MPLS Traffic Engineering—Verbatim Path Support

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The MPLS Traffic Engineering—Verbatim Path Support feature allows network nodes to support Resource Reservation Protocol (RSVP) extensions without supporting Interior Gateway Protocol (IGP) extensions for traffic engineering (TE), thereby bypassing the topology database verification process.

History for the MPLS Traffic Engineering—Verbatim Path Support Feature

Release	Modification
12.0(26)S	This feature was introduced.
12.2(33)SRA	This feature was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This feature was integrated into Cisco IOS Release 12.2(33)SXH.

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Contents

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Prerequisites for MPLS Traffic Engineering—Verbatim Path Support

- You must configure an Multiprotocol Label Switching (MPLS) TE tunnel globally.
- You must enable MPLS TE on all links.

Restrictions for MPLS Traffic Engineering—Verbatim Path Support

- You can use the **verbatim** keyword only on a label-switched path (LSP) that is configured with the explicit path option.
- This release does not support reoptimization on the verbatim LSP.

Information About MPLS Traffic Engineering—Verbatim Path Support

MPLS TE LSPs usually require that all the nodes in the network are TE aware meaning they have IGP extensions to TE in place. However, some network administrators want the ability to build TE LSPs to traverse nodes that do not support IGP extensions to TE, but that do support RSVP extensions to TE.

Verbatim LSPs are helpful when all or some of the intermediate nodes in a network do not support IGP extensions for TE.

When this feature is enabled, the IP explicit path is not checked against the TE topology database. Since the TE topology database is not verified, a Path message with IP explicit path information is routed using the shortest path first (SPF) algorithm for IP routing.

How to Configure and Verify MPLS Traffic Engineering—Verbatim Path Support

This section contains the following procedures:

Configuring MPLS Traffic Engineering—Verbatim Path Support

Perform this task to configure MPLS traffic engineering—verbatim path support.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** [*type-number*]
4. **ip unnumbered** [*type-number*]
5. **tunnel destination** {*host-name* | *ip-address*}
6. **tunnel mode mpls traffic-eng**
7. **tunnel mpls traffic-eng bandwidth** [**sub-pool** | **global**] *kbps*
8. **tunnel mpls traffic-eng autoroute announce**
9. **tunnel mpls traffic-eng priority** *setup-priority* [*hold-priority*]
10. **tunnel mpls traffic-eng path-option** *number* {**dynamic** | **explicit** {**name** *path-name* | *path-number*} [**verbatim**]} [**attributes** *string*] [**bandwidth** [**sub-pool** | **global-pool**] *kbps*] [**lockdown**]
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** [*type-number*] **Example:** `Router(config)# interface 1`	Enters interface configuration mode. • The *type-number* argument identifies the interface to be configured.
Step 4	**ip unnumbered** [*type-number*] **Example:** `Router(config-if)# ip unnumbered 1`	Gives the tunnel interface an IP address. **Note** An MPLS traffic engineering tunnel interface should be unnumbered because it represents a unidirectional link.

