.

fast-repair

To configure fast repair to determine a new optimal path for delegated tunnels that went down, or are under fast reroute (FRR) or soft-preemption, use the **fast-repair** command in MPLS-TE PCE stateful-client configuration mode. To remove fast repair configuration, use the **no** form of this command.

fast-repair

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

MPLS-TE PCE stateful-client configuration

Command History

Release	Modification
Release 5.3.2	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to configure fast repair:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname# (config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# pce
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-pce)#stateful-client
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-pce-stateful)#fast-repair
```

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

Syntax Description

This command has no arguments or keywords.

Command Default

FRR is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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 switchover before triggering FRR on standby RSPs to synchronize with the active RSP (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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# fast-reroute
```

Related Commands

Command	Description
fast-reroute protect, on page 87	Configures node and bandwidth protection for an MPLS-TE tunnel.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
show mpls traffic-eng forwarding, on page 242	Displays the contents of the FRR database.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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**}

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 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# fast-reroute protect bandwidth
```

Related Commands

Command	Description
fast-reroute, on page 85	Enables FRR protection for an MPLS-TE tunnel.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# fast-reroute timers promotion 600
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
mpls traffic-eng fast-reroute promote, on page 124	Configures the router to use a new or more efficient backup MPLS-TE tunnel when a current tunnel is overloaded.

flooding threshold

To set the reserved bandwidth thresholds for a link as a percentage of the total bandwidth change, use the **flooding threshold** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

flooding threshold {**up** | **down**} *percent*

Syntax Description

up	Configures the upward flooding threshold as a percentage of the total link bandwidth change.
down	Configures the downward flooding threshold as a percentage of the total link bandwidth change.
percent	Bandwidth threshold level. Range is 0 to 100 .

Command Default

No default behavior or values.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 5.3.4	This command was introduced.

Usage Guidelines

Use the **flooding threshold** command to set the up and down thresholds as a percentage of the total bandwidth change. If the **flooding threshold** command is configured, flooding occurs only if the change from the previous flooding is greater than the configured thresholds.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to set the reserved bandwidth thresholds as a percentage of the total bandwidth change. Flooding occurs only if the change from the previous flooding is greater than the configured thresholds. In this example, the up and down thresholds are configured as 10 percent. That means, if the last flooded bandwidth percentage is 50 percent, then the flooding occurs only if the bandwidth goes below 40 percent, or if the bandwidth goes above 60 percent.

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# flooding threshold up 10 down 10
```

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*}]

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# interface POS 0/7/0/0
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# flooding thresholds down 100 75 25
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# flooding thresholds up 25 50 100
```

Related Commands

Command	Description
interface (MPLS-TE), on page 101	Enables MPLS-TE on an interface and enters MPLS-TE interface configuration mode.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
link-management timers periodic-flooding, on page 113	Sets the length of the interval used for periodic flooding.
show mpls traffic-eng link-management advertisements, on page 253	Displays local link information currently being flooded by MPLS-TE link management into the global TE topology.
show mpls traffic-eng link-management bandwidth-allocation, on page 256	Displays current local link information.

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*

forward-class	Forward class for the tunnel. Range is 0 to 7.

Command Default

No default behavior or values

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 4.3.1	This command was introduced.
Release 6.4.1	This command was modified.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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**]

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 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.
Release 5.1.1	The **include-ipv6** keyword was added to support IPv6 forwarding adjacency announcements.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 888
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# forwarding-adjacency holdtime 60
```

Related Commands

Command	Description
bandwidth (RSVP)	Configures RSVP bandwidth on an interface using prestandard DS-TE mode.
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
show mpls traffic-eng forwarding-adjacency, on page 245	Displays forwarding-adjacency information.

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* }

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# explicit-path identifier 200
RP/0/RP0RSP0/CPU0:router:hostname(config-expl-path)# index 3 exclude-address ipv4 unicast
192.168.3.2
```

Related Commands

Command	Description
index next-address, on page 99	Specifies path entries at a specific index.
show explicit-paths, on page 214	Displays the configured IP explicit paths.

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*

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 4.0.0	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# explicit-path identifier 100
RP/0/RP0RSP0/CPU0:router:hostname(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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# explicit-path identifier 200
RP/0/RP0RSP0/CPU0:router:hostname(config-expl-path)# index 3 next-address ipv4 unicast
192.168.3.2
```

Related Commands

Command	Description
index exclude-address, on page 96	Specifies the next IP address to exclude from the explicit path.
show explicit-paths, on page 214	Displays the configured IP explicit paths.

interface (MPLS-TE)

To enable MPLS-TE on an interface and to enter MPLS-TE interface configuration mode, use the **interface** command in Global Configuration modeXR Config mode. To return to the default behavior, use the **no** form of this command.

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

Global Configuration

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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 .

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# interface POS 0/7/0/1
```

The following example shows how to remove an interface from the MPLS-TE domain:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# no interface POS 0/7/0/1
```

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*

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 4.0.0	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to enter SRLG interface configuration mode:

```
RP/0/RP0RSP0/CPU0:router:hostname(config)# srlg
RP/0/RP0RSP0/CPU0:router:hostname(config-srlg)# interface POS 0/1/0/1
RP/0/RP0RSP0/CPU0:router:hostname(config-srlg-if)# value 10
RP/0/RP0RSP0/CPU0:router:hostname(config-srlg-if)#value 50
```

Related Commands

Command	Description
interface (MPLS-TE), on page 101	Enables MPLS-TE on an interface and enters MPLS-TE interface configuration mode.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.

interface tunnel-mte

To configure an MPLS-TE P2MP tunnel interface, use the **interface tunnel-mte** command in Global Configuration modeXR Config mode. To return to the default behavior, use the **no** form of this command.

interface tunnel-mte *tunnel-id*

Syntax Description

tunnel-id	Tunnel number. Range is from 0 to 65535.

Command Default

Tunnel interfaces are disabled.

Command Modes

Global Configuration

Command History

Release	Modification
Release 4.1.0	This command was introduced.

Usage Guidelines

Configuring MPLS-TE links or tunnel-te, tunnel-gte, or tunnel-mte interfaces begins the TE-control process on route processor (RP).

The **interface tunnel-mte** command indicates that the tunnel interface is for an MPLS-TE P2MP tunnel and enables these MPLS-TE P2MP configuration options.

Note You must configure record-route on TE tunnels that are protected by multiple backup tunnels merging at a single node.

To use the P2MP tunnels, you must configure a Loopback address and use the **ipv4 unnumbered** command for the Loopback interface type.

Task ID

Task ID	Operations
interface	read, write

Examples

This example shows how to configure tunnel interface 1:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-mte 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# ipv4 unnumbered loopback0
```

Related Commands

Command	Description
affinity, on page 10	Configures affinity (the properties that the tunnel requires in its links) for an MPLS-TE tunnel.

Command	Description
backup-bw, on page 41	Configures backup bandwidth for FRR.
fast-reroute, on page 85	Enables FRR protection for an MPLS-TE tunnel.
path-selection metric (interface), on page 173	Configures a path selection metric—TE or IGP.
priority (MPLS-TE), on page 192	Configures setup and reservation priority for an MPLS-TE tunnel.
record-route, on page 194	Configures record-route on an MPLS-TE tunnel.
signalled-bandwidth	Configures the bandwidth required for an MPLS-TE tunnel.
signalled-name, on page 347	Configures the name of the tunnel required for an MPLS-TE tunnel.

interface tunnel-te

To configure an MPLS-TE tunnel interface, use the **interface tunnel-te** command in Global Configuration modeXR Config mode. To return to the default behavior, use the **no** form of this command.

interface tunnel-te *tunnel-id*

Syntax Description

tunnel-id	Tunnel number. Range is 0 to 65535.

Command Default

Tunnel interfaces are disabled.

Command Modes

Global Configuration

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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 .

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# policy-class 1
```

Related Commands

Command	Description
affinity, on page 10	Configures affinity (the properties that the tunnel requires in its links) for an MPLS-TE tunnel.
autoroute metric, on page 35	Instructs the IGP to use the tunnel in its enhanced SPF calculation, if the tunnel is in an up state.
backup-bw, on page 41	Configures backup bandwidth for FRR.
fast-reroute, on page 85	Enables FRR protection for an MPLS-TE tunnel.
path-option (MPLS-TE), on page 154	Configures a path option for an MPLS tunnel.
path-selection metric (interface), on page 173	Configures a path selection metric—TE or IGP.
policy-class	Configures PBTS to direct traffic into specific TE tunnels.
priority (MPLS-TE), on page 192	Configures setup and reservation priority for an MPLS-TE tunnel.
record-route, on page 194	Configures record-route on an MPLS-TE tunnel.

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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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 Global Configuration modeXR Config mode. To remove the IPv4 address, use the **no** form of this command.

ipv4 unnumbered mpls traffic-eng *interface-path-id*

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

Global Configuration

Command History

Release	Modification
Release 4.0.0	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#  ipv4 unnumbered mpls traffic-eng GigabitEthernet
 0/1/0/1
```

The following example shows how to specify unnumbered IPv4 address for an MPLS-TE tunnel with tunnel ID 200:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#  ipv4 unnumbered mpls traffic-eng tunnel-te 200
```

Related Commands

Command	Description
ipv4 unnumbered (MPLS), on page 108	Specifies the MPLS-TE tunnel Internet Protocol Version 4 (IPv4) address

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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
```

```
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# link-management timers bandwidth-hold
10
```

Related Commands

Command	Description
link-management timers periodic-flooding, on page 113	Sets the length of the interval used for periodic flooding.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
show mpls traffic-eng link-management bandwidth-allocation, on page 256	Displays current local link information and bandwidth hold time.

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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# link-management timers periodic-flooding
```

```
120
```

Related Commands

Command	Description
flooding thresholds, on page 91	Sets the reserved bandwidth flooding thresholds for a link.
link-management timers bandwidth-hold, on page 111	Sets the length of time that bandwidth is held for a RSVP Path (setup) message to wait for the corresponding RSVP Resv message to return.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
show mpls traffic-eng link-management summary, on page 268	Displays the current periodic flooding interval.

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 4.2.0	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# link-management timers preemption-delay
 bundle-capacity 180
```

load-share

To determine load-sharing balancing parameters for a specified 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*

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.

value: 0 (if no value is assigned)

Command Modes

Interface configuration

Command History

Release	Modification
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure load-sharing parameters on a specified interface:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 100
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# load-share 100
```

Related Commands

Command	Description
load-share unequal	Enables unequal load-sharing.

Command	Description
interface tunnel-te	Configures an MPLS-TE tunnel interface.
signalled-bandwidth	Configures the bandwidth required for an MPLS-TE tunnel.

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

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 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enable unequal load-sharing:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# load-share unequal
```

Related Commands

Command	Description
load-share	Configures load-sharing balancing parameters for a specified interface.

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
signalled-bandwidth	Configures the bandwidth required for an MPLS-TE tunnel.

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*

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 5.2.2	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/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#class-map type traffic class_mpls_src_test
RP/0/RP0RSP0/CPU0:router:hostname(config-cmap)#match mpls disposition access-group ipv4
ACL_MPLS_SRC
RP/0/RP0RSP0/CPU0:router:hostname(config-cmap)#end-class-map
```

mpls traffic-eng

To enter MPLS-TE configuration mode, use the **mpls traffic-eng** command in Global Configuration modeXR Config mode.

mpls traffic-eng

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

Global Configuration

Command History

Release	Modification
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enter MPLS-TE configuration mode:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#
```

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.9.0	No modification.
Release 3.9.1	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 bw-limit (MPLS-TE), on page 51 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/RP0RSP0/CPU0:router:hostname# mpls traffic-eng auto-bw apply tunnel-te 1
```

Related Commands

Command	Description
auto-bw collect frequency (MPLS-TE), on page 30	Configures the automatic bandwidth collection frequency and controls the manner in which the bandwidth for a tunnel collects output rate information, but does not adjust the tunnel bandwidth.
show mpls traffic-eng tunnels auto-bw brief, on page 333	Displays the list of automatic-bandwidth-enabled tunnels, and indicates if the current signaled bandwidth of the tunnel is identical to the bandwidth that is applied by the automatic bandwidth.

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 EXEC modeXR EXEC mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng fast-reroute promote

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# mpls traffic-eng fast-reroute promote
```

Related Commands

Command	Description
fast-reroute, on page 85	Enables FRR protection for an MPLS-TE tunnel.

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 router configuration mode. To return to the default behavior, use the **no** form of this command.

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

Router configuration

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# router isis 1
RP/0/RP0RSP0/CPU0:router:hostname(config-isis)# address-family ipv4 unicast
RP/0/RP0RSP0/CPU0:router:hostname(config-isis-af)# mpls traffic-eng level 1
```

```
RP/0/RP0RSP0/CPU0:router:hostname(config-isis-af)# metric-style wide
```

Related Commands

Command	Description
mpls traffic-eng router-id (MPLS-TE router), on page 139	Specifies that the TE router identifier for the node is the IP address associated with a given interface.

mpls traffic-eng link-management bandwidth-accounting apply all

To apply measured rates to all RSVP-TE enabled interfaces immediately, use the **mpls traffic-eng link-management bandwidth-accounting apply all** in EXEC modeXR EXEC mode.

mpls traffic-eng link-management bandwidth-accounting apply all

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 6.2.2	This command was introduced.

Usage Guidelines

The **bandwidth-accounting apply all** command acts like the end of an application interval. The measured rates are applied immediately, which may cause RSVP-TE bandwidth-accounting to flood the updated bandwidth values immediately. This command does not affect the periodic application of the bandwidth.

Task ID

Task ID	Operation
mpls-te	read, write

Example

```
RP/0/RP0RSP0/CPU0:router:hostname# mpls traffic-eng link-management bandwidth-accounting
apply all
```

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 EXEC modeXR EXEC mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng link-management flood

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

Note 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/RP0RSP0/CPU0:router:hostname# mpls traffic-eng link-management flood
```

Related Commands

Command	Description
show mpls traffic-eng link-management advertisements, on page 253	Displays MPLS-TE link-management advertisements.

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 EXEC modeXR EXEC mode. To disable this feature, use the **no** form of this command.

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

EXECXR EXEC

Command History

Release	Modification
Release 3.9.0	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/RP0RSP0/CPU0:router:hostname# mpls traffic-eng path-protection switchover tunnel-te 8
```

Related Commands

Command	Description
path-option (MPLS-TE), on page 154	Configures a path option for an MPLS-TE tunnel.

mpls traffic-eng pce activate-pcep

To force idle peers to be reestablished without waiting for a timer, use the **mpls traffic-eng pce activate-pcep** command in EXEC modeXR EXEC mode. To return to the default behavior, use the **no** form of this command.

mpls traffic-eng pce activate-pcep {*address* | **all**}

Syntax Description

address	Address of the idle peer.
all	Activates all the idle peers.

Command Default

No default behavior or values

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write, execute

Examples

The following example shows how to trigger a path computation client (PCC) or PCE to activate an idle path computation element protocol (PCEP) session:

```
RP/0/RP0RSP0/CPU0:router:hostname# mpls traffic-eng pce activate-pcep all
```

Related Commands

Command	Description
mpls traffic-eng pce reoptimize, on page 133	Triggers reoptimization manually either for all tunnels or a specific PCE-based tunnel.

mpls traffic-eng pce redelegate

To manually redelegate all tunnels to the available explicit peer, use the **mpls traffic-eng pce redelegate** command in EXEC modeXR EXEC mode.

mpls traffic-eng pce redelegate [**peer** {**ipv4** *address* | **node-id** *name*}]

Syntax Description

peer	(Optional) Redelegates all static tunnels to the specific peer.
ipv4 *address*	Specifies the peer IPv4 address in A.B.C.D format.
node-id *name*	Specifies the peer node ID name.

Command Default

No default behavior or values

Command Modes

EXEC modeXR EXEC mode

Command History

Release	Modification
Release 5.3.0	This command was introduced.

