Configuring Basic MPLS TE

This chapter describes how to configure Multiprotocol Label Switching (MPLS) traffic engineering (TE) on Cisco NX-OS devices.

This chapter includes the following sections:

Finding Feature Information

Your software release might not support all the features documented in this module. For the latest caveats and feature information, see the Bug Search Tool at https://tools.cisco.com/bugsearch/ and the release notes for your software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the "New and Changed Information" chapter or the Feature History table below.

Information About MPLS TE

MPLS enabled for traffic engineering makes traditional Layer 2 features available to Layer 3.

This section includes the following topics:

MPLS TE Operation

MPLS TE learns the topology and resources available in a network and then maps traffic flows to particular paths based on resource requirements and network resources such as bandwidth. MPLS TE builds a unidirectional tunnel from a source to a destination in the form of a label switched path (LSP), which is then used to forward traffic. The point where the tunnel begins is called the tunnel headend or tunnel source, and the node where the tunnel ends is called the tunnel tailend or tunnel destination.

MPLS uses extensions to a link-state based Interior Gateway Protocol (IGP), such as Intermediate System-to-Intermediate System (IS-IS) or Open Shortest Path First (OSPF). MPLS calculates TE tunnels at the LSP head based on required and available resources (constraint-based routing). If configured, the IGP automatically routes the traffic onto these LSPs. Typically, a packet that crosses the MPLS TE backbone travels on a single LSP that connects the ingress point to the egress point. MPLS TE automatically establishes and maintains the LSPs across the MPLS network by using the Resource Reservation Protocol (RSVP).

MPLS TE is built on the following Cisco NX-OS mechanisms:

- TE tunnel interfaces—From a Layer 2 standpoint, an MPLS TE tunnel interface represents the head of an LSP. It is configured with a set of resource requirements, such as bandwidth, media requirements, and priority. From a Layer 3 standpoint, a TE tunnel interface is the headend of a unidirectional virtual link to the tunnel destination.
- MPLS TE path calculation—This calculation, which operates at the LSP head, determines a path to use for an LSP. The path calculation uses a link-state database that contains flooded topology and resource information.
- Resource Reservation Protocol (RSVP) with TE extensions—RSVP, which operates at each LSP hop, is used to signal and maintain LSPs based on the calculated path.
- MPLS TE link management— Link management, which operates at each LSP hop, performs link call admission on the RSVP signaling messages and tracking of topology and resource information to be flooded.
- Link-state IGP (IS-IS or OSPF)—These IGPs (with TE extensions) globally flood topology and resource information based on link management.
- Enhancements to the SPF calculation used by the link-state IGP (IS-IS or OSPF)—If configured, the IGP automatically routes traffic onto the appropriate TE tunnel based on the tunnel destination. You can also use static routes to direct traffic onto TE tunnels.
- Label switching forwarding—This forwarding mechanism provides routers with a Layer 2-like ability to direct traffic across multiple hops of the LSP established by RSVP signaling.

MPLS TE and HA

MPLS TE supports these Cisco NX-OS high availability (HA) features:

- Nonstop Forwarding (NSF)
- Stateful HA

MPLS TE supports these Cisco NX-OS HA technologies to allow NSF and Stateful HA:

- Stateful Process Restart
- Stateful Switch Over (SSO)

- In-Service Software Upgrade (ISSU)

MPLS TE CSPF Cost Limit

The cost-limit feature allows you to specify the maximum permitted total cost for a tunnel's path. The total cost for a path is the total of the costs of each link traversed. If no path with a total cost less than specified is found, path-calculation fails. The configured cost-limit applies to the metric type that is used while calculating the tunnel's path, which may be the IGP or TE link metrics.

By default, no cost-limit is imposed.

Licensing Requirements for MPLS TE

Product	License Requirement
Cisco NX-OS	MPLS TE feature requires an MPLS license. For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the *Cisco NX-OS Licensing Guide.*

Prerequisites for MPLS TE

MPLS TE has the following prerequisites:

- Your network must support Multiprotocol Label Switching (MPLS)
- Your network must support at least one of the following Interior Gateway (IGP) protocols:
  - Intermediate System-to-Intermediate System (IS-IS)
  - Open Shortest Path First (OSPF)
- Ensure that the MPLS feature set is installed.
- Ensure that the MPLS feature set is enabled.

Guidelines and Limitations for MPLS TE

MPLS TE has the following configuration guidelines and limitations:

- MPLS TE supports only a single IGP process or instance. You should not configure MPLS TE in more than one IGP process or instance.
- The IGP process or instance that you configure for MPLS TE must be one of the first four OSPFv2 or IS-IS processes or instances created. Cisco NX-OS Release 6.1 introduces support for more than four process instances for OSPFv2 per VDC. However, only the first four configured OSPFv2 instances are supported with MPLS TE.
- You cannot configure MPLS TE over the logical generic routing encapsulation (GRE) tunnel interface.
- MPLS TE is supported in no more than four VDCs.