	Command or Action	Purpose
Step 5	**tunnel destination** {*host-name* | *ip-address*} **Example:** `Router(config-if)# tunnel destination 10.100.100.100`	Specifies the destination for a tunnel. • The *host-name* argument is the name of the host destination. • The *ip-address* argument is the IP address of the host destination expressed in decimal in four-part, dotted notation.
Step 6	**tunnel mode mpls traffic-eng** **Example:** `Router(config-if)# tunnel mode mpls traffic-eng`	Sets the tunnel encapsulation mode to MPLS traffic engineering.
Step 7	**tunnel mpls traffic-eng bandwidth** [**sub-pool** | **global**] *kbps* **Example:** `Router(config-if)# tunnel mpls traffic-eng bandwidth 1000`	Configures the bandwidth required for an MPLS TE tunnel and assigns it either to the sub-pool or the global pool. • The **sub-pool** keyword indicates a subpool tunnel. • The **global** keyword indicates a global pool tunnel. Entering this keyword is not necessary, for all tunnels are in the global pool in the absence of the **sub-pool** keyword. The *kbps* argument is the bandwidth, in kilobits per second, set aside for the MPLS TE tunnel. The range is from 1 to 4294967295.
Step 8	**tunnel mpls traffic-eng autoroute announce** **Example:** `Router(config-if)# tunnel mpls traffic-eng autoroute announce`	Specifies that IGP should use the tunnel (if the tunnel is up) in its enhanced SPF calculation.
Step 9	**tunnel mpls traffic-eng priority** *setup-priority* [*hold-priority*] **Example:** `Router(config-if)# tunnel mpls traffic-eng priority 1 1`	Configures setup and reservation priority for a tunnel. • The *setup-priority* argument is the priority used when signaling an LSP for this tunnel to determine which existing tunnels can be preempted. Valid values are from 0 to 7. A lower number indicates a higher priority. An LSP with a setup priority of 0 can preempt any LSP with a non-0 priority. • The *hold-priority* argument is the priority associated with an LSP for this tunnel to determine if it should be preempted by other LSPs that are being signaled. Valid values are from 0 to 7, where a lower number indicates a higher priority.

	Command or Action	Purpose
Step 10	**tunnel mpls traffic-eng path-option** *number* {**dynamic** | **explicit** {**name** *path-name* | *path-number*} [**verbatim**]} [**attributes** *string*] [**bandwidth** [**sub-pool** |**global**] *kbps*] [**lockdown**] **Example:** `Router(config-if)# tunnel mpls traffic-eng path-option 1 explicit name test verbatim`	Specifies LSP-related parameters, including the **verbatim** keyword used with an explicit path option, for an MPLS TE tunnel. • The *number* argument identifies the path option. • The **dynamic** keyword indicates that the path option is dynamically calculated. (The router figures out the best path.) • The **explicit** keyword indicates that the path option is specified. You specify the IP addresses of the path. • The **name** *path-name* keyword argument combination identifies the name of the explicit path option. • The *path-number* argument identifies the number of the explicit path option. • The **verbatim** keyword bypasses the topology database verification. **Note** You can use the **verbatim** keyword only with the explicit path option. • The **attributes** *string* keyword argument combination names an attribute list to specify path options for the LSP. • The **bandwidth** keyword specifies LSP bandwidth. • The **sub-pool** keyword indicates a subpool path option. • The **global** keyword indicates a global pool path option. Entering this keyword is not necessary, for all path options are from the global pool in the absence of the **sub-pool** keyword. • The *kbps* argument is the number of kilobits per second set aside for the path option. The range is from 1 to 4294967295. • The **lockdown** keyword disables reoptimization of the LSP.
Step 11	**end** **Example:** `Router(config)# end`	(Optional) Exits to privileged EXEC mode.

Verifying Verbatim LSPs for MPLS TE Tunnels

Perform this task to verify that the verbatim option is configured for the LSPs for MPLS TE tunnels.

SUMMARY STEPS

1. **enable**
2. **show mpls traffic-eng tunnels** *tunnel-interface* [**brief**]
3. **disable**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show mpls traffic-eng tunnels** *tunnel-interface* [**brief**] **Example:** `Router# show mpls traffic-eng tunnels tunnel1`	Displays information about tunnels including those configured with an explicit path option using verbatim.
Step 3	**disable** **Example:** `Router# disable`	(Optional) Exits to user EXEC mode.