Usage Guidelines

If the IPv4 address or the node-id is not specified, the **pce redelegate** command delegates all the tunnels to the peer with the best precedence. If the peer is specified by an IP address or a node ID, all tunnels will be delegated to the specified peer.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how manually redelegate all tunnels to the available explicit peer:

```
RP/0/0/CPU0:ios#mpls traffic-eng pce redelegate
```

The following example shows how to manually redelegate all tunnels to the specified IPv4 address:

```
RP/0/0/CPU0:ios#mpls traffic-eng pce redelegate peer ipv4 192.168.0.2
```

The following example shows how to manually redelegate all tunnels to the specified node-id:

```
RP/0/0/CPU0:ios#mpls traffic-eng pce redelegate peer node-id pce1
```

mpls traffic-eng pce reoptimize

To trigger reoptimization manually either for all or a specific PCE-based tunnel, use the **mpls traffic-eng pce reoptimize** command inEXEC modeXR EXEC mode. To disable this feature, use the **no** form of this command.

mpls traffic-eng pce reoptimize [*tunnel ID*] [**force**]

Syntax Description

tunnel ID	(Optional) Tunnel ID to be reoptimized. Range is from 0 to 65535.
force	(Optional) Forces the router to start using the newly calculated route even if the used path has a better metric.

Command Default

Reoptimizes all the PCE tunnels.

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

This command determines the time allowed for an RSVP message to return from a neighbor RSVP node.

If you do not run the **mpls traffic-eng pce reoptimize** command, the system tries to reoptimize at an interval of 3600 seconds.

Task ID

Task ID	Operations
mpls-te	read, write, execute

Examples

The following example shows how to trigger reoptimization for all PCE-based tunnels:

```
RP/0/RP0RSP0/CPU0:router:hostname# mpls traffic-eng pce reoptimize
```

Related Commands

Command	Description
mpls traffic-eng pce activate-pcep, on page 131	Forces idle peers to be re-established without waiting for a timer.

mpls traffic-eng reoptimize (EXEC)

To trigger the reoptimization interval of all TE tunnels, use the **mpls traffic-eng reoptimize** command in EXEC modeXR EXEC mode.

mpls traffic-eng reoptimize [*tunnel-id*] [*tunnel-name*] [**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.
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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	The following keywords and arguments were added to support the P2P feature: • **all** keyword • **p2p** keyword, **all** keyword, and *tunnel-id* argument

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/RP0RSP0/CPU0:router:hostname# mpls traffic-eng reoptimize
```

The following example shows how to immediately reoptimize TE tunnel-te90:

```
RP/0/RP0RSP0/CPU0:router:hostname# mpls traffic-eng reoptimize tunnel-te90
```

The following example shows how to immediately reoptimize all P2P TE tunnels:

```
RP/0/RP0RSP0/CPU0:router:hostname# mpls traffic-eng reoptimize p2p all
```

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 EXEC modeXR 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

EXEC modeXR 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/RP0RSP0/CPU0:router:hostname#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/RP0RSP0/CPU0:router:hostname#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/RP0RSP0/CPU0:router:hostname#mpls traffic-eng resetup P2MP tunnel-id 2
```

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 Global Configuration modeXR 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

Syntax Description

This command has no arguments or keywords.

Command Modes

Global Configuration

Command History

Release	Modification
Release 5.2.2	This command was introduced.

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/RP0RSP0/CPU0:router:hostname# mpls traffic-eng reoptimize events link-up
```

Related Commands

Command	Description
mpls traffic-eng reoptimize timers delay	Delays removal of old LSPs or installation of new LSPs after tunnel reoptimization.

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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# router ospf CORE_AS
RP/0/RP0RSP0/CPU0:router:hostname(config-ospf)# mpls traffic-eng router-id 7.7.7.7

RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# router isis 811
RP/0/RP0RSP0/CPU0:router:hostname(config-isis)# address-family ipv4 unicast
RP/0/RP0RSP0/CPU0:router:hostname(config-isis-af)# mpls traffic-eng router-id 8.8.8.8
```

Related Commands

Command	Description
mpls traffic-eng level, on page 125	Configures a router running OSPF MPLS so that it floods TE for the indicated IS-IS level.

mpls traffic-eng repotimize mesh group

To reoptimize all tunnels of a mesh group, use the **mpls traffic-eng repotimize mesh group**command in EXEC modeXR 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

MPLS Transport profile configuration

Command History

Release	Modification
Release 4.1.1	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 is sample out from the **mpls traffic-eng reoptimize mesh group** command:

```
RP/0/RP0RSP0/CPU0:router:hostname mpls traffic-eng reoptimize mesh group 10
```

mpls traffic-eng signal path-error soft-preempt transit

To signal soft-preemption path errors to the MPLS LSPs that are transiting through a router use the **mpls traffic-eng signal path-error soft-preempt transit** { **all** | **interface** *interface-name*} in EXEC modeXR EXEC mode.

mpls traffic-eng signal path-error soft-preempt transit {**all** | **interface** *interface-name*}

Syntax Description

all	Issue soft-preemption path errors on all the MPLS LSPs that are transiting through the router.
interface*interface-name*	Issue soft-preemption path errors on all the MPLS LSPs that are egressing on the specified interface.

Command Default

No default behavior or values.

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 6.4.1	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read, write

Examples

The following example shows how to issue soft preemption errors from a router to all the LSPs :

```
RP/0/0/CPU0:router(config)# mpls traffic-eng signal path-error soft-preempt transit all
```

The following example shows how to issue soft preemption errors from a router to the LSPs with the specified outgoing interface :

```
RP/0/0/CPU0:router(config)# mpls traffic-eng signal path-error soft-preempt transit interface
 gigabitEthernet 0/2/0/0
```

mpls traffic-eng srlg

To enter MPLS-TE SRLG configuration mode, use the **mpls traffic-eng srlg** command in Global Configuration modeXR 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*

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

Global Configuration

Command History

Release	Modification
Release 4.3.1	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to enter MPLS-TE SRLG configuration mode:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng srlg
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-srlg)#
```

The following example shows how to enter MPLS-TE SRLG value configuration submode:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng srlg value 150
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-srlg)#
```

The following example shows how to specify admin-weight in the MPLS-TE SRLG value configuration submode:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng srlg value 150
RP/0/RP0RSP0/CPU0:router:hostname(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 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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# router isis 1
RP/0/RP0RSP0/CPU0:router:hostname(config-isis)# address-family ipv4 unicast
RP/0/RP0RSP0/CPU0:router:hostname(config-isis-af)# mpls traffic-eng tunnel preferred
```

mpls traffic-eng tunnel restricted

To specify an autoroute tunnel as a designated path, 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.

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
```

mpls traffic-eng timers backoff-timer

To update MPLS-TE backoff timer duration, use the **mpls traffic-eng timers backoff-timer** command in global configuration mode. To revert to the default backoff timer duration, use the **no** form of the command.

mpls traffic-eng timers backoff-timer initial-interval *seconds* **final-interval** *seconds*
no mpls traffic-eng timers backoff-timer

Syntax Description

initial-interval *seconds*	Specifies the initial wait period after which the head-end router attempts to send traffic over an LSP, when a path error occurs. The default value of the initial wait period after an LSP error occurs is 3 seconds.
final-interval *seconds*	Specifies the total time duration for which the head-end router attempts to send traffic over the LSP after an LSP error occurs. The default value of the total time is 300 seconds.

Command Default

The MPLS-TE backoff timer duration is enabled with the default values mentioned in the Syntax Description section.

Command Modes

Global configuration (config)

Command History

Release	Modification
Release 7.3.2	This command was introduced.

Usage Guidelines

If you want MPLS-TE to send traffic over a different LSP immediately after a path error occurs, set the initial and final backoff timer values to 0.

Example

This example shows how to set an MPLS-TE backoff timer initial duration of 10 seconds, for a total timer duration of 600 seconds.

```
Router# configure
Router(config)# mpls traffic-eng timers backoff-timer initial-interval 10 final-interval
600
Router(config)# commit
```

This example shows how to enable MPLS-TE to send traffic over a different LSP, immediately after an LSP error occurs.

```
Router# configure
Router(config)# mpls traffic-eng timers backoff-timer initial-interval 0 final-interval 0
Router(config)# commit
```

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*]

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 6.1.2	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#named-tunnels
RP/0/RP0RSP0/CPU0:router:hostname(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/0/0RP0RSP0/CPU0:router:hostname# configure
RP/0/0RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/0RP0RSP0/CPU0:router:hostname(config-mpls-te)# named-tunnels tunnel-te ABC
RP/0/0RP0RSP0/CPU0:router:hostname(config-te-tun-name)# self-ping
RP/0/0RP0RSP0/CPU0:router:hostname(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

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 4.0.0	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/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# interface pos 0/1/0/1
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if)# auto-tunnel backup
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-if-auto-backup)# nhop-only
```

Related Commands

Command	Description
auto-tunnel backup (MPLS-TE), on page 38	Builds automatic NHOP and NNHOP backup tunnels.

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*

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 3.9.1	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
```

```
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# auto-bw
RP/0/RP0RSP0/CPU0:router:hostname(config-if-tunte-autobw)# overflow threshold 50 limit 3
```

Related Commands

Command	Description
adjustment-threshold (MPLS-TE), on page 6	Configures the tunnel bandwidth change threshold to trigger an adjustment.
application (MPLS-TE), on page 17	Configures the application frequency in minutes for the applicable tunnel.
auto-bw (MPLS-TE), on page 28	Configures automatic bandwidth on a tunnel interface and enters MPLS-TE automatic bandwidth interface configuration mode.
bw-limit (MPLS-TE), on page 51	Configures the minimum and maximum automatic bandwidth to set on a tunnel.
collect-bw-only (MPLS-TE), on page 69	Enables only the bandwidth collection without adjusting the automatic bandwidth.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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* {**dynamic** [**pce** [**address ipv4** *address*]] | **explicit** {**name** *path-name* | **identifier** *path-number*}} **[attribute-set** *name]* [**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.
dynamic	Specifies that label switched paths (LSP) are dynamically calculated.
pce	(Optional) Specifies that the LSP is computed by a Path Computation Element (PCE).
address	(Optional) Configures the address for the PCE.
ipv4 *address*	Configures the IPv4 address for the PCE.
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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.
Release 3.9.0	The **dynamic** keyword is required for a path-protection configuration.
Release 4.2.0	The **attribute-set** keyword was added.
Release 4.2.3	The **protected-by** keyword was added.

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).

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.

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/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
```

```
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# path-option 1 explicit name po4
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# path-option 1 dynamic isis mtbf level 1
lockdown
```

Related Commands

Command	Description
show explicit-paths, on page 214	Displays the configured IP explicit paths.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

path-option (Named Tunnels)

To configure one or more path options - each identified by a unique name - for a given MPLS-TE named tunnel, use the **path-option** command in MPLS-TE named-tunnels configuration mode. To delete the path option, use the **no** form of this command.

path-option *path-name* {**preference** *preference-priority* | **computation** {**dynamic** | **explicit** *explicit-path-name*}}

Syntax Description

path-name	Configures the given name to the path. **Note** If the path-option name contains more than one word, use hyphens to separate the words.
preference *preference-priority*	Specifies the path option preference. The range is from 1 to 4294967295. Lower values have a higher preference.
computation	Specifies the computation method for the path.
dynamic	Specifies that the path is dynamically calculated.
explicit	Specifies that an explicit path is used.
explicit-path-name	Configures the given name to the explicit path.

Command Default

None

Command Modes

MPLS-TE named tunnels configuration

Command History

Release	Modification
Release 6.1.2	The *path-name* argument, and the **preference** and **computation** keywords were added to support the named tunnels and named path option configurations.

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 configure one or more path options for a given MPLS-TE named tunnel:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#named-tunnels
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-named-tunnels)#tunnel-te FROM-NY-TO-SJ
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-tunnel-name)#destination 192.168.0.1
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-tunnel-name)#path-option VIA-SF
RP/0/RP0RSP0/CPU0:router:hostname(config-path-option-name)#preference 10
RP/0/RP0RSP0/CPU0:router:hostname(config-path-option-name)#computation explicit MyExplicitPath
RP/0/RP0RSP0/CPU0:router:hostname(config-path-option-name)#exit
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-tunnel-name)#path-option SHORTEST
RP/0/RP0RSP0/CPU0:router:hostname(config-path-option-name)#preference 20
RP/0/RP0RSP0/CPU0:router:hostname(config-path-option-name)#computation dynamic
RP/0/RP0RSP0/CPU0:router:hostname(config-path-option-name)#exit
```

path-option (P2MP TE)

To configure the primary or fallback path setup option for a Point-to-Multipoint (P2MP) TE tunnel, use the **path-option** command in P2MP destination interface configuration mode. To return to the default behavior, use the **no** form of this command.

path-option *preference-priority* {**dynamic** | **explicit** {**name** *path-name* | **identifier** *path-number*} } [**verbatim**] [**lockdown**]

Syntax Description

preference-priority	Path option number. 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.
verbatim	(Optional) Bypasses the Topology/CSPF check for explicit paths.
lockdown	(Optional) Specifies that the LSP cannot be reoptimized.

Command Default

None

Command Modes

P2MP destination interface configuration

Command History

Release	Modification
Release 4.1.0	This command was introduced.

Usage Guidelines

You can configure several path options for each destination of a P2MP tunnel. For example, for one tunnel, there can be several explicit path options and a dynamic option. The path preference is for lower (not higher) numbers, so option 1 is preferred over higher options.

When the lower number path option fails, the next path option under the destination is attempted.

Several path-options can be configured for each destination under a tunnel.

When configuring multiple path-options under each destination of a P2MP tunnel, the PCALC on the TE tunnel source attempts to generate the P2MP tree starting from the preferred path-options (lower numbers) for each destination. If some destinations use explicit paths that cause remerges with the dynamic generated paths for other destinations in the P2MP tree, the PCALC source modifies the dynamic paths (for example, optimal path); therefore, it follows the explicit path to correct the remerge problem.

The **path-option** command is common for both Point-to-Point (P2P) and P2MP tunnels.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

This example shows how to configure a P2MP tunnel with two destinations and several path-options per destination:

```
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-mte 100
RP/0/RP0RSP0/CPU0:router:hostname(config-if)#  destination 10.0.0.1
RP/0/RP0RSP0/CPU0:router:hostname(config-if-p2mp-dest)# path-option 1 explicit name po_dest1
RP/0/RP0RSP0/CPU0:router:hostname(config-if-p2mp-dest)# path-option 2 dynamic
```

This example shows that the fallback path option is dynamic:

```
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-mte 100
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# destination 172.16.0.1
RP/0/RP0RSP0/CPU0:router:hostname(config-if-p2mp-dest)# path-option 1 explicit name po_dest2
RP/0/RP0RSP0/CPU0:router:hostname(config-if-p2mp-dest)# path-option 2 dynamic
```

Related Commands

Command	Description
destination (MPLS-TE), on page 72	Configures the destination address of a TE tunnel.
mpls traffic-eng path-protection switchover gmpls	Specifies a switchover for path protection.
show explicit-paths, on page 214	Displays the configured IP explicit paths.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.
show mrib mpls traffic-eng fast-reroute	Displays information about Multicast Routing Information Base (MRIB) MPLS traffic engineering fast reroute.

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

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 3.9.0	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# path-protection
```

Related Commands

Command	Description
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.
mpls traffic-eng path-protection switchover tunnel-te, on page 130	Forces a manual switchover for path-protected tunnel.
path-protection timers reopt-after-switchover, on page 162	Configures the time to wait after a switchover occurs on a tunnel before a reoptimization is attempted for the tunnel.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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*

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 3.9.0	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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# path-protection timers
reopt-after-switchover 180
```

Related Commands

Command	Description
mpls traffic-eng path-protection switchover tunnel-te, on page 130	Forces a manual switchover for path-protected tunnel.
path-protection (MPLS-TE), on page 161	Enables a tunnel interface for path protection.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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

Global configuration

Interface tunnel TE configuration

MPLS TE path-option attribute set configuration

Command History

Release	Modification
Release 5.1.2	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/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#attribute-set path-option PO3AttrSet
RP/0/RP0RSP0/CPU0:router:hostname(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}

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 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.
Release 4.1.0	The **head, mid,** and **tail** keywords were added.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# path-selection ignore overload
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#
```

path-selection invalidation

To configure the path invalidation timer such that when the timer expires, the path is either removed or the data is dropped, use the **path-selection invalidation** command in MPLS-TE configuration mode. To remove the path invalidation timer, use the **no** form of this command.

path-selection invalidation *path-invalidation-timer-value***{drop | tear}**

Syntax Description

path-invalidation-timer-value	Configures the path invalidation timer value in milliseconds. The range is from 0 to 60000.
drop	The data is dropped after the path invalidation timer expires.
tear	The path is torn down after the path invalidation timer expires.

Command Default

None

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	read, write

This example shows how to set the **path-selection invalidation** timer in MPLS TE configuration mode.

