

MPLS Traffic Engineering Verbatim Path Support

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.

- Prerequisites for MPLS Traffic Engineering--Verbatim Path Support, on page 1
- Restrictions for MPLS Traffic Engineering Verbatim Path Support, on page 1
- Information About MPLS Traffic Engineering - Configurable Path Calculation Metric for Tunnels, on page 2
- How to Configure MPLS Traffic Engineering - Configurable Path Calculation Metric for Tunnels, on page 2
- Configuration Examples for MPLS Traffic Engineering Verbatim Path Support, on page 6
- Additional References, on page 6
- Feature Information for MPLS Traffic Engineering Verbatim Path Support, on page 7
- Glossary, on page 8

Prerequisites for MPLS Traffic Engineering--Verbatim Path Support

- A Multiprotocol Label Switching (MPLS) TE tunnel must be configured globally.
- MPLS TE must be enabled on all links.

Restrictions for MPLS Traffic Engineering Verbatim Path Support

- The **verbatim** keyword can be used 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 - Configurable Path Calculation Metric for Tunnels

MPLS TE Verbatim Path Support Overview

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. Because 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 MPLS Traffic Engineering - Configurable Path Calculation Metric for Tunnels

Configuring MPLS Traffic Engineering--Verbatim Path Support

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface tunnel** *number*
4. **ip unnumbered loopback** *number*
5. **tunnel destination** {*host-name*| *ip-address*}
6. **tunnel mode mpls traffic-eng**
7. **tunnel mpls traffic-eng bandwidth** {**sub-pool** *kbps* | *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** *preference-number* {**dynamic** [**attributes** *string* | **bandwidth** {**sub-pool** *kbps* | *kbps*} **| lockdown | verbatim**] | **explicit**{**name** *path-name* | **identifier** *path-number* **}}**
11. **exit**
12. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface tunnel** *number* **Example:** `Router(config)# interface tunnel 1`	Configures a tunnel interface and enters interface configuration mode. • The *number* argument identifies the tunnel number to be configured.

Step 4	**ip unnumbered loopback** *number*
	Example:
	`Router(config-if)`
	`# ip unnumbered loopback 1`
		Configures an unnumbered IP interface, which enables IP processing without an explicit address. A loopback interface is usually configured with the router ID.
		Note
		An MPLS traffic engineering tunnel interface should be unnumbered because it represents a unidirectional link.

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 Version 4 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** *kbps* | *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 *kbps* argument is the bandwidth, in kilobits per second, set aside for the MPLS TE tunnel. The range is from 1 to 4294967295.

	Command or Action	Purpose
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.
Step 10	**tunnel mpls traffic-eng path-option** *preference-number* {**dynamic** [**attributes** *string* | **bandwidth** {**sub-pool** *kbps* | *kbps*} | **lockdown** | **verbatim**] | **explicit** {**name** *path-name* | **identifier** *path-number* **}}** **Example:** `Router(config-if)# tunnel mpls traffic-eng path-option 1 explicit name test verbatim` **Example:**	Specifies LSP-related parameters, including the **verbatim** keyword used with an explicit path option, for an MPLS TE tunnel. • The *preference-number* argument identifies the path option. • The **protect** keyword and *preference-number argument identify the path option with protection.* • 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. The IP addresses are specified for 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.

	Command or Action	Purpose
		• The **attributes** *string* keyword argument combination names an attribute list to specify path options for the LSP. • The **bandwidth** keyword specifies the LSP bandwidth. • The **sub-pool** keyword indicates a subpool path option. • 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	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 12	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode and returns to privileged EXEC mode.

Verifying Verbatim LSPs for MPLS TE Tunnels

SUMMARY STEPS

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

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
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.

Configuration Examples for MPLS Traffic Engineering Verbatim Path Support

Configuring MPLS Traffic Engineering Verbatim Path Support Example

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

```
interface tunnel 1
 ip unnumbered loopback 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

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
MPLS commands	*Cisco IOS Multiprotocol Label Switching Command Reference*
Interface commands	*Cisco IOS Interface and Hardware Component Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this release.	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for MPLS Traffic Engineering Verbatim Path Support

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for MPLS Traffic Engineering Verbatim Path Support

Feature Name	Releases	Feature Information
MPLS Traffic Engineering: Verbatim Path Support	Cisco IOS XE Release 2.3	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. The following commands were introduced or modified: **show mpls traffic-eng tunnels**, **tunnel mpls traffic-eng path option**.

Glossary

Fast Reroute --Procedures that enable temporary routing around a failed link or node while a new label-switched path (LSP) is being established at the head end.

headend --The router that originates and maintains a given label-switched path (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 Interior Gateway Routing Protocol (IGRP), Open Shortest Path First (OSPF), and Routing Information protocol (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 Multiprotocol Label Switching (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 label-switched path (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.