Examples

This section provides the following example output:

• Sample Output for the show mpls traffic-eng tunnels Command, page 6

Sample Output for the show mpls traffic-eng tunnels Command

In the following example, the **show mpls traffic-eng tunnels** command displays tunnel information, including whether the explicit path option is using verbatim and the Active Path Options Parameters that show the status of verbatim.

```
Router# show mpls traffic-eng tunnels tunnel100

Name: GSR-2_t100                          (Tunnel100) Destination: 192.168.30.1
  Status:
    Admin: up         Oper: up     Path: valid       Signalling: connected

    path option 1, type explicit (verbatim) BACKUP (Basis for Setup, path weight 0)

  Config Parameters:
    Bandwidth: 0        kbps (Global)  Priority: 7  7   Affinity: 0x0/0xFFFF
    Metric Type: TE (default)
    AutoRoute:  disabled  LockDown: disabled  Loadshare: 0        bw-based
    auto-bw: disabled
  Active Path Option Parameters:
```

```
State: explicit path option 1 is active
BandwidthOverride: disabled  LockDown: disabled  Verbatim: enabled
```

Configuration Examples for MPLS Traffic Engineering—Verbatim Path Support

This section provides the following configuration examples:

- Configuring MPLS Traffic Engineering—Verbatim Path Support, page 7

Configuring MPLS Traffic Engineering—Verbatim Path Support

The following example shows a tunnel that has been configured with an explicit path option using verbatim:

```
interface 1
 ip unnumbered 1
 tunnel destination 10.10.100.100
 tunnel mode mpls traffic-eng
 tunnel mpls traffic-eng bandwidth 1000
 tunnel mpls traffic-eng autoroute announce
 tunnel mpls traffic-eng priority 1 1
 tunnel mpls traffic-eng path-option 1 explicit name path1 verbatim
```

Additional References

The following sections provide references related to the MPLS Traffic Engineering—Verbatim Path feature.

Related Documents

Related Topic	Document Title
MPLS TE configuration tasks	*MPLS Traffic Engineering and Enhancements*

Standards

Standard	Title
None	—

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	—

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com.	http://www.cisco.com/techsupport

Command Reference

This section documents only commands that are new or modified.

- **show mpls traffic-eng tunnels**
- **tunnel mpls traffic-eng path option**

show mpls traffic-eng tunnels

To display information about tunnels, use the **show mpls traffic-eng tunnels** command in user EXEC or privileged EXEC mode.

show mpls traffic-eng tunnels
[**tunnel** *number*]
[**accounting**]
[**attributes**]
[**backup | brief | protection**]
[**destination** *address*]
[**interface in** *phys-intf*] [**interface out** *phys-intf* | **interface** *phys-intf*]
[**name** *name*]
[**name-regexp** *reg-exp*]
[**property** {**auto-tunnel | backup-tunnel | fast-reroute**}]
[**role** {**all | head | middle | tail | remote**}]
[**source-id** {*num* | *ipaddress* | *ipaddress num*}]
[**statistics**]
[**suboptimal constraints** {**none | current | max**}]
[**summary**]
[**up | down**]

Syntax Description

tunnel *number*	(Optional) Restricts the display to the specified tunnel interface.
accounting	(Optional) Displays accounting information (the rate of the traffic flow) for tunnels.
attributes	(Optional) Restricts the display to tunnels that use a matching attributes list.
backup	(Optional) Displays information about the Fast Reroute protection provided by each tunnel selected by other options specified with this command. The information includes the physical interface protected by the tunnel, the number of traffic engineering (TE) label-switched packets (LSPs) (that is, tunnels) protected, and the bandwidth protected.
brief	(Optional) Specifies a format with one line per tunnel.
protection	(Optional) Displays information about the protection provided by 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 bandwidth protected.
destination *address*	(Optional) Restricts the display to tunnels destined to the specified IP address.
interface in *phys-intf*	(Optional) Displays information for the specified input interface.
interface out *phys-intf*	(Optional) Displays information for the specified output interface.
interface *phys-intf*	(Optional) Displays tunnels that use the specified interface as an input or output interface.
name *name*	(Optional) Displays tunnel with the specified string. The tunnel string is derived from the interface description, if specified; otherwise, it is the interface name. The tunnel string is included in the signaling message so that it is available at all hops.