```
RP/0/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#path-selection invalidation 1 drop
```

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*]

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 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

Note 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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# path-selection loose-expansion affinity
 55 mask FFFFFFFF
```

Related Commands

Command	Description
path-selection loose-expansion metric (MPLS-TE), on page 169	Configures a metric type to be used to expand a path to the next loose hop for a tunnel on an area border router.
path-selection metric (MPLS-TE), on page 171	Configures the MPLS-TE tunnel path-selection metric.

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*]

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 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

Note 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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# path-selection loose-expansion metric
igp
```

Related Commands

Command	Description
path-selection loose-expansion affinity (MPLS-TE), on page 167	Specifies the affinity value to be used to expand a path to the next loose hop for a tunnel on an area border router.

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# path-selection metric igp
```

Related Commands

Command	Description
path-selection loose-expansion affinity (MPLS-TE), on page 167	Specifies the affinity value to be used to expand a path to the next loose hop for a tunnel on an area border router.

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# path-selection metric igp
```

Related Commands

Command	Description
show mpls traffic-eng topology	Displays the tunnel path used.

pce address (MPLS-TE)

To configure the IPv4 self address for Path Computation Element (PCE), use the **pce address** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

pce address ipv4 *address*

Syntax Description

ipv4 *address*	Configures the IPv4 address for PCE.

Command Default

No default behavior or values

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

The IP address is used in the TCP communication with the other PCEs or PCCs. In addition, this address is advertised using IGP.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure the IPv4 self address for PCE:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# pce address ipv4 10.10.10.10
```

Related Commands

Command	Description
pce keepalive (MPLS-TE), on page 179	Configures a PCEP keepalive interval.
path-option (MPLS-TE), on page 154	Configures a path option for an MPLS-TE tunnel.

Command	Description
pce peer (MPLS-TE), on page 181	Configures an IPv4 self address for a PCE peer.
pce reoptimize (MPLS-TE), on page 183	Configures a periodic reoptimization timer.
pce request-timeout (MPLS-TE), on page 185	Configures a PCE request-timeout.
pce tolerance keepalive (MPLS-TE), on page 188	Configures a PCE tolerance keepalive (which is the minimum acceptable peer proposed keepalive).

pce deadtimer (MPLS-TE)

To configure a path computation element (PCE) deadtimer, use the **pce deadtimer** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

pce deadtimer *value*

Syntax Description

value	Keepalive dead interval, in seconds. The range is 0 to 255.

Command Default

value: 120

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.

Usage Guidelines

When the dead interval is 0, the LSR does not time out a PCEP session to a remote peer.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure a PCE deadtimer:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# pce deadtimer 50
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
path-option (MPLS-TE), on page 154	Configures a path option for an MPLS-TE tunnel.
pce address (MPLS-TE), on page 175	Configures the IPv4 self address for a PCE.
pce keepalive (MPLS-TE), on page 179	Configures a PCEP keepalive interval.
pce peer (MPLS-TE), on page 181	Configures an IPv4 self address for a PCE peer.
pce reoptimize (MPLS-TE), on page 183	Configures a periodic reoptimization timer.

Command	Description
pce request-timeout (MPLS-TE), on page 185	Configures a PCE request-timeout.
pce tolerance keepalive (MPLS-TE), on page 188	Configures a PCE tolerance keepalive (which is the minimum acceptable peer proposed keepalive).

pce keepalive (MPLS-TE)

To configure a path computation element protocol (PCEP) keepalive interval, use the **pce keepalive** command in MPLS-TE configuration mode. To disable this command, use the **no** form of this command.

pce keepalive *interval*

Syntax Description

interval	Keepalive interval, in seconds. The range is 0 to 255.

Command Default

interval: 30

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

When the keepalive interval is 0, the LSR does not send keepalive messages.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure PCEP keepalive interval for 10 seconds:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname#(config-mpls-te) pce keepalive 10
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
path-option (MPLS-TE), on page 154	Configures a path option for an MPLS-TE tunnel.
pce address (MPLS-TE), on page 175	Configures the IPv4 self address for a PCE.
pce deadtimer (MPLS-TE), on page 177	Configures a PCE deadtimer.
pce peer (MPLS-TE), on page 181	Configures an IPv4 self address for a PCE peer.

Command	Description
pce reoptimize (MPLS-TE), on page 183	Configures a periodic reoptimization timer.
pce request-timeout (MPLS-TE), on page 185	Configures a PCE request-timeout.
pce tolerance keepalive (MPLS-TE), on page 188	Configures a PCE tolerance keepalive (which is the minimum acceptable peer proposed keepalive).

pce peer (MPLS-TE)

To configure an IPv4 self address for a path computation element (PCE) peer, use the **pce peer** command in MPLS-TE configuration mode. To return to the default behavior, use the **no** form of this command.

pce peer ipv4 *address*

Syntax Description

ipv4 *address*	Configures the IPv4 address for PCE.

Command Default

TE metric

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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 an IPv4 self address for a PCE peer:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# pce peer ipv4 11.11.11.11
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
path-option (MPLS-TE), on page 154	Configures a path option for an MPLS-TE tunnel.
pce address (MPLS-TE), on page 175	Configures the IPv4 self address for a PCE.

Command	Description
pce deadtimer (MPLS-TE), on page 177	Configures a PCE deadtimer.
pce keepalive (MPLS-TE), on page 179	Configures a PCEP keepalive interval.
pce reoptimize (MPLS-TE), on page 183	Configures a periodic reoptimization timer.
pce request-timeout (MPLS-TE), on page 185	Configures a PCE request-timeout.
pce tolerance keepalive (MPLS-TE), on page 188	Configures a PCE tolerance keepalive (which is the minimum acceptable peer proposed keepalive).

pce reoptimize (MPLS-TE)

To configure a periodic reoptimization timer, use the **pce reoptimize** command in MPLS-TE configuration mode. To disable this feature, use the **no** form of this command.

pce reoptimize *value*

Syntax Description

value	Periodic reoptimization timer value, in seconds. The range is 60 to 604800.

Command Default

value: 3600

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.

Usage Guidelines

When the dead interval is 0, the LSR does not time out a path computation element protocol (PCEP) session to a remote peer.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure a periodic reoptimization timer for 200 seconds:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# pce reoptimize 200
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
path-option (MPLS-TE), on page 154	Configures a path option for an MPLS-TE tunnel.
pce address (MPLS-TE), on page 175	Configures the IPv4 self address for a PCE.
pce deadtimer (MPLS-TE), on page 177	Configures a PCE deadtimer.
pce keepalive (MPLS-TE), on page 179	Configures a PCEP keepalive interval.

Command	Description
pce peer (MPLS-TE), on page 181	Configures an IPv4 self address for a PCE peer.
pce request-timeout (MPLS-TE), on page 185	Configures a PCE request-timeout.
pce tolerance keepalive (MPLS-TE), on page 188	Configures a PCE tolerance keepalive (which is the minimum acceptable peer proposed keepalive).

pce request-timeout (MPLS-TE)

To configure a path computation element (PCE) request-timeout, use the **pce request-timeout** command in MPLS-TE configuration mode. To disable this feature, use the **no** form of this command.

pce request-timeout *value*

Syntax Description

value	PCE request-timeout, in seconds. The range is 5 to 100.

Command Default

value: 10

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.

Usage Guidelines

PCC or PCE keeps a pending path request only for the request-timeout period.

Task ID

Task ID	Operations
mpls-te	read, write

Examples

The following example shows how to configure a PCE request-timeout for 10 seconds:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# pce request-timeout 10
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
path-option (MPLS-TE), on page 154	Configures a path option for an MPLS-TE tunnel.
pce address (MPLS-TE), on page 175	Configures the IPv4 self address for a PCE.
pce deadtimer (MPLS-TE), on page 177	Configures a PCE deadtimer.
pce keepalive (MPLS-TE), on page 179	Configures a PCEP keepalive interval.
pce peer (MPLS-TE), on page 181	Configures an IPv4 self address for a PCE peer

Command	Description
pce reoptimize (MPLS-TE), on page 183	Configures a periodic reoptimization timer.
pce tolerance keepalive (MPLS-TE), on page 188	Configures a PCE tolerance keepalive (which is the minimum acceptable peer proposed keepalive).

pce stateful-client

To enter the stateful PCE client configuration mode and enable stateful PCE capabilities, use the **pce stateful-client** command in MPLS-TE configuration mode. To disable stateful PCE capabilities, use the **no** form of this command.

pce stateful-client

This command has no keywords or arguments.

Command Default

Stateful PCE is disabled.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 5.1.1	This command was introduced.

Usage Guidelines

When the stateful-client configuration is added to the TE-node, it will close all existing PCEP peer connections, and add the stateful capabilities TLV to the OPEN object it exchanges during the PCEP session establishment.

When the stateful-client configuration is removed from the TE-node, it will delete all PCE instantiated tunnels, close all existing PCEP connections, and no longer add the stateful capabilities TLV to the OPEN object it exchanges during the PCEP session establishment.

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to configure stateful PCE mode:

```
RP/0/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#pce stateful-client
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te-pce-stateful)#
```

pce tolerance keepalive (MPLS-TE)

To configure a path computation element (PCE) tolerance keepalive (which is the minimum acceptable peer proposed keepalive), use the **pce tolerance keepalive** command in MPLS-TE configuration mode. To disable this feature, use the **no** form of this command.

pce tolerance keepalive *value*

Syntax Description

value	PCE tolerance keepalive value, in seconds. The range is 0 to 255.

Command Default

value: 10

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.

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 a PCE tolerance keepalive for 10 seconds:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# pce tolerance keepalive 10
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
path-option (MPLS-TE), on page 154	Configures a path option for an MPLS-TE tunnel.
pce address (MPLS-TE), on page 175	Configures the IPv4 self-address for a PCE.
pce deadtimer (MPLS-TE), on page 177	Configures a PCE deadtimer.
pce keepalive (MPLS-TE), on page 179	Configures a PCEP keepalive interval.

Command	Description
pce peer (MPLS-TE), on page 181	Configures an IPv4 self address for a PCE peer
pce reoptimize (MPLS-TE), on page 183	Configures a periodic reoptimization timer.
pce request-timeout (MPLS-TE), on page 185	Configures a PCE request-timeout.

peer source ipv4

To configure PCEP session outgoing interface, use the **peer source ipv4** command in MPLS-TE pce configuration mode.

peer source ipv4 *ip-address*

Syntax Description

ip-address	Specifies IP version 4 address of the source in A.B.C.D format.

Command Default

No default behavior or values

Command Modes

MPLS-TE pce configuration

Command History

Release	Modification
Release 5.3.0	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to configure PCEP session outgoing interface:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#mpls traffic-eng pce
RP/0/0/CPU0:ios(config-mpls-te-pce)#peer source ipv4 10.0.0.1
```

precedence (MPLS-TE)

To configure stateful path computation elements (PCEs) for delegating label switched paths (LSPs), use the **precedence** command in MPLS-TE pce configuration mode. To remove the configuration, use the **no** form of this command.

precedence *N*

Syntax Description

N	Precedence value. The range is from 0 to 255.

Command Default

N: 255

Command Modes

MPLS-TE pce configuration

Command History

Release	Modification
Release 5.3.0	This command was introduced.

Usage Guidelines

The path computation client (PCC) uses the configured precedence value to select stateful PCEs for delegating LSPs. Low precedence value corresponds to high priority.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to configure precedence for a PCE IPv4 peer:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#mpls traffic-eng pce
RP/0/0/CPU0:ios(config-mpls-te-pce)#peer ipv4 10.1.1.1
RP/0/0/CPU0:ios(config-mpls-te-pce-peer)#precedence 255
```

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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# priority 1 1
```

Related Commands

Command	Description
interface tunnel-te, on page 106	Configures an MPLS-TE tunnel interface.

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

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

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 enable record-route on the TE tunnel:

```
RP/0/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# record-route
```

Related Commands

Command	Description
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

redelegation-timeout

To configure the time (in seconds) that a path computation client (PCC) must wait before re-delegating LSPs after a PCEP session with the active stateful PCE is disconnected, use the **redelegation-timeout** command in MPLS-TE pce configuration mode.

redelegation-timeout *seconds*

Syntax Description

seconds	Specifies redelegation timeout for LSPs after session failure in seconds. The range is from 0 to 3600.

Command Default

seconds: 180

Command Modes

MPLS-TE pce configuration

Command History

Release	Modification
Release 5.3.0	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to configure the time (in seconds) that a PCC must wait before re-delegating LSPs:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#mpls traffic-eng pce
RP/0/0/CPU0:ios(config-mpls-te-pce)#stateful-client timers redelegation-timeout 30
```

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 5.3.0	This command was introduced.

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 5.3.0	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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# reoptimize 60
```

Related Commands

Command	Description
mpls traffic-eng reoptimize (EXEC), on page 135	Triggers the reoptimization interval of all TE tunnels.

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*}

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	The **after-frr** and **path-protection** keywords were added.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# reoptimize timers delay path-protection
 80
```

Related Commands

Command	Description
mpls traffic-eng reoptimize (EXEC), on page 135	Reoptimizes all traffic engineering tunnels immediately.

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*

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 4.2.4	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/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(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*

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 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# router-id secondary 10.0.0.1
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# router-id secondary 172.16.0.1
```

Related Commands

Command	Description
mpls traffic-eng router-id (MPLS-TE router), on page 139	Specifies that the TE router identifier for the node is the IP address associated with a given interface.

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*

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 5.2.2	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 forward-class

To associate a forward class with a policy, use the **set forward-class** command in the MPLS-TE configuration mode.

set forward-class *range*

Syntax Description

range	Forward class for the routing policy. Range is 1 to 7.

Command Default

If no forward class value is specified, the default tunnel is used for forwarding.

Command Modes

MPLS-TE configuration

Command History

Release	Modification
Release 6.0	This command is introduced

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

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 5.1	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operation
qos	read, write

This example shows how to set the IPv4 df bit policy value as *1*:

```
RP/0/RP0RSP0/CPU0:router:hostname(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 5.3.0	This command was introduced.

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
```

service-policy apply-order pbr qos

To configure ingress Quality of Service (QoS) remarking policy, use the **service-policy apply-order pbr qos** command in the Global Configuration modeXR Config mode. To remove this configuration, use the **no** form of this command.

service-policy apply-order pbr qos

Syntax Description

This command has no arguments or keywords.

Command Default

By default, PBR is processed before QoS.

Command Modes

Global Configuration modeXR Config mode

Command History

Release	Modification
Release 5.3.2	This command was introduced.

Usage Guidelines

PBTS has a knob that explicitly configures QoS and PBTS processing order (service-policy apply-order pbr qos). If this configuration is not set explicitly, PBR is processed before QoS by default.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to configure ingress QoS remarking policy:

```
RP/0/RP0RSP0/CPU0:router:hostname(config)# service-policy apply-order pbr qos
```

service-policy apply-order qos pbr

To configure service policy ordering for Policy Based Routing (PBR), use the **service-policy apply-order qos pbr** command in the Global Configuration modeXR Config mode. To remove this configuration, use the **no** form of this command.

service-policy apply-order qos pbr

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

Global Configuration modeXR Config mode

Command History

Release	Modification
Release 4.3.1	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to configure service policy ordering of PBR:

```
RP/0/RP0RSP0/CPU0:router:hostname(config)# service-policy apply-order qos pbr
```

show explicit-paths

To display the configured IP explicit paths, use the **show explicit-paths** command in EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# 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 1: 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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# 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
```

Related Commands

Command	Description
index exclude-address, on page 96	Specifies the next IP address to exclude from the explicit path.
index next-address, on page 99	Specifies path entries at a specific index.