name-regexp *regexp*	(Optional) Displays tunnels whose descriptions match the specified regular expression.
property auto-tunnel	(Optional) Displays information about autotunnels.
property backup-tunnel	(Optional) Selects Multiprotocol Label Switching (MPLS) traffic engineering (TE) tunnels being 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) Selects Fast Reroute-protected MPLS TE tunnels originating, transmitting, or terminating on this router.
role	(Optional) Restricts the display to tunnels with the indicated role (all, head, middle, tail, or remote).
all	Displays all tunnels.
head	Displays tunnels with their head at this router.
middle	Displays tunnels with a midpoint at this router.
tail	Displays tunnels with a tail at this router.
remote	Displays tunnels with their head at some other router; this is a combination of **middle** and **tail**.
source-id	(Optional) Restricts the display to tunnels with a matching source IP address or tunnel number.
num	Tunnel number.
ipaddress	Source IP address.
ipaddress num	Source IP address and tunnel number.
statistics	(Optional) Displays tunnel counters and statistics.
suboptimal constraints none	(Optional) Displays tunnels whose path metric is greater than the shortest unconstrained path. Selected tunnels have a longer path than the Interior Gateway Protocol's (IGP) shortest path.
suboptimal constraints current	(Optional) Displays tunnels whose path metric is greater than the current shortest path, constrained by the tunnel's configured options. Selected tunnels would have a shorter path if they were reoptimized immediately.
suboptimal constraints max	(Optional) Displays information for the specified tunneling interface.
summary	(Optional) Displays summary information about tunnels that provide Fast Reroute protection.
up	(Optional) Displays tunnels if the tunnel interface is up. Tunnel midpoints and tails are typically up or not present.
down	(Optional) Displays tunnels that are down.

Defaults

If you specify this command without any arguments or keywords, the command displays general information about each MPLS TE tunnel known to the router.

Command Modes

User EXEC
Privileged EXEC

Command History

Release	Modification
12.0(5)S	This command was introduced.
12.1(3)T	Input and output interface information was added to the new **brief** form of the output. The **suboptimal** and **interface** keywords were added to the nonbrief format. The nonbrief, nonsummary formats contain the history of the LSP selection.
12.0(10)ST	This command was integrated into Cisco IOS Release 12.0(10)ST.
12.0(22)S	The **property** and **protection** keywords were added. The command is supported on the Cisco 10000 series routers.
12.2(18)S	The following keywords were added: **accounting**, **attributes**, **property auto-tunnel**, and **name-regexp**. The **property backup** keyword was changed to **property backup-tunnel**.
12.2(18)SXD1	This command was integrated into Cisco IOS Release 12.2(18)SXD1.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.

Usage Guidelines

To select the tunnels for which information is displayed, use the **tunnel**, **attributes**, **destination**, **name**, **name-regexp**, **source-id**, **role**, **up**, **down**, **name**, **suboptimal constraints**, **interface,** and **property** keywords and options singly or combined.

To select the type of information displayed about the selected tunnels, use the **accounting**, **backup**, **protection**, **statistics**, and **summary** keywords.

The **tunnel** and **property** keywords display the same information, except that the **property** keyword restricts the display to autotunnels, backup tunnels, or tunnels that are Fast Reroute-protected.

The **name-regexp** keyword displays output for each tunnel whose name contains a specified string. For example, if there are tunnels named iou-100_t1, iou-100_t2, and iou-100_t100, the following command displays output for the three tunnels whose name contains the string iou-100.

```
Router# show mpls traffic-eng tunnels name-regexp iou-100
```

If you specify the **name** keyword, there is command output only if the command name is an exact match. For example: iou-100_t1.