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 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

EXEC

Command History

Release	Modification
Release 5.1.1	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read

This example displays accounting information from tunnel-te interface *1*:

```
RP/0/RP0RSP0/CPU0:router:hostname#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 isis mpls traffic-eng tunnel

To display MPLS traffic engineering information that are announced to IS-IS IGP, use the **show isis mpls traffic-eng tunnel** command in EXEC modeXR EXEC mode.

show isis mpls traffic-eng tunnel

This command has no keywords or arguments.

Command Default

None

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 5.1.1	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read

This example shows a sample output from the **show isis mpls traffic-eng tunnel** command:

```
RP/0/RP0RSP0/CPU0:router:hostname#show isis mpls traffic-eng tunnel
IS-IS ring Level-1 MPLS Traffic Engineering tunnels
System Id         Tunnel  Bandwidth  Nexthop         Metric   Mode     IPv4 FA  IPv6 FA
Chkpt ID
rtrA              tt2     500000     192.168.0.1     0        Relative Disabled Disabled
80002e48
```

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	The Bit Position field was added to the sample output.

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/RP0RSP0/CPU0:router:hostname# 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 2: show mpls traffic-eng affinity-map Field Descriptions, on page 219describes the significant fields shown in the display.

Table 2: 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.

Related Commands

Command	Description
affinity, on page 10	Configures an affinity (the properties the tunnel requires in its links) for an MPLS-TE tunnel.
affinity-map, on page 15	Assigns a numerical value to each 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 4.2.0	This command was introduced.
Release 4.3.0	The **xro** keyword was added.
Release 4.3.1	The Forward class field was added to the sample output.

Usage Guidelines

To use this command, first enable the MPLS-TE application.

Task ID

Task ID	Operation
mpls-te	read
ouni	read

Example

The following command shows the attribute set for auto-backup attribute type.

```
RP/0/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# 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 EXEC modeXR EXEC mode.

show mpls traffic-eng autoroute [**name** *tunnel-name*][*IP-address*][**exclude-traffic segment-routing** [*destination_ip_addr*]]

Syntax Description

IP-address	(Optional) Tunnel leading to this address.
name *tunnel-name*	(Optional) Specifies a tunnel by name.
exclude-traffic segment-routing [*destination_ip_addr*]	(Optional) Displays only those tunnels configured to exclude segment routing traffic.

Command Default

None

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.
Release 5.1.1	• Support was added to include **name** *tunnel-name* keyword and argument and to display *signalled-name* in the command output. • Support was added to display MPLS TE IPv6 autoroute announce information for IS-IS IGP.
Release 6.2.2	The **exclude-traffic segment-routing** keywords were added to display only those tunnels configured to exclude segment routing traffic. The command output was modified to display autoroute exclude-traffic segment-routing information.

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/RP0RSP0/CPU0:router:hostname# 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 3: show mpls traffic-eng autoroute Command Field Descriptions

Field	Description
Destination	Multiprotocol Label Switching (MPLS) TE tail-end router ID.
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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname#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)
```

This sample output displays IS-IS autoroute and autoroute exclude-traffic segment-routing information:

```
RP/0/RP0RSP0/CPU0:router:hostname#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)
       Signalled-Name: rtrA_t1
             Exclude-traffic:  segment-routing
```

Related Commands

Command	Description
autoroute metric, on page 35	Specifies the MPLS-TE tunnel metric that the IGP-enhanced SPF calculation uses.
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.
topology holddown sigerr (MPLS-TE), on page 361	Specifies the time that a router should ignore a link in its TE topology database in tunnel path CSPF computations following a TE tunnel signalling error on the link.

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 4.0.0	This command was introduced.
Release 4.3.1	The output of this command was modified to include SRLG weighted information.

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/RP0RSP0/CPU0:router:hostname#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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 4.1.1	This command was introduced.
Release 5.1.2	The **onehop** keyword was added to display onehop enabled mesh groups.

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/RP0RSP0/CPU0:router:hostname 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/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# auto-tunnel mesh
RP/0/RP0RSP0/CPU0:router:hostname(config-te-auto-mesh)# group 65
RP/0/RP0RSP0/CPU0:router:hostname(config-te-mesh-group)# disable
RP/0/RP0RSP0/CPU0:router:hostname(config-te-mesh-group)# destination-list dl-65
RP/0/RP0RSP0/CPU0:router:hostname(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 this n router, this mesh group create tunnels with all routers in the network.

This sample output displays information about one-hop tunnels:

```
RP/0/RP0RSP0/CPU0:router:hostname#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 collaborator-timers

To display the current status of the MPLS-TE collaborator timers, use the **show mpls traffic-eng collaborator-timers** command in EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.9.0	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/RP0RSP0/CPU0:router:hostname# 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 4: 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 bandwidth-accounting

To display bandwidth accounting statistics, use the **show mpls traffic-eng counters bandwidth-accounting** command in EXEC modeXR EXEC mode.

show mpls traffic-eng counters bandwidth-accounting

Syntax Description

This command has no arguments or keywords.

Command Default

No default behavior or values

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 6.2.2	This command was introduced.

Usage Guidelines

Counters are global and for all interfaces combined.

Task ID

Task ID	Operations
mpls-te	read

The following sample output shows the bandwidth accounting statistics:

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng counters bandwidth-accounting
Bandwidth Accounting Statistics:
  Total number of bandwidth samples collected    : 388
  Total number of bandwidth applications         : 128
  Total number of invalid bandwidth samples      : 0
  Total number of skipped bandwidth applications : 0
```

show mpls traffic-eng counters signaling

To display tunnel signaling statistics, use the **show mpls traffic-eng counters signaling** command in EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.
Release 4.2.0	The **soft-preemption** keyword was added.
Release 5.1.1	Support was added to include **signame** keyword and to display *signalled-name* in the command output.

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/RP0RSP0/CPU0:router:hostname# 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

  Tunnel Head: tunnel-mte200
  Cumulative Tunnel Counters:
    Signalling Events      Recv     Xmit                          Recv     Xmit
       PathCreate             2        2      ResvCreate             2        0
       PathChange             0        0      ResvChange             0        0
```

```
    PathError              0        0      ResvError              0        0
    PathTear               0       20      ResvTear               0        0
    BackupAssign           0        2      BackupError            0        0
    PathQuery              0        0      Unknown                0        0

  Destination 100.0.0.4
  Cumulative counters
    Signalling Events      Recv     Xmit                          Recv     Xmit
       PathCreate             2        2      ResvCreate             2        0
       PathChange             0        0      ResvChange             0        0
       PathError              0        0      ResvError              0        0
       PathTear               0       20      ResvTear               0        0
       BackupAssign           0        2      BackupError            0        0
       PathQuery              0        0      Unknown                0        0
    S2L LSP ID: 10021 Sub-Grp ID: 1 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

Tunnel Mid/Tail: router Source: 100.0.0.1 P2MP ID: 1677721603 Tunnel ID: 1 LSP ID: 21
Cumulative LSP Counters:
  Signalling Events      Recv     Xmit                          Recv     Xmit
     PathCreate             2        1      ResvCreate             2        1
     PathChange             0        0      ResvChange             0        0
     PathError              0        0      ResvError              0        0
     PathTear               0        0      ResvTear               0        0
     BackupAssign           0        0      BackupError            0        0
     PathQuery              0        0      Unknown                0        0
  S2L LSP ID: 21 Sub-Grp ID: 0 Destination: 100.0.0.3
    Signalling Events      Recv     Xmit                          Recv     Xmit
       PathCreate             2        1      ResvCreate             2        1
       PathChange             0        0      ResvChange             0        0
       PathError              0        0      ResvError              0        0
       PathTear               0        0      ResvTear               0        0
       BackupAssign           0        0      BackupError            0        0
       PathQuery              0        0      Unknown                0        0

Tunnel Mid/Tail: router Source: 100.0.0.1 P2MP ID: 1677721603 Tunnel ID: 2 LSP ID: 21
Cumulative LSP Counters:
  Signalling Events      Recv     Xmit                          Recv     Xmit
     PathCreate             2        1      ResvCreate             2        1
     PathChange             0        0      ResvChange             0        0
     PathError              0        0      ResvError              0        0
     PathTear               0        0      ResvTear               0        0
     BackupAssign           0        0      BackupError            0        0
     PathQuery              0        0      Unknown                0        0
  S2L LSP ID: 21 Sub-Grp ID: 0 Destination: 100.0.0.3
    Signalling Events      Recv     Xmit                          Recv     Xmit
       PathCreate             2        1      ResvCreate             2        1
       PathChange             0        0      ResvChange             0        0
       PathError              0        0      ResvError              0        0
       PathTear               0        0      ResvTear               0        0
       BackupAssign           0        0      BackupError            0        0
       PathQuery              0        0      Unknown                0        0

Tunnel Mid/Tail: router-1_t3 Source: 100.0.0.1 P2MP ID: 1677721603 Tunnel ID: 3 LSP ID:
18
Cumulative LSP Counters:
  Signalling Events      Recv     Xmit                          Recv     Xmit
     PathCreate             2        1      ResvCreate             2        1
```

```
      PathChange              0         0      ResvChange              0         0
      PathError               0         0      ResvError               0         0
      PathTear                0         0      ResvTear                0         0
      BackupAssign            0         0      BackupError             0         0
      PathQuery               0         0      Unknown                 0         0
   S2L LSP ID: 18 Sub-Grp ID: 0 Destination: 100.0.0.3
     Signalling Events      Recv     Xmit                          Recv     Xmit
        PathCreate             2        1      ResvCreate              2        1
        PathChange             0        0      ResvChange              0        0
        PathError              0        0      ResvError               0        0
        PathTear               0        0      ResvTear                0        0
        BackupAssign           0        0      BackupError             0        0
        PathQuery              0        0      Unknown                 0        0

 Tunnel Mid/Tail: router-3_t33 Source: 100.0.0.3 P2MP ID: 1677721605 Tunnel ID: 33 LSP ID:
2
 Cumulative LSP Counters:
   Signalling Events      Recv     Xmit                          Recv     Xmit
      PathCreate             2        1      ResvCreate              2        1
      PathChange             0        0      ResvChange              0        0
      PathError              0        0      ResvError               0        0
      PathTear               0        0      ResvTear                0        0
      BackupAssign           0        0      BackupError             0        0
      PathQuery              0        0      Unknown                 0        0
   S2L LSP ID: 2 Sub-Grp ID: 0 Destination: 100.0.0.5
     Signalling Events      Recv     Xmit                          Recv     Xmit
        PathCreate             2        1      ResvCreate              2        1
        PathChange             0        0      ResvChange              0        0
        PathError              0        0      ResvError               0        0
        PathTear               0        0      ResvTear                0        0
        BackupAssign           0        0      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/RP0RSP0/CPU0:router:hostname# 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 5: 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/RP0RSP0/CPU0:router:hostnameshow 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/RP0RSP0/CPU0:router:hostname#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
```

Related Commands

Command	Description
clear mpls traffic-eng counters signaling, on page 61	Clears the counters for MPLS-TE tunnels.
clear mpls traffic-eng fast-reroute log, on page 64	Clears the counters for MPLS-TE tunnels.
soft-preemption	Enables soft-preemption on a head-end for the MPLS TE tunnel.

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

Note 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/RP0RSP0/CPU0:router:hostname# 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 6: 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 forwarding

To display forwarding information on tunnels that were admitted locally, use the **show mpls traffic-eng forwarding** command in EXEC modeXR EXEC mode.

show mpls traffic-eng forwarding [**backup-name** *tunnel-name*] [**signalled-name** *tunnel-name*] [**source** *source-address*][**tunnel-id** *tunnel-id*] [**interface** {**in** | **inout** | **out**} *type interface-path-id*] {**p2p**} [**detail**]

Syntax Description

backup-name *tunnel-name*	(Optional) Restricts tunnels with this backup tunnel name.
signalled-name *tunnel-name*	(Optional) Restricts tunnels with this signalled 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 EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.9.0	The following keywords and arguments were added: • **backup-name** keyword and *tunnel-name* argument. • **signalled-name** keyword and *tunnel-name* argument. • **source** keyword and *source-address* argument. • **tunnel-id** keyword and *tunnel-id* argument. • **in** keyword. • **inout** keyword. • **out** keyword.

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/RP0RSP0/CPU0:router:hostname# 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
---------------------- ------------ ------------ -------- -------- -------------
2.2.2.2 2_2            Gi0/0/0/3    Gi0/0/0/4    16004    16020    unknown
6.6.6.6 1_23           -            Gi0/0/0/3    16000    3        tt1300
6.6.6.6 1100_9         -            Gi0/0/0/3    16002    16001    unknown
6.6.6.6 1200_9         -            Gi0/0/0/3    16001    16000    unknown
6.6.6.6 1300_2         -            Gi0/0/0/4    16005    16021    unknown
6.6.6.6 1400_9         -            Gi0/0/0/3    16003    16002    unknown
```

This table describes the significant fields shown in the display.

Table 7: 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.
Release 5.1.1	Support was added to display information on IPv6 autoroute forwarding adjacency information for IS-IS IGP.

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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng forwarding-adjacency

destination 3.3.3.3 has 1 tunnels
tunnel-te1    (traffic share 0, next-hop 3.3.3.3)
(Adjacency Announced: yes, holdtime 0)
```

This sample output displays information on IPv6 autoroute forwarding adjacency information for IS-IS IGP:

```
RP/0/RP0RSP0/CPU0:router:hostname#show mpls traffic-eng forwarding-adjacency
```

```
destination 3.3.3.3 has 1 tunnels

             tunnel-te10     (traffic share 0, next-hop 3.3.3.3)
                             (Adjacency Announced: yes, holdtime 0)
                             (IS-IS 100, IPv4 unicast)
                             (IS-IS 100, IPv6 unicast)
```

Related Commands

Command	Description
forwarding-adjacency, on page 94	Configures an MPLS-TE forwarding adjacency.

show mpls traffic-eng igp-areas

To display MPLS-TE internal area storage, use the **show mpls traffic-eng igp-areas** command in EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	The **detail** keyword was added.

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/RP0RSP0/CPU0:router:hostname# 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 8: 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# 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         -          PO0/2/0/1  7/7 Resv Admitted 100          RB0
  10.10.10.10 15_2         -          PO0/2/0/2  7/7 Resv Admitted 0            B0
```

This table describes the significant fields shown in the display.

Table 9: 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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng link-management interface pos
0/2/0/1

    System Information::
        Links Count         : 1

    Link ID:: POS0/2/0/1 (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 10: 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[1], TDM[2], FSC[3].
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.

Field	Description
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.

1 PSC = Packet switch capable.
2 TDM = Time-division multiplexing.
3 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.9.0	Sample output was modified to display the Attribute Names field.
Release 6.2.2	The command output was modified to display flooding triggers information.

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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng link-management advertisements

  Flooding Status             : Ready
  Last Flooding               : 103 seconds ago
```

```
  Last Flooding Trigger       : Max Reservable BW down|up threshold crossed
  Next Periodic Flooding In   : 76 seconds
  Diff-Serv TE Mode           : Not enabled
  Configured Areas            : 1

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 11: 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.
SRLGs[4]	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.

[4] 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng link bandwidth-allocation interface
 POS 0/2/0/1

System Information::
        Links Count         : 4
        Bandwidth Hold time : 15 seconds

    Link ID:: POS0/2/0/1 (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 12: 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[5] • TDM[6] • FSC[7]
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.

[5] PSC = Packet switch capable.
[6] TDM = Time-division multiplexing.
[7] FSC = Fiber switch capable.

show mpls traffic-eng link-management bfd-neighbors

To display TE-enabled Bidirectional Forwarding Detection (BFD) neighbors, use the **show mpls traffic-eng link-management bfd-neighbors** command in EXEC modeXR EXEC mode.

show mpls traffic-eng link-management bfd-neighbors [**interface** *type* *interface-path-id*]

Syntax Description

interface	(Optional) Displays information about the 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 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

EXECXR EXEC

Command History

Release	Modification
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.

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 bfd-neighbors** command:

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng link-management bfd-neighbors

  Link ID:: POS0/6/0/0
  BFD Neighbor Address: 7.3.3.1, State: Up
  Link ID:: POS0/6/0/1
  No BFD Neighbor
  Link ID:: POS0/6/0/2
  BFD Neighbor Address: 7.4.4.1, State: Down
```

This table describes the significant fields shown in the display.

Table 13: show mpls traffic-eng link-management bfd Command Field Descriptions

Field	Description
Link ID	Link by which the neighbor is reached.
BFD Neighbor Address	Neighbor address and Up/Down state.

Related Commands

Command	Description
bfd fast-detect (MPLS-TE)	Enables BFD for communication failure detection.
bfd minimum-interval (MPLS-TE)	Sets the BFD interval.
bfd multiplier (MPLS-TE)	Sets the BFD multiplier.

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng link igp-neighbors

    Link ID: POS0/7/0/0
      No Neighbors

    Link ID: POS0/7/0/1
      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 14: 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.9.0	The following modifications are included: • Sample output was modified to add the Attribute Names field. • More than 250 links can be configured under MPLS-TE.
Release 6.2.2	The command output was modified to display bandwidth accounting information.

Usage Guidelines

You cannot configure more than 250 links under MPLS-TE.

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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng link-management interfaces
GigabitEthernet0/1/1/0

  System Information::
      Links Count         : 16 (Maximum Links Supported 800)
  Link ID:: GigabitEthernet0/1/1/0 (10.12.110.1)
    Local Intf ID: 22
    Link Status:
      Link Label Type          : PSC
      Physical BW              : 1000000 kbits/sec
      BCID                     : RDM
      Max Reservable BW        : 743346 kbits/sec (reserved: 40% in, 40% out)
      Flooded Max Reservable BW: 743346 kbits/sec
      BC0 (Res. Global BW)     : 743346 kbits/sec (reserved: 40% in, 40% out)
      BC1 (Res. Sub BW)        : 0 kbits/sec (reserved: 100% in, 100% out)
      MPLS TE Link State       : MPLS TE on, RSVP on, admin-up
      IGP Neighbor Count       : 1
      Max Res BW (RDM)    : 900000 kbits/sec
      BC0 (RDM)           : 900000 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: Enabled
      Bandwidth Accounting Collection : RSVP-TE
      Bandwidth Accounting Application: Enabled
      Bandwidth Utilization Details:
        Sampling Interval               : 30 sec
        Application Interval            : 90 sec
        Adjustment Factor               : 200%
        Max Reservable BW Up Threshold  : 10
        Max Reservable BW Down Threshold: 10
        Last Application at:  13:17:52 Wed 22 Feb 2017 (61 seconds ago)
          Total Link BW Utilization           : 156974 kbits/sec
          RSVP-TE BW Utilization              : 78647 kbits/sec
          Non-RSVP-TE BW Utilization          : 78328 kbits/sec
          Applied Non-RSVP-TE BW Utilization  : 156655 kbits/sec
        Next Application at:  13:19:21 Wed 22 Feb 2017 (in 28 seconds)
        Last Collection at :  13:18:50 Wed 22 Feb 2017 (3 seconds ago)
        Next Collection at :  13:19:19 Wed 22 Feb 2017 (in 26 seconds)
      Bandwidth Samples (Kbps):
        Timestamp                         RSVP-TE    Non-RSVP-TE          Total
        13:16:50 Wed 22 Feb 2017            79206          78886         158093
        13:17:20 Wed 22 Feb 2017            79210          78885         158095
        13:17:50 Wed 22 Feb 2017            77521          77208         154730
        13:18:20 Wed 22 Feb 2017            79211          78882         158094
        13:18:50 Wed 22 Feb 2017            79205          78889         158095
      Attributes          : 0x0
      Ext Admin Group     :
          Length : 256 bits
          Value  : 0x::
```

```
Attribute Names     :
Flooding Status: (1 area)
  IGP Area[1]: IS-IS 0 level 2, flooded
    Nbr: ID 0000.0000.0002.00, IP 10.12.110.2 (Up)
    Admin weight: not set (TE), 10 (IGP)
Lockout Status: Never
```

This table describes the significant fields shown in the display.

Table 15: 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.
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.
IGP Neighbor Count	IGP[8] 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.

[8] 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# 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 16: show mpls traffic-eng link-management statistics summary Command Field Descriptions, on page 267 describes the significant fields shown in the display.

Table 16: 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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No more than 250 links can be configured under MPLS-TE.
Release 6.2.2	The command output was modified to display bandwidth accounting information.

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/RP0RSP0/CPU0:router:hostname# 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

Bandwidth accounting:
    Sampling interval   : 30 seconds, Next in 19 seconds
    Application interval: 180 seconds, Next in 81 seconds
```

This table describes the significant fields shown in the display.

Table 17: 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[9] 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.

[9] 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 EXEC modeXR EXEC mode.

show mpls traffic-eng maximum tunnels

Syntax Description

This command has no keywords or arguments.

Command Default

None

Command Modes

No specific guidelines impact the use of this command.

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.9.0	Point-to-Multipoint (P2MP) tunnels are not supported.
Release 4.0.0	Sample output was modified to support the maximum number of allowed automatic backup tunnels.
Release 4.1.1	Sample output was modified to support the maximum number of allowed automatic mesh tunnels.

Usage Guidelines

The maximum value for the tunnel heads is 4096. P2MP tunnels are not supported.

Task ID

Task ID	Operations
mpls-te	read

Examples

This is sample output from the **show mpls traffic-eng maximum tunnels** command:

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng maximum tunnels

Maximum Global Tunnel Count:
```

```
Maximum              Current Count
--------------     ---------------------
  4096            2


Maximum P2MP Tunnel Count:

Maximum     Current Count
-------     -------------
    0            0

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/RP0RSP0/CPU0:router:hostname# 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 P2MP Tunnel Count:

Maximum     Current Count
-------     -------------
  500            1

Maximum Global Destination Count:

Maximum     Current Count
-------     -------------
 4096           13
```

```
Maximum GMPLS-UNI Tunnel Count:

Maximum     Current Count
-------     -------------
 500          39
```

Table 18: show mpls traffic-eng maximum tunnels Command Field Descriptions, on page 272 describes the significant fields shown in the display.

Table 18: show mpls traffic-eng maximum tunnels Command Field Descriptions

Field	Description
Maximum Global Tunnel Count	Maximum number of tunnel interfaces (all TE tunnel types and tunnel-te) that can be configured.
Maximum P2MP Tunnel Count	Maximum number of P2MP tunnels 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.
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.

Related Commands

Command	Description
tunnel-id (auto-tunnel backup), on page 363	Configures the range of tunnel interface numbers used for automatic backup tunnels.

show mpls traffic-eng pce lsp-database

To display information about all LSPs and their attributes, use the **show mpls traffic-eng pce lsp-database** command in EXEC modeXR EXEC mode.

show mpls traffic-eng pce lsp-database [{**brief** | **delegated** | **instantiated** | **session-internal-lsp-id** | **standby** | **static** | **symbolic-name**}]

Syntax Description

brief	(Optional) Uses brief output format.
delegated	(Optional) Displays requesting delegation tunnels.
instantiated	(Optional) Displays PCE instantiated tunnels.
session-internal-lsp-id	(Optional) Displays tunnels with session internal lsp id.
standby	(Optional) Displays standby node specific information.
static	(Optional) Displays configured tunnels.
symbolic-name	(Optional) Displays tunnels with symbolic names.

Command Default

No default behavior or values

Command Modes

EXEC modeXR EXEC mode

Command History

Release	Modification
Release 5.3.0	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read

Example

The following shows a sample output for the **show mpls traffic-eng pce lsp-database** command:

```
RP/0/0/CPU0:ios#show mpls traffic-eng pce lsp-database
Symbolic name: pcc_t0
Session internal LSP ID: 1
Stateful Request Parameters ID: 0
Path Setup Type: 0 - (RSVP)
Request queue size: 0
Create: FALSE
Created by: Not set
Delegatable: TRUE
Delegation status: Delegated
Delegated to: Speaker-entity-id: pce1 ip: 192.168.0.2
```

```
Destination: 192.168.0.2 Source: 192.168.0.1
LSP Object:
Administrative: Up
Operational state: Up
Identifiers:
Sender Address: 192.168.0.1
TE LSP ID: 4
Tunnel ID: 0
Extended tunnel ID: 0x200a8c0
LSP Path Object:
Explicit Route Object:
Cost: 0
1. ipv4: 10.10.10.2/32 (strict)
2. ipv4: 192.168.0.2/32 (strict)
LSP Attributes:
Exclude any: 0
Include any: 0
Include all: 0
Setup priority: 7
Hold priority: 7
Local Protection Bit: FALSE
Reported Route Object: Not set
Bandwidth: 0 Bps (0 kbps)
Metric: Not set
Vendor Specific Information:
Forward-Class: Not set
Load Share: Not set
Backup path: Not set
```

show mpls traffic-eng pce peer

To display the status of the path computation element (PCE) peer address and state, use the **show mpls traffic-eng pce peer** command in EXEC modeXR EXEC mode.

show mpls traffic-eng pce peer [{ *address* | **all** }] { **all** | **ipv4** *address* | **node-id** *node-id* | **stateless** | **stateful** }

Syntax Description

address	(Optional) IPv4 peer address for the PCE.
all	(Optional) Displays all the peers for the PCE.
ipv4 *address*	Displays PCE peer address.
node-id *node-id*	Specifies PCE peer node identifier.
stateless	Displays stateless PCE peers.
stateful	Displays Show stateful PCE peers.

Command Default

No default behavior or values

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.9.0	No modification.
Release 5.1.1	The stateful keyword was added. Command output was updated to display stateful PCE information.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following sample output shows the status of both the PCE peer and state:

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng pce peer

  PCE Address 202.202.88.8
  State Up
    PCEP has been up for: 04:18:31
  Learned through:
    OSPF 1
```

```
Sending KA every 30 s
Time out peer if no KA received for 120 s
Tolerance: Minimum KA 10 s
KA messages rxed 518 txed 517
PCEReq messages rxed 0, txed 0
PCERep messages rxed 0, txed 0
PCEErr messages rxed 0, txed 0
  Last error received:  None
  Last error sent:  None
PCE OPEN messages: rxed 1, txed 2
PCEP session ID: local 0, remote 0

Average reply time from peer: 0 ms
Minimum reply time from peer: 0 ms
Maximum reply time from peer: 0 ms
0 requests timed out with this peer
Transmit TCP buffer: Current 0, Maximum 12
Receive  TCP buffer: Current 0, Maximum 12
```

This table describes the significant fields shown in the display.

Table 19: show mpls traffic-eng pce peer Field Descriptions

Field	Description
KA	PCEP keepalive.
Learned through	Learned through is how the peer was learned which is either through a static configuration or an IGP.
Average reply time from peer	Average reply time for the peer to respond to PCEReq request messages with PCERep response messages.
Minimum reply time from peer	Minimum reply time for the peer to respond to PCEReq request messages with PCERep response messages.
Maximum reply time from peer	Maximum reply for the peer to respond to PCEReq request messages with PCERep response messages.
Transmit TCP buffer Receive TCP Buffer	Number of messages that are in the TCP buffer with the peer waiting to be sent or processed locally.
0 requests timed out with this peer	Number of PCEReq messages that timed out waiting for a response from this peer.

Command output with stateful information:

```
RP/0/RP0RSP0/CPU0:router:hostname#show mpls traffic-eng pce peer all

PCE Address 2.2.2.2
Node-ID: aaa
State Up
  PCEP has been up for: 00:03:52
Learned through:
  Static Config
Sending KA every 30 s
Time out peer if no KA received for 120 s
LSP cleanup timer: 60 s
Tolerance: Minimum KA 10 s
```

```
Stateful
  Update capability

KA messages rxed 8 txed 8
PCEReq messages rxed 0, txed 0
PCERep messages rxed 0, txed 0
PCEErr messages rxed 0, txed 0
  Last error received:  None
  Last error sent:  None
PCE OPEN messages: rxed 1, txed 1
PCERpt messages rxed 0, txed 0
PCEUpd messages rxed 0, txed 0
PCECrt messages rxed 0, txed 0
PCEP session ID: local 0, remote 0

Average reply time from peer: 0 ms
Minimum reply time from peer: 0 ms
Maximum reply time from peer: 0 ms
0 requests timed out with this peer
Transmit TCP buffer: Current 0, Maximum 20 Receive  TCP buffer: Current 0, Maximum 20
```

Related Commands

Command	Description
clear mpls traffic-eng pce, on page 67	Clears the PCE statistics.
pce address (MPLS-TE), on page 175	Configures the IPv4 self address for a PCE.
pce peer (MPLS-TE), on page 181	Configures an IPv4 self address for a PCE peer.

show mpls traffic-eng pce tunnels

To display the status of the path computation element (PCE) tunnels, use the **show mpls traffic-eng pce tunnels** command in EXEC modeXR EXEC mode.

show mpls traffic-eng pce tunnels [*tunnel-id*]

Syntax Description

tunnel-id	(Optional) Tunnel identifier. The range is 0 to 4294967295.

Command Default

No default behavior or values

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Task ID

Task ID	Operations
mpls-te	read

Examples

The following sample output shows the status of the PCE tunnels:

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng pce tunnels

  Tunnel : tunnel-te10
      Destination : 205.205.10.10
      State : down, PCE failed to find path