Examples

The following is sample output from the **show mpls traffic-eng tunnels brief** command. It displays brief information about every MPLS TE tunnel known to the router.

```
Router# show mpls traffic-eng tunnels brief 500

Signalling Summary:
    LSP Tunnels Process:           running
    RSVP Process:                  running
    Forwarding:                    enabled
    Periodic reoptimization:       every 3600 seconds, next in 1706 seconds
TUNNEL NAME                     DESTINATION      UP IF     DOWN IF   STATE/PROT
Router_t1                       10.112.0.12      -         PO4/0/1   up/up
Router_t2                       10.112.0.12      -         unknown   up/down
Router_t3                       10.112.0.12      -         unknown   admin-down
Router_t1000                    10.110.0.10      -         unknown   up/down
Router_t2000                    10.110.0.10      -         PO4/0/1   up/up
Displayed 5 (of 5) heads, 0 (of 0) midpoints, 0 (of 0) tails
```

Table 1 describes the significant fields shown in the displays.

Table 1 show mpls traffic-eng tunnels Field Descriptions

Field	Description
LSP Tunnels Process	Status of the LSP tunnels process.
RSVP Process	Status of the Resource Reservation Protocol (RSVP) process.
Forwarding	Status of forwarding (enabled or disabled).
Periodic reoptimization	Schedule for periodic reoptimization (in seconds).
TUNNEL NAME	Name of the interface that is configured at the tunnel head.
DESTINATION	Identifier of the tailend router.
UP IF	Upstream interface that the tunnel used.
DOWN IF	Downstream interface that the tunnel used.
STATE/PROT	For tunnel heads, admin-down. up, or down. For nonheads, signaled.

The following is sample output from the **show mpls traffic-eng tunnels property backup brief** command. It displays brief information about all MPLS TE tunnels acting as Fast Reroute backup tunnels (**property backup**) for interfaces on the router.

```
Router# show mpls traffic-eng tunnels property backup brief

Signalling Summary:
    LSP Tunnels Process:            running
    RSVP Process:                   running
    Forwarding:                     enabled
    Periodic reoptimization:        every 3600 seconds, next in 2231 seconds
    Periodic FRR Promotion:         every 300 seconds, next in 131 seconds
    Periodic auto-bw collection:    disabled
TUNNEL NAME                     DESTINATION      UP IF     DOWN IF   STATE/PROT
Router_t2000                    10.110.0.10      -         PO4/0/1   up/up
Router_t2                       10.112.0.12      -         unknown   up/down
Router_t3                       10.112.0.12      -         unknown   admin-down
Displayed 3 (of 9) heads, 0 (of 1) midpoints, 0 (of 0) tails
```

The following is sample output from the **show mpls traffic-eng tunnels backup** command. This command selects every MPLS TE tunnel known to the router and displays information about the Fast Reroute protection each selected tunnels provides for interfaces on this router; the command does not generate output for tunnels that do not provide Fast Reroute protection of interfaces on this router.

```
Router# show mpls traffic-eng tunnels backup

Router_t578
  LSP Head, Tunnel578, Admin: up, Oper: up
  Src 10.55.55.55, Dest 10.88.88.88, Instance 1
  Fast Reroute Backup Provided:
    Protected i/fs: PO1/0, PO1/1, PO3/3
    Protected lsps: 1
    Backup BW: any pool unlimited; inuse: 100 kbps
Router_t5710
  LSP Head, Tunnel5710, Admin: admin-down, Oper: down
  Src 10.55.55.55, Dest 192.168.7.7, Instance 0
  Fast Reroute Backup Provided:
    Protected i/fs: PO1/1
```

```
    Protected lsps: 0
    Backup BW: any pool unlimited; inuse: 0 kbps
Router_t5711
  LSP Head, Tunnel5711, Admin: up, Oper: up
  Src 10.55.55.55, Dest 10.7.7.7, Instance 1
  Fast Reroute Backup Provided:
    Protected i/fs: PO1/0
    Protected lsps: 2
    Backup BW: any pool unlimited; inuse: 6010 kbps
```