  Tunnel : tunnel-te30
      Destination : 3.3.3.3
      State : up
      Current path option: 10, path obtained from dynamically learned PCE 1.2.3.4
      Admin weight : 15
      Hop Count : 3
```

This table describes the significant fields shown in the display.

Table 20: show mpls traffic-eng pce tunnels Command Field Descriptions

Field	Description
Tunnel	Tunnel number for the MPLS-TE tunnel interface.

Field	Description
Destination	IP address of the destination of the tunnel.
State	State of the tunnel. Values are up, down, or admin-down.
Admin weight	Administrative weight (cost) of the link.

Related Commands

Command	Description
pce address (MPLS-TE), on page 175	Configures the IPv4 self address for a PCE.

show mpls traffic-eng preemption log

To display the log of preemption events, use the **show mpls traffic-eng preemption log** command in EXEC modeXR EXEC mode.

show mpls traffic-eng preemption log

Syntax Description

log	Displays a log of preemption events.

Command Default

None

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 4.2.0	This command was introduced.
Release 5.1.2	The command output was modified to display the log of soft-preemption over FRR backup tunnels events.

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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname#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 EXEC modeXR 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

EXEC modeXR 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 21: 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 EXEC modeXR EXEC mode.

show mpls traffic-eng topology [*IP-address*] [**affinity**] [**brief**] [**link-only**] [{ **bandwidth** *number* | **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.
bandwidth *number*	(Optional) Displays the bandwidth value that is required by this label switched path (LSP).
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.
link-only	(Optional) Displays the MPLS-TE topology that is filtered by the given neighbor address.
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

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.

Release	Modification
Release 3.9.0	These enhancements are listed: • The **tunnel** keyword and *P2P tunnel-number* argument were added. • The **destination** keyword and *IP-address* argument were added. • The **link-only** keyword was added. • The **affinity** keyword was modified. • Sample output was modified to display the Attribute Names field.
Release 4.0.0	These enhancements are listed: • The **exclude-srlg** keyword and *exclude-srlg-interface-address* argument were added. • **explicit-path** keyword and *explicit-path-id-number* argument were added. • Sample output was added to support the additional keywords and arguments. • Sample output was added to show the SRLG interfaces.
Release 4.3.1	• The output of this command was updated to exclude static SRLG values. • The output of this command was updated to display statically configured SRLG when **srlg static** keyword is used.
Release 5.1.1	Support was added to include **signame** keyword and to display *signalled-name* in the command output.

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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng topology

  Link[1]:Point-to-Point, Nbr IGP Id:192.168.0.1, Nbr Node Id:9, gen:23
        Frag Id:25, Intf Address:13.9.1.1, Intf Id:0
        Nbr Intf Address:13.9.1.3, 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:12.9.0.2, Nbr Node Id:1, gen:23
        Frag Id:28, Intf Address:12.9.0.1, 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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng topology

  My_System_id: 0000.0000.0002.00 (isis   level-2)
  My_System_id: 20.20.20.20 (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: 20.20.20.20 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:7.3.3.1, Intf Id:0
         Nbr Intf Address:7.3.3.2, Nbr Intf Id:0
        TE Metric:10, IGP Metric:10, Attribute Flags:0x0
        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/RP0RSP0/CPU0:router:hostname# 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:7.2.2.1, Intf Id:0
         Nbr Intf Address:7.2.2.2, Nbr Intf Id:0

        TE Metric:10, IGP Metric:10, Attribute Flags:0x0
        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:7.1.1.1, Intf Id:0
         Nbr Intf Address:7.1.1.2, Nbr Intf Id:0
```

```
        TE Metric:10, IGP Metric:10, Attribute Flags:0x0
        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/RP0RSP0/CPU0:router:hostname# 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

        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/RP0RSP0/CPU0:router:hostname# 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: 11.11.1.1 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: 12.9.1.1, Nbr Intf Address: 12.9.1.2
        Attribute Flags: 0x0
        Attribute Names:
    Link[1]:      Intf Address: 13.9.1.1, Nbr Intf Address: 13.9.1.3
        Attribute Flags: 0x0
        Attribute Names:
    Link[2]:      Intf Address: 12.9.0.1, DR: 12.9.0.2
        Attribute Flags: 0x4
        Attribute Names: red2
    Link[3]:      Intf Address: 14.9.0.1, DR: 14.9.0.4
        Attribute Flags: 0x0
        Attribute Names:
```

```
    Link[4]:      Intf Address: 13.9.0.1, DR: 13.9.0.3
        Attribute Flags: 0x0
        Attribute Names:

  IGP Id: 4.4.4.4, MPLS TE Id: 4.4.4.4 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: 14.9.0.4, DR: 14.9.0.4
        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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng topology 12.9.1.1 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:12.9.1.2, Intf Id:0
      Nbr Intf Address:12.9.1.1, 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:12.9.1.2, Intf Id:0
      Nbr Intf Address:12.9.1.1, 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/RP0RSP0/CPU0:router:hostname# 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:7.2.2.1, Nbr Intf Address:7.2.2.2
    Link[1]:      Intf Address:7.1.1.1, Nbr Intf Address:7.1.1.2

  IGP Id: 0000.0000.0002.00, MPLS-TE Id: 20.20.20.20 Router Node  (isis 1 level-2)
    Link[0]:      Intf Address:7.2.2.2, Nbr Intf Address:7.2.2.1
    Link[1]:      Intf Address:7.1.1.2, Nbr Intf Address:7.1.1.1
    Link[2]:      Intf Address:7.3.3.1, Nbr Intf Address:7.3.3.2

  IGP Id: 0000.0000.0003.00, MPLS-TE Id: 30.30.30.30 Router Node  (isis 1 level-2)
    Link[0]:      Intf Address:7.3.3.2, Nbr Intf Address:7.3.3.1
```

The following shows a sample output from the **show mpls traffic-eng topology** command specifying the topology for the SRLG interfaces:

```
RP/0/RP0RSP0/CPU0:router:hostname# 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      51.1.2.1        100.0.0.1       IS-IS 1 level-2
         2      51.1.2.1        100.0.0.1       IS-IS 1 level-2
         3      51.1.2.1        100.0.0.1       IS-IS 1 level-2
         4      51.1.2.1        100.0.0.1       IS-IS 1 level-2
         5      51.1.2.1        100.0.0.1       IS-IS 1 level-2
         6      51.1.2.1        100.0.0.1       IS-IS 1 level-2
         7      51.1.2.1        100.0.0.1       IS-IS 1 level-2
         8      51.1.2.1        100.0.0.1       IS-IS 1 level-2
        10      50.4.5.5        100.0.0.5       IS-IS 1 level-2
        30      50.4.5.5        100.0.0.5       IS-IS 1 level-2
        77      50.4.5.5        100.0.0.5       IS-IS 1 level-2
        88      50.4.5.5        100.0.0.5       IS-IS 1 level-2
      1500      50.4.5.5        100.0.0.5       IS-IS 1 level-2
  10000000      50.4.5.5        100.0.0.5       IS-IS 1 level-2
4294967290      50.4.5.5        100.0.0.5       IS-IS 1 level-2
4294967295      50.4.5.5        100.0.0.5       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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng topology path destination 100.0.0.2
 exclude-srlg 50.4.5.5 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 : 50.4.5.5
SRLGs Excluded: 10, 30, 77, 88, 1500, 10000000
                4294967290, 4294967295
Hop0:50.5.1.5
Hop1:50.5.1.1
Hop2:51.1.2.1
Hop3:51.1.2.2
Hop4:100.0.0.2
```

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/RP0RSP0/CPU0:router:hostname# 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
Hop0:50.5.1.5
Hop1:50.5.1.1
Hop2:50.1.2.1
Hop3:50.1.2.2
Hop4:100.0.0.2
```

This table describes the significant fields shown in the display.

Table 22: show mpls traffic-eng topology Field Descriptions

Field	Description
My_System_id	IGP[10] system or IGP router ID.
Signalling error holddown	Link hold-down timer configured to handle path error events to exclude link from topology.
IGP Id	Identification of the advertising router.
Link	MPLS-TE link.
Frag Id	GP LSA[11] fragment identifier.
Nbr Intf Address	Neighbor Interface address of this link.
TE Metric	TE cost of link.

Field	Description
Switching Capability	Switching capability: packet, optical, lambda.
Physical BW	Physical line rate.
BC Model ID	Bandwidth constraint model ID (RDM or MAM).
Max Reservable BW	Maximum bandwidth (in kilobits per second) that you can reserve on a link.
Max Reservable BW Global	Maximum bandwidth (in kilobits per second) that you can reserve on a link in global-pool (prestandard and RDM).
Max Reservable BW Sub	Maximum bandwidth (in kilobits per second) that you can reserve on a link in subpool (prestandard and RDM).
BC0	Maximum bandwidth (in kilobits per second) that you can reserve on a link in BC0.
BC1	Maximum bandwidth (in kilobits per second) that you can reserve on a link in BC1.
TE-class[index]	Available bandwidth in TE-class (map of class-type and priority) at given index.
Total Allocated BW	Bandwidth (in Kbps) allocated at that priority.
Global Pool Reservable BW	Available bandwidth (in kbps) reservable at that priority in global pool (prestandard RDM).
Sub Pool Reservable BW	Available bandwidth (in kbps) reservable at that priority in sub-pool (prestandard RDM).
Attribute Names	Brief topology and the associated affinity attributes. The names of the affinity attribute of the link are displayed.

[10] IGP = Interior Gateway Protocol.
[11] LSA = link-state advertisement.

Related Commands

Command	Description
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.
interface (SRLG), on page 103	Enables SRLG on an interface and enters SRLG interface configuration mode.
srlg, on page 354	Configures an MPLS traffic enginnering SRLG values for a link on an interface.
show srlg, on page 342	Displays the SRLG interface and configuration information.

show mpls traffic-eng tunnels

To display information about MPLS-TE tunnels, use the **show mpls traffic-eng tunnels** command in EXEC modeXR EXEC mode .

show mpls traffic-eng tunnels [*tunnel-number*] [**affinity**] [**all**] [**auto-bw**] [**attribute-set** { **auto-backup** | **auto-mesh** } { **all** *tunnel-name* }] [**auto-tunnel**] [**backup** [{ *tunnel-number* | **auto-tunnel [mesh]** *mesh-value* | [**name** *tunnel-name*] | **promotion-timer** *promotion-timer* | **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** }] [**unused**]] [**reoptimized within-last** *interval*] [**role** { **all** | **head** | **tail** | **middle** }] [**soft-preemption** { **desired** | **triggered}** }] [**source** *source-address*] [**suboptimal constraints** { **current** | **max** | **none** }] [**summary**] [**tabular**] [**unused**] [**up**] [**class-type** *ct*] [**igp** { **isis** | **ospf** }] [**within-last** *interval*]

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.
auto-backup	Restricts the display of specific or all tunnels that are using auto-backup type of attribute-set.
auto-mesh	Restricts the display of specific or all tunnels that are using auto-mesh type of 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[12] backup tunnels information. The information includes the physical interface protected by the tunnel, the number of TE LSPs[13] 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.

promotion-timer *promotion-timer*	(Optional) Displays the configured FRR backup tunnel promotion timer value, in seconds.
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.
unused	(Optional) Displays only unused backup tunnels.
up	(Optional) Displays tunnels when the tunnel interface is up.
class-type *ct*	(Optional) Displays tunnels using the given class-type value configuration.
igp *isis*	(Optional) Displays tunnels with the path calculated as the IS-IS type for IGP.
igp *ospf*	(Optional) Displays tunnels with the path calculated as the OSPF type for IGP.
within-last *interval*	(Optional) Displays tunnels that has come up within the last given time interval.
auto-tunnel pcc	Displays stateful PCE client (PCC) auto-tunnel information.

[12] FRR = Fast Reroute.
[13] LSPs = Label Switched Paths.

Command Default

None

Command Modes

EXECXR EXEC

Command History

Release	Modification
Release 3.0	No modification.
Release 3.4.0	No modification.
Release 3.6.0	No modification.
Release 3.7.2	This command was introduced.

Release	Modification
Release 3.9.0	To support the path-protection feature, the following items were added: • The **frr** keyword was added. • The **path** keyword was added. • The **tabular** keyword was added. • The **tunnel-id** keyword and *tunnel-id* argument were added. • Sample output was added to support the **path** keyword. • Sample output was modified to display the path protection fields and standby LSP fields for the path options for the tunnel-te interface with the **detail** keyword. These items were added: • The **affinity** keyword was added. • Sample output was added to support the **affinity** keyword. • The **p2p** keyword was added. • Sample output was added to support the **brief** keyword. • Sample output was added to support the **summary** keyword. • Sample output was added to support the **tabular** keyword.
Release 3.9.1	These items were updated to support the MPLS-TE automatic bandwidth feature: • The **auto-bw** keyword was added. • The sample ouput was modified for the **detail** keyword to display the output after the MPLS-TE automatic bandwidth feature is configured.
Release 4.0.0	These items were added to support the MPLS-TE automatic backup tunnel feature: • The **auto-tunnel** keyword was added. • The **unused** keyword was added.
Release 4.1.1	The **mesh** keyword was added.
Release 4.2.0	The **soft-preemption** and **attribute-set** keywords were added. Sample output was modified to display only tunnels on which the soft-preemption feature is enabled.
Release 4.2.1	The **auto-backup** and **auto-mesh** keywords were added. Sample output was modified to display tunnels that are using auto-backup or auto-mesh type of attribute-set.
Release 4.2.3	Sample output was modified to display P2MP-TE inter-area related configuration details.

Release	Modification
Release 4.3.1	• The Forward class field was added to the output. • The output of this command was updated to include weighted SRLG information when the **auto-backup** keyword is used. • The output of this command was updated to include weighted SRLG information when the **backup protected-interface** keyword is used. • The output of this command was updated to include weighted SRLG information when the **summary** keyword is used.
Release 5.1.1	• The command output was modified to display information on stateful PCE client (PCC) auto-tunnels. • Support was added to include **signame** keyword and to display *signalled-name* in the command output.
Release 5.1.2	These changes were made to support the path-selection cost-limit feature: • The command output was modified to show the configured cost-limit. • The shown PCALC error was modified to show cost-limit failure: applies for new paths and verification of existing paths. • The 'Reopt Reason' field in the show output was modified to show the cost-limit. • The path-protection switchover reason in the show output was modified to show the cost-limit. The command output was modified to display the 'Traffic switched to FRR backup tunnel-te' message as part of Soft-preemption over FRR backup tunnels feature implementation.
Release 6.2.2	The command output was modified to display autoroute exclude-traffic segment-routing information.

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/RP0RSP0/CPU0:router:hostname# 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 exclude-traffic:  segment-routing
    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 (since Sun Mar 14 23:48:23 UTC 2010)
    Current LSP:
      Uptime: 00:05:41 (since Mon Mar 15 00:01:36 UTC 2010)
    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: GigabitEthernet0/5/0/21, 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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels property backup interface
 out pos 0/6/0/0

  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 23: show mpls traffic-eng tunnels Command Field Descriptions

Field	Description
LSP Tunnels Process	Status of the LSP[14] 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[15] promotion.
Periodic auto-bw collection	Time, in seconds, till the next periodic auto-bw collection.
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.

[14] LSP = Link-State Packet.
[15] FRR = Fast Reroute.

This sample output shows the link attributes of links that are traversed by the tunnel (color information):

```
RP/0/RP0RSP0/CPU0:router:hostname# 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: 192.168.0.1
    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/RP0RSP0/CPU0:router:hostname# 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
                 OUNI POS0/1/0/1          100.0.0.1            up  up
                 OUNI POS0/1/0/2          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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# 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: POS0/6/0/0
     LSP signalling info:
      Original: out I/f: POS0/7/0/0, 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 24: 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[16].
Instance	LSP ID.
Backup tunnel	Backup tunnel protection for NHOP/NNHOP.
out if	Backup tunnel's outgoing interface

Field	Description
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 [17].

[16] LSP = Link-State Packet.
[17] 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/RP0RSP0/CPU0:router:hostname# 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: POS0/7/0/0
    Protected lsps: 0
    Backup BW: any-class unlimited, Inuse: 0 kbps
```

This table describes the significant fields shown in the display.

Table 25: 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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels backup protected-interface


  Interface: POS0/5/0/1
      Tunnel100  UNUSED : out I/f:               Admin: down  Oper: down

  Interface: POS0/7/0/0
      Tunnel160    NHOP : out I/f: POS0/6/0/0   Admin:   up  Oper:   up
```

This table describes the significant fields shown in the display.

Table 26: 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.
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 up** command using the **igp ospf** keywords:

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels up igp ospf

  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 **up within-last** keywords:

```
RP/0/RP0RSP0/CPU0:router:hostname# 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/RP0RSP0/CPU0:router:hostname# 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 [2013]
        Removal Trigger: reoptimization completed

    Path info (ospf   area 0):
    Hop0: .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/RP0RSP0/CPU0:router:hostname# 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: POS0/4/0/0, 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: POS0/6/0/0, 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
```

This is a sample output that shows the path-protection options for tunnel-te 100 using the **detail** keyword.

```
RP/0/RP0RSP0/CPU0:router:hostname# 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: POS0/6/0/0, 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: POS0/6/0/0, 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: POS0/6/0/1, 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: POS0/6/0/0, 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/RP0RSP0/CPU0:router:hostname# 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: POS0/2/0/1, 33
  OutLabel: POS0/3/0/0, 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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels tabular

Tunnel                LSP      Destination          Source     Tun     FRR    LSP
Name                   ID         Address         Address   State   State   Role
------------------ ------ --------------- --------------- ------- ------- ------

     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
  OUNI POS0/1/0/1       2       100.0.0.1       200.0.0.1      up   Inact   Head InAct
  OUNI POS0/1/0/2       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/RP0RSP0/CPU0:router:hostname# 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 27: 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.

Field	Description
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/RP0RSP0/CPU0:router:hostname# 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: POS0/6/0/0, Out lbl: implicit-null
      Path: 10.0.0.1, 172.16.0.1, 192.168.0.1, 8.8.8.8
  Standby LSP: None | LSP ID, Up time 12:00:05,
      Local lbl: 16002, Out Interface: POS0/6/0/1, 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/RP0RSP0/CPU0:router:hostname# 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 28: 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/RP0RSP0/CPU0:router:hostname# 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 29: 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.

Field	Description
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.
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/RP0RSP0/CPU0:router:hostname# 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: Gi0/1/0/0     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 30: 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/RP0RSP0/CPU0:router:hostname# 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: Tue Aug 14 23:35:58 2012 (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 Tue Aug 14 23:36:10 EST 2012)
    Current LSP:
      Uptime: 00:00:30 (since Tue Aug 14 23:36:10 EST 2012)
  Current LSP Info:
    Instance: 2, Signaling Area: OSPF 100 area 16909060
    Uptime: 00:00:30 (since Tue Aug 14 23:36:10 EST 2012)
    Outgoing Interface: GigabitEthernet0/2/0/2, Outgoing Label: 16005
    Router-IDs: local      192.168.0.1
                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/RP0RSP0/CPU0:router:hostname# 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 31: 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.

Field	Description
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.
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.

Field	Description
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/RP0RSP0/CPU0:router:hostname# 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]: Thu Oct 13 16:40:24 2011
      Info: Can't reach 10.10.10.2 on 192.168.0.2, from node 192.168.0.1 (bw)
    Last Signalled Error: Thu Oct 13 16:38:53 2011
      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 Oct 13 15:46:45 2011 (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: Thu Oct 13 16:38:53 2011 (00:01:36 ago)
      Addresses of preempting links:
        10.10.10.1: Thu Oct 13 16:38:53 2011 (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 Oct 13 15:47:43 EDT 2011)
    Current LSP:
      Uptime: 00:52:46 (since Thu Oct 13 15:47:43 EDT 2011)
    Reopt. LSP:
      Last Failure:
        LSP not signalled, has no S2Ls
        Date/Time: Thu Oct 13 16:40:24 EDT 2011 [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 Oct 13 15:47:43 EDT 2011)
    Outgoing Interface: GigabitEthernet0/0/0/0, Outgoing Label: 16002
    Router-IDs: local      192.168.0.1
                downstream 192.168.0.2
    Soft Preemption: Pending
      Preemption Link: GigabitEthernet0/0/0/0; Address: 10.10.10.1
      Preempted at: Thu Oct 13 16:38:53 2011 (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/RP0RSP0/CPU0:router:hostname# 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: Thu 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 Thu Jan 14 09:09:58 EST 2010)
    Current LSP:
      Uptime: 01:41:00 (since Thu Jan 14 09:09:51 EST 2010)
    Reopt. LSP:
      Last Failure:
        LSP not signalled, identical to the [CURRENT] LSP
        Date/Time: Thu 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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels summary
Thu 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

P2MP Summary:
    Tunnel Head:         250 total, 250 connected
    Destination Head:    500 total, 500 connected
    S2L Head: 500 established, 0 proceeding
    S2L Mid:  0 established, 0 proceeding
    S2L Tail: 0 established

P2MP Fast ReRoute Summary:
    Tunnel Head: 250 FRR enabled
    S2L Head: 500 FRR, 500 protected, 0 rerouted
    S2L Mid:  0 FRR, 0 protected, 0 rerouted
    Summary:  500 protected, 500 link protected, 0 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 shows an auto-tunnel mesh summary sample output from the **show mpls traffic-eng tunnels** command using the **auto-mesh** keyword:

```
RP/0/RP0RSP0/CPU0:router:hostname#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: Thu 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 Thu Jan 14 09:09:58 EST 2010)
    Current LSP:
      Uptime: 01:41:00 (since Thu Jan 14 09:09:51 EST 2010)
    Reopt. LSP:
      Last Failure:
        LSP not signalled, identical to the [CURRENT] LSP
        Date/Time: Thu 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 example shows the details about the tunnel that is using auto-backup type of attribute-set.

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels attribute-set auto-backup
 ab

Name: tunnel-te3000  Destination: 10.0.0.1 (auto-tunnel backup)
  Status:
    Admin:    up Oper:   up   Path:  valid   Signalling: connected

    path option 20,  type explicit (autob_nhop_te3000) (Basis for Setup, path weight 2)
    path option 10,  type explicit (autob_nhop_srlg_te3000) [disabled]
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 0 kbps  CT0
    Creation Time: Tue Aug 14 23:24:27 2012 (00:05:28 ago)
  Config Parameters:
    Bandwidth:        0 kbps (CT0) Priority:  7  7
    Number of affinity constraints: 2
       Include bit map       : 0x4
       Include name          : blue
       Exclude bit map       : 0x2
       Exclude name          : red
```

```
    Metric Type: TE (default)
    Hop-limit: disabled
    AutoRoute: disabled  LockDown: disabled   Policy class: 1
    Forwarding-Adjacency: disabled
    Loadshare:          0 equal loadshares
    Auto-bw: disabled
    Fast Reroute: Disabled, Protection Desired: None
    Path Protection: Not Enabled
    Soft Preemption: Disabled
  Auto Backup:
    Protected LSPs: 2
    Protected S2L Sharing Families: 0
    Protected S2L: 0
    Protected i/f: PO0/3/0/1
    Attribute-set: ab
    Protection: NHOP
    Unused removal timeout: not running
  History:
    Tunnel has been up for: 00:04:57 (since Tue Aug 14 23:24:58 EST 2012)
    Current LSP:
      Uptime: 00:04:57 (since Tue Aug 14 23:24:58 EST 2012)

  Path info (OSPF 100 area 16909060):
  Node hop count: 2
  Hop0: 23.9.0.2
  Hop1: 12.9.0.2
  Hop2: 12.9.0.1
  Hop3: 10.0.0.1
Displayed 1 (of 7) heads, 0 (of 3) midpoints, 0 (of 0) tails Displayed 1 up, 0 down, 0
recovering, 0 recovered heads
```

This example shows the protected interface for auto-backup auto-tunnels.

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels backup protected-interface


Interface: Gi0/2/0/1 (auto-tunnel backup)
  SRLG: N/A, NHOP-only: No
  Attribute-set: Not configured
  Auto-tunnel backup recreate time remaining:  timer not running
    No backup tunnel found

Interface: Gi0/2/0/3
     tunnel-te340   PROTECTED : out i/f:   PO0/3/0/2   Admin:   up  Oper:   up

Interface: PO0/3/0/1 (auto-tunnel backup)
  SRLG: N/A, NHOP-only: No
  Attribute-set: ab
  Auto-tunnel backup recreate time remaining:  timer not running
    *tunnel-te3000        NHOP : out i/f:   Gi0/2/0/2   Admin:   up  Oper:   up

 * = automatically created backup tunnel
```

This example shows the details about all the tunnels that are using auto-mesh type of attribute-set.

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels attribute-set auto-mesh
all

Name: tunnel-te3501  Destination: 10.0.0.1 (auto-tunnel mesh)
  Status:
    Admin:    up Oper:   up   Path:  valid   Signalling: connected

    path option 10,  type dynamic  (Basis for Setup, path weight 2)
```

```
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 100 kbps  CT0
    Creation Time: Tue Aug 14 23:25:41 2012 (00:06:13 ago)
  Config Parameters:
    Bandwidth:      100 kbps (CT0) Priority:  2  2
    Number of affinity constraints: 2
       Include bit map       : 0x8
       Include name          : yellow
       Exclude bit map       : 0x2
       Exclude name          : red

    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: Node, Bandwidth
    Path Protection: Not Enabled
    Attribute-set: am (type auto-mesh)
    Soft Preemption: Disabled
  Auto-tunnel Mesh:
    Group ID: 1
    Destination list: blah
    Unused removal timeout: not running
  History:
    Tunnel has been up for: 00:06:13 (since Tue Aug 14 23:25:41 EST 2012)
    Current LSP:
      Uptime: 00:06:13 (since Tue Aug 14 23:25:41 EST 2012)

  Path info (OSPF 100 area 16909060):
  Node hop count: 2
  Hop0: 23.9.0.2
  Hop1: 12.9.0.2
  Hop2: 12.9.0.1
  Hop3: 10.0.0.1

Name: tunnel-te3502  Destination: 172.16.0.1 (auto-tunnel mesh)
  Status:
    Admin:    up Oper:   up   Path:  valid   Signalling: connected

    path option 10,  type dynamic  (Basis for Setup, path weight 1)
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 100 kbps  CT0
    Creation Time: Tue Aug 14 23:25:41 2012 (00:06:13 ago)
  Config Parameters:
    Bandwidth:      100 kbps (CT0) Priority:  2  2
    Number of affinity constraints: 2
       Include bit map       : 0x8
       Include name          : yellow
       Exclude bit map       : 0x2
       Exclude name          : red

    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: Node, Bandwidth
    Path Protection: Not Enabled
    Attribute-set: am (type auto-mesh)
    Soft Preemption: Disabled
  Auto-tunnel Mesh:
```

```
    Group ID: 1
    Destination list: blah
    Unused removal timeout: not running
  History:
    Tunnel has been up for: 00:06:13 (since Tue Aug 14 23:25:41 EST 2012)
    Current LSP:
      Uptime: 00:06:13 (since Tue Aug 14 23:25:41 EST 2012)

  Path info (OSPF 100 area 16909060):
  Node hop count: 1
  Hop0: 23.9.0.2
  Hop1: 172.16.0.1

Name: tunnel-te3503  Destination: 4.4.4.4 (auto-tunnel mesh)
  Status:
    Admin:    up Oper: down   Path: not valid   Signalling: Down

    path option 10,  type dynamic
    Last PCALC Error: Tue Aug 14 23:31:26 2012
      Info: No path to destination, 4.4.4.4 (affinity)
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 100 kbps  CT0
    Creation Time: Tue Aug 14 23:25:41 2012 (00:06:13 ago)
  Config Parameters:
    Bandwidth:      100 kbps (CT0) Priority:  2  2
    Number of affinity constraints: 2
       Include bit map       : 0x8
       Include name          : yellow
       Exclude bit map       : 0x2
       Exclude name          : red

    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: Node, Bandwidth
    Path Protection: Not Enabled
    Attribute-set: am (type auto-mesh)
    Soft Preemption: Disabled
  Auto-tunnel Mesh:
    Group ID: 1
    Destination list: blah
    Unused removal timeout: not running
Displayed 3 (of 7) heads, 0 (of 3) midpoints, 0 (of 0) tails Displayed 2 up, 1 down, 0
recovering, 0 recovered heads
```

This example shows the P2MP-TE head end inter-area related configuration details.

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels p2mp detail

Name: tunnel-mte1
   Status:
     Admin: up  Oper: up (Up for 2d22h)

     Config Parameters:
      Bandwidth: 10 kbps (CT0) Priority: 7 7 Affinity: 0x0/0xffff
      Metric Type: TE (default)
      Fast Reroute: Not Enabled, Protection Desired: None
      Record Route: Not Enabled

      Destination summary: (2 up, 0 down, 0 disabled) Affinity: 0x0/0xffff
      Auto-bw: disabled
```

```
       Destination: 192.168.0.5
        State: Up for 03:00:27
        Path options:
          path-option 1 explicit name ABCE1    [active]
          Last Signalled Error: Wed Feb 22 00:12:28 2012
            Info: [10990] PathErr(25,13)-(notify, preferred tree exists) at 11.11.11.3
        Reoptimization Info in Inter-area:
          Better Path Queries sent = 14; Preferred Tree Exists received = 2
          Last Better Path Query was sent 00:00:35 ago
          Last Preferred Tree exists was received 00:08:35 ago from 11.11.11.3
       Destination: 192.168.0.8
        State: Up for 03:00:27
        Path options:
          path-option 1 explicit name ABCE1    [active]
          Last Signalled Error: Wed Feb 22 00:12:28 2012
           Info: [10990] PathErr(25,13)-(notify, preferred loose tree exists) at 11.11.11.3

        Reoptimization Info in Inter-area:
          Better Path Queries sent = 14; Preferred Tree Exists received = 2
          Last Better Path Query was sent 00:00:35 ago
          Last Preferred Tree exists was received 00:08:35 ago from 11.11.11.3

       History:
       Reopt. LSP:
         Last Failure:
           LSP not signalled, identical to the [CURRENT] LSP
           Date/Time: Thu Feb 16 14:53:19 EST 2012 [00:57:25 ago]

       Current LSP:
        lsp-id: 10992 p2mp-id: 1 tun-id: 1 src: 192.168.0.1 extid: 192.168.0.1
        LSP up for: 00:08:35 (since Wed Feb 22 00:12:28 EST 2012)
       Reopt Trigger: Received Preferred Tree Exists Msg, Reopt Reason: inter-area preferred
 tree exists
...
```

This example shows the P2MP-TE midpoint inter-area related configuration details.

```
RP/0/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng tunnels p2mp detail

LSP Tunnel 192.168.0.1 1 [10013] is signalled, connection is up
  Tunnel Name: rtrA_mt1 Tunnel Role: Mid
  InLabel: GigabitEthernet0/0/0/1, 16000
  OutLabel: GigabitEthernet0/0/0/3, 16000
  Signalling Info:
    Src 192.168.0.1 Dst 192.168.0.5, Tun ID 1, Tun Inst 10013, Ext ID 192.168.0.1
    Router-IDs: upstream   192.168.0.2
                local      192.168.0.3
                downstream 192.168.0.5
    Bandwidth: 10 kbps (CT0) Priority:  7  7 DSTE-class: 0
    Soft Preemption: None
    Path Info:
      Incoming Address: 11.11.11.3
      Incoming:
      Explicit Route:
        Strict, 11.11.11.3
        Strict, 192.168.0.3
      ERO Expansion Info:
      OSPF ring area 0, Metric 8(TE), Affinity 0x0, Mask 0xffff, Queries 8
      Last Better Path Query was received 00:00:35 ago
      Last Preferred Tree Exists was send 00:08:35 ago
      Outgoing:
      Explicit Route:
        Strict, 13.13.13.5
        Strict, 192.168.0.5
```

```
      Record Route: Disabled
      Tspec: avg rate=10 kbits, burst=1000 bytes, peak rate=10 kbits
      Session Attributes: Local Prot: Not Set, Node Prot: Not Set, BW Prot: Not Set
                          Soft Preemption Desired: Not Set
      Resv Info: None
      Record Route: Disabled
      Fspec: avg rate=10 kbits, burst=1000 bytes, peak rate=10 kbits
      TE LSP Info:
      Path-in       : Feb 13 19:26:08.950 (start)
      Path-out      : Feb 13 19:26:08.951 (1ms, 1ms)
      Resv-in       : Feb 13 19:26:08.961 (11ms, 10ms)
      Label rewrite : Not set (0ms, 0ms)
      Resv-out      : Feb 13 19:26:08.963 (13ms, 1ms)
  Displayed 0 (of 2) heads, 1 (of 2) midpoints, 0 (of 0) tails
  Displayed 0 up, 0 down, 0 recovering, 0 recovered heads
```

This example includes output for Generalized Multiprotocol Label Switching (GMPLS) User-Network Interface (UNI) configuration for the **show mpls traffic-eng tunnels** command using the **summary** keyword:

```
RP/0/RP0RSP0/CPU0:router:hostname show mpls traffic-eng tunnels auto-tunnel
Thu 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

P2MP Summary:
    Tunnel Head:         250 total, 250 connected
    Destination Head:    500 total, 500 connected
    S2L Head: 500 established, 0 proceeding
    S2L Mid:  0 established, 0 proceeding
    S2L Tail: 0 established

P2MP Fast ReRoute Summary:
    Tunnel Head: 250 FRR enabled
    S2L Head: 500 FRR, 500 protected, 0 rerouted
    S2L Mid:  0 FRR, 0 protected, 0 rerouted
    Summary:  500 protected, 500 link protected, 0 node protected, 0 bw protected

<snip>
GMPLS UNI Summary:
    Heads: 23 up, 4 down
    Tails: 13 up, 2 down
```

This sample output includes stateful PCE client (PCC) auto-tunnel information:

```
RP/0/RP0RSP0/CPU0:router:hostname#show mpls traffic-eng tunnels auto-tunnel pcc
Name: tunnel-te1  Destination: 192.168.0.1
  Status:
    Admin:    up Oper: down   Path: not valid   Signalling: Down

    path option 1,  type dynamic pce
    Last PCALC Error: Tue Feb 19 16:40:43 2013
      Info: PCE not available to compute path
    G-PID: 0x0800 (derived from egress interface properties)
    Bandwidth Requested: 0 kbps  CT0
    Creation Time: Tue Feb 19 16:39:03 2013 (00:01:49 ago)
  Config Parameters:
    Bandwidth:        0 kbps (CT0) Priority:  7  7 Affinity: 0x0/0xffff
    Metric Type: TE (default)
    Hop-limit: disabled
    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
    Soft Preemption: Disabled
Auto-tunnel PCC:
  Symbolic name: <symbolic-name>
  Session internal ID: 1
  Created by: node-id <Node-ID> ip <IPv4>
  Delegated to: none | node-id <Node-ID> ip <IPv4>

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 *Signalled-Name* information:

```
RP/0/RP0RSP0/CPU0:router:hostname#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/RP0RSP0/CPU0:router:hostname#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: Tue Apr 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/RP0RSP0/CPU0:router:hostname#show mpls traffic-eng tunnels detail
.
.
.
Soft Preemption: Pending
      Preemption Link: GigabitEthernet0/0/0/1; Address: 14.14.14.2
      Traffic switched to FRR backup tunnel-te 1000
      Preempted at: Thu Apr 25 12:56:14 2013 (00:00:03 ago)
      Time left before hard preemption: 96 seconds
.
.
.
```

Related Commands

Command	Description
auto-tunnel backup (MPLS-TE)	Builds automatic NHOP and NNHOP backup tunnels.
backup-bw	Specifies the bandwidth type that LSPs can use for a backup tunnel, whether the backup tunnel should provide bandwidth protection, and if yes, how much and in which bandwidth pool.
srlg	Configures an SRLG membership for a link on a given interface.
soft-preemption	Enables soft-preemption on a head-end for the MPLS TE tunnel.

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 3.9.0	No modification.
Release 3.9.1	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/RP0RSP0/CPU0:router:hostname# 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 32: 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.

Field	Description
Last appl BW (kbps)	Last bandwidth applied (for example, requested) by the automatic-bandwidth feature for the tunnel.
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.

Related Commands

Command	Description
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

show mpls traffic-eng tunnels bidirectional-associated

To display information about bidirectional associated LSP for an MPLS-TE tunnel, use the **show mpls traffic-eng tunnels bidirectional-associated** command in the MPLS tunnel-te interface.

show mpls traffic-eng tunnels bidirectional-associated [{ [**affinity**] | [**associated-lsp**] | [{ **association id** *value* | **source-address** *IP address* | **global-id** *value* }] | [**bfd-down**] | [**brief**] | [**class-type**] | [**co-routed**] | [**concise**] | [**destination**] | [**detail**] | [**down**] | [**hold-priority**] | [**interface**] | [**non-associated-lsp**] | [**non-co-routed**] [**path-option**] | [**property**] | [**reoptimized**] | [**role**] | [**setup-priority**] | [**signame**] | [**soft-preemption**] | [**source**] | [**standby**] | [**static**] | [**suboptimal**] | [**sync-pending**] | [**tabular**] | [**up**] }]

Syntax Description

affinity	(Optional) Display 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.
associated-lsp	(Optional) Show tunnels with associated reverse LSPs.
association id *value***source-address** *IP address***global-id** *value*	(Optional) Show tunnels with the specified association information.
bfd-down	(Optional) Show tunnels with BFD session down.
brief	(Optional) Display a brief form of the output of the tunnel status and configuration.
class-type	(Optional) Display tunnels that are signaled in this class type.
co-routed	(Optional) Show co-routed tunnels.
concise	(Optional) Show concise information.
destination	(Optional) Restrict display to tunnels with this destination.
detail	(Optional) Include extra detail of the tunnel status and configuration.
down	(Optional) Restrict display to tunnels in down state.
hold-priority	(Optional) Display tunnels that are signaled using this hold-priority.
interface	(Optional) Restrict display to tunnels using a specified interface.
non-associated-lsp	(Optional) Show tunnels with no associated reverse LSPs.
non-co-routed	(Optional) Show non-co-routed tunnels.
path-option	(Optional) Restrict display to tunnels with specified path-option.
property	(Optional) Restrict display to tunnels with specified property.
reoptimized	(Optional) Restrict display to tunnels that have been re-optimized.

role	(Optional) Restrict display to tunnels with specified role.
setup-priority	(Optional) Tunnels that are signaled using this setup priority.
signame	(Optional) Tabular summary of tunnel status and configuration showing signaled name.
soft-preemption	(Optional) Show tunnels with soft-preemption enabled.
source	(Optional) Restrict display to tunnels with this source.
standby	(Optional) Standby node specific information.
static	(Optional) Show only static (not auto) head-end tunnels.
suboptimal	(Optional) Restrict display to tunnels using a sub-optimal path.
sync-pending	(Optional) Display tunnels that are in sync-pending state.
tabular	(Optional) Display tabular summary of tunnel status and configuration
up	(Optional) Restrict display to tunnels whose status is UP.

Command Default

None

Command Modes

MPLS tunnel-te interface

Command History

Release	Modification
Release 5.2.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read

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 EXEC modeXR 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

EXECXR EXEC

Command History

Release	Modification
Release 4.2.0	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/RP0RSP0/CPU0:router:hostname# show mpls traffic-eng link-management soft-preemption
```

```
interface POS0/1/0/1

Name: POS0/1/0/1; IPv4 Address: 1.2.3.10
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        4.4.4.40        10.0.0.10   2/2        400      BC0  100
    51     11        4.4.4.40        10.0.0.10   2/2        600      BC0  100
    52     12        4.4.4.40        10.0.0.10   3/3        200      BC0   80
    53     11        4.4.4.40        10.0.0.10   3/3        500      BC1   90
    54     12        4.4.4.40        10.0.0.10   4/4        300      BC1   90
```

show policy-map type pbr interface

To display the policy map information about Policy Based Routing (PBR) on the specified interface, use the **show policy-map type pbr interface** command in EXEC modeXR EXEC mode .

show policy-map type pbr [**interface** *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

EXEC modeXR EXEC mode

Command History

Release	Modification
Release 4.3.1	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read

Example

The following example shows a sample output of the **show policy-map type pbr interface** command:

```
show policy-map type pbr interface HundredGigE0/0/0/0


HundredGigE0/0/0/0 input: dscp

Policy Name: dscp

Class ipv4-cs1
  Classification statistics          (packets/bytes) (May be 10secs old)
    Matched             :             301276/306698968
  Transmitted statistics             (packets/bytes) (May be 10secs old)
    Total Transmitted   :             301276/306698968
Class ipv4-cs2
  Classification statistics          (packets/bytes) (May be 10secs old)
    Matched             :             301276/306698968
```

```
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv4-cs3
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv4-cs4
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv4-cs5
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv4-cs6
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301338/306703313
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301338/306703313
Class ipv4-cs7
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv6-cs1
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv6-cs2
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv6-cs3
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv6-cs4
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv6-cs5
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class ipv6-cs6
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301340/306704509
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301340/306704509
Class ipv6-cs7
  Classification statistics           (packets/bytes) (May be 10secs old)
    Matched             :               301276/306698968
  Transmitted statistics              (packets/bytes) (May be 10secs old)
    Total Transmitted   :               301276/306698968
Class class-default
  Classification statistics           (packets/bytes) (May be 10secs old)
```

```
Matched               :                602579/613400290
```

show srlg

To show the SRLG interface and configuration information, use the **show srlg** command in EXEC modeXR EXEC mode.

show srlg [**interface** *type interface-path-id*] [**location** {*node-id* | **all** | **mgmt-nodes**}] [**value** *value-number*] [**trace**{**file** *filename* **original** | **hexdump** | **last** *entries* | **reverse** | **stats** | **tailf** | **unique** | **verbose** | **wrapping**}]

Syntax Description

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.
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

EXECXR EXEC

Command History

Release	Modification
Release 4.0.0	This command was introduced.

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   : POS0/1/0/0, Value Count : 2
SRLG Values : 10,20

Interface   : POS0/1/0/1, Value Count : 2
SRLG Values : 10,30

Interface   : POS0/1/0/2, Value Count : 2
SRLG Values : 10,40

Interface  : POS0/2/0/0, Value Count : 1
SRLG Values : 100
```

Related Commands

Command	Description
interface (MPLS-TE), on page 101	Enables MPLS-TE on an interface and enters MPLS-TE interface configuration mode.

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.

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*}

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

Usage Guidelines

The **signalled-bandwidth** command supports two bandwidth pools (class-types) for the Diff-Serv Aware TE (DS-TE) feature.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# signalled-bandwidth 1000

RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# signalled-bandwidth sub-pool 1000

RP/0/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# signalled-bandwidth 1000 class-type 1
```

Related Commands

Command	Description
show mpls traffic-eng	Displays information about MPLS-TE tunnels.

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*

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 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname(config)# interface tunnel-te 1
RP/0/RP0RSP0/CPU0:router:hostname(config-if)# signalled-name tunnel-from-NY-to-NJ
```

Related Commands

Command	Description
show mpls traffic-eng tunnels, on page 294	Displays information about MPLS-TE tunnels.

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

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
```

```
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# signalling advertise explicit-null
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.
path-selection loose-expansion metric (MPLS-TE), on page 169	Configures a metric type to be used to expand a path to the next loose hop for a tunnel on an area border router.

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 Global Configuration modeXR Config mode. To disable this behavior, use the **no** form of this command.

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

Global Configuration

Command History

Release	Modification
Release 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.
Release 4.2.0	The **preempt** keyword was added.

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/RP0RSP0/CPU0:router:hostname(config)# snmp traps mpls traffic-eng up
```

Related Commands

Command	Description
snmp-server host	Specifies the recipient of a SNMP notification operation.
soft-preemption	Enables soft-preemption on a head-end for the MPLS TE tunnel.

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*

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 4.2.0	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/RP0RSP0/CPU0:router:hostname(config)#interface tunnel-te 50
RP/0/RP0RSP0/CPU0:router:hostname(config-if)#soft-preemption
```

This example shows how to enable soft-preemption on a node :

```
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#soft-preemption
RP/0/RP0RSP0/CPU0:router:hostname(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

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 5.1.2	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/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(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 modeXR Config mode. To disable this configuration, use the **no** form of this command.

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

Global Configuration

Command History

Release	Modification
Release 3.9.0	This command was introduced.
Release 3.9.0	No modification.
Release 4.0.0	The **value** argument was added. Command mode was changed to the global configuration mode.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname#(config)# srlg
RP/0/RP0RSP0/CPU0:router:hostname#(config-srlg)# interface POS 0/3/0/2
RP/0/RP0RSP0/CPU0:router:hostname#(config-srlg-if)# value 10
```

Related Commands

Command	Description
interface (MPLS-TE), on page 101	Enables MPLS-TE on an interface and enters MPLS-TE interface configuration mode.
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.

stateful-client delegation

To enable stateful path computation element (PCE) delegation on all tunnels, use **stateful-client delegation** in the MPLS-TE pce configuration mode.

stateful-client delegation

This command has no keywords or arguments.

Command Default

No default behavior or values

Command Modes

MPLS-TE pce configuration

Command History

Release	Modification
Release 5.3.0	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to enable stateful PCE delegation on all tunnels:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#mpls traffic-eng pce
RP/0/0/CPU0:ios(config-mpls-te-pce)#stateful-client delegation
```

state-timeout

To configure the time (in seconds) that a path computation client (PCC) must wait before removing the LSPs associated with a PCEP session that is disconnected and reverting back to the defaults, use the **state-timeout** command in MPLS-TE pce configuration mode.

state-timeout *seconds*

Syntax Description

seconds	Specifies state timeout for LSPs without delegation in seconds. The range is from 0 to 3600.

Command Default

seconds: 180

Command Modes

MPLS-TE pce configuration

Command History

Release	Modification
Release 5.3.0	This command was introduced.

Task ID

Task ID	Operation
mpls-te	read, write

Example

The following example shows how to configure the time (in seconds) that a PCC must wait before removing the LSPs:

```
RP/0/0/CPU0:ios#configure
RP/0/0/CPU0:ios(config)#mpls traffic-eng pce
RP/0/0/CPU0:ios(config-mpls-te-pce)#stateful-client timers state-timeout 30
```

Note If the state-timeout is zero seconds, it means immediate removal of the LSPs.

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*

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 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# timers loose-path retry-period 300
```

Related Commands

Command	Description
mpls traffic-eng, on page 121	Enters MPLS-TE configuration mode.

Command	Description
path-selection loose-expansion affinity (MPLS-TE), on page 167	Specifies the affinity value to be used to expand a path to the next loose hop for a tunnel on an area border router.

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*

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 4.0.0	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/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# auto-tunnel backup
RP/0/RP0RSP0/CPU0:router:hostname(config-te-auto-bk)# timers removal unused 10
```

Related Commands

Command	Description
show mpls traffic-eng auto-tunnel backup unused	Displays the unused backup tunnels only.
auto-tunnel backup (MPLS-TE), on page 38	Builds automatic next-hop and next-next-hop tunnels, and enters auto-tunnel configuration mode.

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*

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 4.2.0	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/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# soft-preemption
RP/0/RP0RSP0/CPU0:router:hostname(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*

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 3.0	No modification.
Release 3.3.0	No modification.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.
Release 3.7.2	This command was introduced.
Release 3.8.0	No modification.
Release 3.9.0	No modification.

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/RP0RSP0/CPU0:router:hostname# configure
RP/0/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# topology holddown sigerr 15
```

Related Commands

Command	Description
mpls traffic-eng	Enters MPLS-TE configuration mode.
show mpls traffic-eng topology	Displays the current MPLS-TE global topology of this node as well as the signaling error holddown time.

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*

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 4.0.0	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/RP0RSP0/CPU0:router:hostname(config)# mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)# auto-tunnel backup
RP/0/RP0RSP0/CPU0:router:hostname(config-te-auto-bk)# tunnel-id min 1200 max 2000
```

Related Commands

Command	Description
auto-tunnel backup (MPLS-TE), on page 38	Builds automatic next-hop and next-next-hop tunnels, and enters auto-tunnel configuration mode.

tunnel-id (auto-tunnel p2mp)

To configure the tunnel ID range that can be allocated to P2MP auto-tunnels and to determine the maximum number of P2MP auto-tunnels that can be created, use the **tunnel-id** command in P2MP auto-tunnel configuration mode. To delete P2MP auto-tunnels, use the **no** form of this command.

tunnel-id **min** *number* **max** *number*

Syntax Description

min *number*	Specifies a minimum tunnel ID value for auto-tunnel P2MP. Range is 0 to 65535.
max *number*	Specifies a maximum tunnel ID value for auto-tunnel P2MP. Range is 0 to 65535.

Command Default

None

Command Modes

P2MP auto-tunnel configuration

Command History

Release	Modification
Release 5.1	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 create a 1000 P2MP auto-tunnels:

```
RP/0/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#auto-tunnel p2mp
RP/0/RP0RSP0/CPU0:router:hostname(config-te-auto-p2mp)#tunnel-id min 10000 max 11000
```

tunnel-id (auto-tunnel pcc)

To configure the range of tunnel IDs to be used for stateful PCE instantiation requests, use the **tunnel-id** command in auto-tunnel stateful PCE client configuration mode. To delete the stateful PCE client auto-tunnels, use the **no** form of this command.

tunnel-d min *number* **max** *number*

Syntax Description

min	Specifies minimum number for stateful PCE client auto-tunnels.
max	Specifies maximum number for stateful PCE client auto-tunnels
number	Valid values are from 0 to 65535.

Command Default

None

Command Modes

Auto-tunnel stateful PCE client configuration

Command History

Release	Modification
Release 5.1.1	This command was introduced.

Usage Guidelines

When the tunnel ID range is configured, no action is taken, though subsequent tunnel creation requests from a PCE may succeed. This does not affect the I-bit announced by the PCC, nor does it flap the PCE peer connections.

When the tunnel ID range is unconfigured, PCE instantiated tunnels are deleted by the PCC.

When the tunnel ID range is changed, any PCE instantiated tunnels that fall outside the range will be removed by the PCC. Tunnels whose IDs remain within the new range will be unaffected.

The tunnel ID range cannot conflict with other statically configured tunnels.

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to configure 400 stateful PCE client auto-tunnels to be used for stateful PCE instantiation requests:

```
RP/0/RP0RSP0/CPU0:router:hostname#configure
RP/0/RP0RSP0/CPU0:router:hostname(config)#mpls traffic-eng
RP/0/RP0RSP0/CPU0:router:hostname(config-mpls-te)#auto-tunnel pcc
RP/0/RP0RSP0/CPU0:router:hostname(config-te-auto-pcc)#tunnel-id min 65100 max 65500
```