The following is sample output from the **show mpls traffic-eng tunnels property fast-reroute protection** command. This command selects every MPLS TE tunnel known to the router that was signaled as a Fast Reroute-protected LSP (**property fast-reroute**) and displays information about the protection this router provides each selected tunnel.

```
Router# show mpls traffic-eng tunnels property fast-reroute protection

Router_t1
  LSP Head, Tunnel1, Admin: up, Oper: up
  Src 10.55.55.55, Dest 10.88.88.88, Instance 25
  Fast Reroute Protection: Requested
    Outbound: FRR Ready
      Backup Tu5711 to LSP nhop
        Tu5711: out i/f: PO1/1, label: implicit-null
      LSP signalling info:
        Original: out i/f: PO1/0, label: 12304, nhop: 10.1.1.7
        With FRR: out i/f: Tu5711, label: 12304
      LSP bw: 6000 kbps, Backup level: any unlimited, type: any pool
Router_t2
  LSP Head, Tunnel2, Admin: up, Oper: up
  Src 10.55.55.55, Dest 10.88.88.88, Instance 2
  Fast Reroute Protection: Requested
    Outbound: FRR Ready
      Backup Tu578 to LSP nhop
        Tu578: out i/f: PO1/0, label: 12306
      LSP signalling info:
        Original: out i/f: PO3/3, label: implicit-null, nhop: 10.3.3.8
        With FRR: out i/f: Tu578, label: implicit-null
      LSP bw: 100 kbps, Backup level: any unlimited, type: any pool
r9_t1
  LSP Midpoint, signalled, connection up
  Src 10.9.9.9, Dest 10.88.88.88, Instance 2347
  Fast Reroute Protection: Requested
    Inbound:  FRR Inactive
      LSP signalling info:
        Original: in i/f: PO1/2, label: 12304, phop: 10.205.0.9
    Outbound: FRR Ready
      Backup Tu5711 to LSP nhop
        Tu5711: out i/f: PO1/1, label: implicit-null
      LSP signalling info:
        Original: out i/f: PO1/0, label: 12305, nhop: 10.1.1.7
        With FRR: out i/f: Tu5711, label: 12305
      LSP bw: 10 kbps, Backup level: any unlimited, type: any pool
```

The following is sample output from the **show mpls traffic-eng tunnels tunnel** command. This command displays information about just a single tunnel.

```
Router# show mpls traffic-eng tunnels tunnel 1

Name: swat76k1_t1                         (Tunnel1) Destination: 1.0.0.4
   Status:
     Admin: admin-down Oper: down   Path: not valid   Signalling: Down
     path option 1, type explicit gi7/4-R4
```

```
   Config Parameters:
     Bandwidth: 0        kbps (Global)  Priority: 7  7   Affinity: 0x0/0xFFFF
     Metric Type: TE (default)
     AutoRoute:  disabled  LockDown: disabled  Loadshare: 0        bw-based
     auto-bw: disabled

   Shortest Unconstrained Path Info:
     Path Weight: 2 (TE)
     Explicit Route: 10.1.0.1 10.1.0.2 172.0.0.1 192.0.0.4
   History:
     Tunnel:
       Time since created: 13 days, 52 minutes
       Number of LSP IDs (Tun_Instances) used: 0 swat76k1#
swat76k1#sh mpls traf tun property ?
   auto-tunnel    auto-tunnel created tunnels
   backup-tunnel  Tunnels used as fast reroute
   fast-reroute   Tunnels protected by fast reroute
```

The following is sample output from the **show mpls traffic-eng tunnels accounting** command. This command displays the rate of the traffic flow for the tunnels.

```
Router# show mpls traffic-eng tunnels accounting

Tunnel1 (Destination 10.103.103.103; Name iou-100_t1)
 5 minute output rate 0 kbits/sec, 0 packets/sec
Tunnel2 (Destination 10.103.103.103; Name iou-100_t2)
 5 minute output rate 0 kbits/sec, 0 packets/sec Tunnel100 (Destination 10.101.101.101;
Name iou-100_t100)
 5 minute output rate 0 kbits/sec, 0 packets/sec Totals for 3 Tunnels
 5 minute output rate 0 kbits/sec, 0 packets/sec
```

Related Commands

Command	Description
mpls traffic-eng reoptimize timers frequency	Controls the frequency with which tunnels with established LSPs are checked for better LSPs.
mpls traffic-eng tunnels (configuration)	Enables MPLS traffic engineering tunnel signaling on a device.
mpls traffic-eng tunnels (interface)	Enables MPLS traffic engineering tunnel signaling on an interface.

tunnel mpls traffic-eng path option

To configure a path option for a Multiprotocol Label Switching (MPLS) traffic engineering tunnel, use the **tunnel mpls traffic-eng path-option** command in interface configuration mode. To disable this feature, use the **no** form of this command.

tunnel mpls traffic-eng path-option *number* {**dynamic** | **explicit** {**name** *path-name* | *path-number*} [**verbatim**]} [**attributes** *string*] [**bandwidth** [**sub-pool** | **global-pool**] *kbps*] [**lockdown**]

no tunnel mpls traffic-eng path-option *number* {**dynamic** | **explicit** {**name** *path-name* | *path-number*} [**verbatim**]} [**attributes** *string*] [**bandwidth** [**sub-pool** | **global-pool**] *kbps*] [**lockdown**]

Syntax Description

number	When multiple path options are configured, lower numbered options are preferred.
dynamic	Path of the label switched path (LSP) is dynamically calculated.
explicit	Path of the LSP is an IP explicit path.
name *path-name*	Path name of the IP explicit path that the tunnel uses with this option.
path-number	Path number of the IP explicit path that the tunnel uses with this option.
verbatim	(Optional) Bypasses the topology database verification process. **Note** You can use the **verbatim** keyword only with the explicit path option.
attributes *string*	(Optional) Identifies an LSP attribute list.
bandwidth	(Optional) Specifies a bandwidth override on the path options.
sub-pool	Indicates a subpool path option.
global	(Optional) Indicates a global pool path option. Entering this keyword is not necessary, for all path options are from the global pool in the absence of the **sub-pool** keyword.
kbps	Number of kilobits per second set aside for the path option. The range is from 1 to 4294967295.
lockdown	(Optional) The LSP cannot be reoptimized.

Command Default

No default behavior or values.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)S	This command was introduced.
12.0(26)S	LSP-related keywords and arguments for path options were added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.

Usage Guidelines

You can configure multiple path options for a single tunnel. For example, there can be several explicit path options and a dynamic option for one tunnel. Path setup preference is for lower (not higher) numbers, so option 1 is preferred.

You can use the **bandwidth** keyword on the **tunnel mpls traffic-eng path-option** command to configure multiple path options with decreasing bandwidth. The bandwidth value for the path option can be any valid value, and the pool (subpool or global pool) does not have to be the same as the pool configured on the tunnel. When an LSP is signaled, the bandwidth associated with the path option is signaled instead of the bandwidth configured on the tunnel. This ensures the success of the LSP. For example, you can configure the following path options:

```
Router(config-if)# tunnel mpls traffic-eng path-option 1 explicit name path1

Router(config-if)# tunnel mpls traffic-eng path-option 2 explicit name path2 bandwidth 500

Router(config-if)# tunnel mpls traffic-eng path-option 3 dynamic bandwidth 0
```

The device selects a path option for an LSP in order of preference, as follows:

- The device attempts to signal an LSP using path options starting with path option 1.

  The device attempts to signal an LSP with the 1000 kbps bandwidth configured on the tunnel interface because path-option 1 has no bandwidth configured.

- If 1000 kbps bandwidth is not available over the network, the device attempts to establish an LSP using path-option 2.

  Path-option 2 has a bandwidth of 500 kbps configured. This reduces the bandwidth constraint from the original 1000 kbps configured on the tunnel interface.

- If 500 kbps is not available, the device attempts to establish an LSP using path-option 3.

  Path-option 3 is configured as dynamic and has bandwidth 0. This eliminates bandwidth as a constraint and the device establishes an LSP if an IP path exists to the destination and all other configured attributes satisfy the routing constraint.

Once you select the **bandwidth** keyword on the **tunnel mpls traffic-eng path-option** command, the **attributes** keyword is no longer available for that path option.

```
Router(config-if)# tunnel mpls traffic-eng path-option 3 explicit name path1 ?

   attributes    Specify an LSP attribute list
   bandwidth     Override the bandwidth configured on the tunnel
   lockdown      Not a candidate for reoptimization
   <cr>

Router(config-if)# tunnel mpls traffic-eng path-option 3 explicit name path1 bandwidth ?

   <0-4294967295>   Bandwidth requirement in kbps
   subpool          Tunnel uses sub-pool bandwidth

Router(config-if)# tunnel mpls traffic-eng path-option 3 explicit name path1 bandwidth 0 ?

   lockdown    Not a candidate for optimization
   <cr>
```

Examples

The following example shows how to configure the tunnel to use a named IP explicit path:

```
Router(config-if)# tunnel mpls traffic-eng path-option 1 explicit name test
```

The following example shows how to configure path-option 1 to use an LSP attribute list identified with the numeral 1:

```
Router(config-if)# tunnel mpls traffic-eng path-option 1 dynamic attributes 1
```

The following example shows how to configure bandwidth for a path option to override the bandwidth configured on the tunnel:

```
Router(config-if)# tunnel mpls traffic-eng path-option 3 dynamic bandwidth 0
```

Related Commands

Command	Description
ip explicit-path	Enters the subcommand mode for IP explicit paths and creates or modifies the specified path.
mpls traffic-eng lsp attributes	Creates or modifies an LSP attribute list.
show ip explicit-paths	Displays the configured IP explicit paths.

Glossary

Fast Reroute—Procedures that enable temporary routing around a failed link or node while a new LSP is being established at the head end.

headend—The router that originates and maintains a given LSP. This is the first router in the LSP's path.

IGP—Interior Gateway Protocol. Internet protocol used to exchange routing information within an autonomous system. Examples of common Internet IGPs include IGRP, OSPF, and RIP.

LSP—label-switched path. A configured connection between two routers, in which label switching is used to carry the packets. The purpose of an LSP is to carry data packets.

LSR—label switching router. A device that forwards MPLS packets based on the value of a fixed-length label encapsulated in each packet.

merge point—The backup tunnel's tail.

MPLS—Multiprotocol Label Switching. A method for forwarding packets (frames) through a network. It enables routers at the edge of a network to apply labels to packets (frames). ATM switches or existing routers in the network core can switch packets according to the labels with minimal lookup overhead.

PLR—point of local repair. The head-end of the backup tunnel.

RSVP—Resource Reservation Protocol. A protocol that supports the reservation of resources across an IP network. Applications running on IP end systems can use RSVP to indicate to other nodes the nature (bandwidth, jitter, maximum burst, and so on) of the packet streams they want to receive.

SPF—shortest path first. Routing algorithm that iterates on length of path to determine a shortest-path spanning tree. Commonly used in link-state routing algorithms. Sometimes called Dijkstra's algorithm.

tailend—The router upon which an LSP is terminated. This is the last router in the LSP's path.

traffic engineering—The techniques and processes used to cause routed traffic to travel through the network on a path other than the one that would have been chosen if standard routing methods had been used.

tunnel—A secure communications path between two peers, such as routers.

Note See *Internetworking Terms and Acronyms* for terms not included in this glossary.