Default Settings for MPLS TE

Table 10-1 lists the default settings for basic MPLS TE.

Table 10-1 Default Settings for MPLS TE

Parameters	Default
MPLS TE feature	Disabled

Configuring MPLS TE

This section includes the following topics:

Enabling MPLS TE

You can enable the MPLS TE feature on the device.

Prerequisites

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **feature mpls traffic-engineering**
3. (Optional) **show running-config**
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	**configure terminal** **Example:** switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	**feature mpls traffic-engineering** **Example:** switch(config)# feature mpls traffic-engineering	Enables the MPLS TE feature.
Step 3	**show running-config** **Example:** switch(config)# show running-config	(Optional) Displays information about the running configuration.
Step 4	**copy running-config startup-config** **Example:** switch(config)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Configuring IS-IS for MPLS TE

You can configure IS-IS for MPLS TE.

Note MPLS TE supports a single IGP process or instance. You should not configure MPLS TE in more than one IGP process or instance.

Prerequisites

You must have the MPLS TE feature enabled (see the "Configuring MPLS TE" section on page 10-139).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

Note You can configure a router running IS-IS so that Protocol-Independent Multicast (PIM) and MPLS TE can work together with the **mpls traffic-eng multicast-intact** command. You can disable the interoperability between PIM and MPLS TE with the **no mpls traffic-eng multicast-intact** command.

1. **configure terminal**
2. **feature isis**
3. **router isis** *instance-tag*
4. **mpls traffic-eng** {**level-1** | **level-1-2** | **level-2**}
5. **mpls traffic-eng router-id** *interface*
6. (Optional) **show running-config isis**

7. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	**configure terminal** **Example:** switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	**feature isis** **Example:** switch(config)# feature isis	Enables the IS-IS feature.
Step 3	**router isis** *instance-tag* **Example:** switch(config)# router isis switch(config-router)#	Configures an IS-IS instance and enters router configuration mode. The *instance-tag* can be any case-sensitive, alphanumeric string up to 20 characters.
Step 4	**mpls traffic-eng** {**level-1** | **level-1-2** | **level-2**} **Example:** switch(config-router)# mpls traffic-eng level-1	Configures MPLS TE for IS-IS. You can enable MPLS for level 1, level 2, or level 1 and level 2 routers.
Step 5	**mpls traffic-eng router-id** *interface* **Example:** switch(config-router)# mpls traffic-eng router-id loopback0	Specifies that the TE router identifier for the node is the IP address associated with the configured interface.
Step 6	**show running-config isis** **Example:** switch(config-router)# show running-config isis	(Optional) Displays information about the IS-IS configuration.
Step 7	**copy running-config startup-config** **Example:** switch(config-router)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Configuring OSPF for MPLS TE

You can configure OSPF for MPLS TE.

Note MPLS TE supports a single IGP process or instance. You should not configure MPLS TE in more than one IGP process or instance.

Prerequisites

You must have the MPLS TE feature enabled (see the "Configuring MPLS TE" section on page 10-139).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

Note You can configure a router running OSPF so that Protocol-Independent Multicast (PIM) and MPLS TE can work together with the **mpls traffic-eng multicast-intact** command. You can disable the interoperability between PIM and MPLS TE with the **no mpls traffic-eng multicast-intact** command.

1. **configure terminal**
2. **feature ospf**
3. **router ospf** *instance-tag*
4. **mpls traffic-eng area** *area-id*
5. **mpls traffic-eng router-id** *interface*
6. (Optional) **show running-config ospf**
7. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	**configure terminal** **Example:** switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	**feature ospf** **Example:** switch(config)# feature ospf	Enables the IS-IS feature.
Step 3	**router ospf** *instance-tag* **Example:** switch(config)# router ospf 200 switch(config-router)#	Configures an OSPF routing instance and enters router configuration mode. The *instance-tag* can be any case-sensitive, alphanumeric string up to 20 characters.
Step 4	**mpls traffic-eng area** *area-id* **Example:** switch(config-router)# mpls traffic-eng area 1	Turns on MPLS TE for the indicated OSPF area. The *area-id* argument can be an IP address or a positive integer.
Step 5	**mpls traffic-eng router-id** *interface* **Example:** switch(config-router)# mpls traffic-eng router-id loopback0	Specifies that the TE router identifier for the node is the IP address associated with the configured interface.
Step 6	**show running-config ospf** **Example:** switch(config-router)# show running-config ospf	(Optional) Displays information about the OSPF configuration.
Step 7	**copy running-config startup-config** **Example:** switch(config-router)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Configuring MPLS TE on an Interface

You can configure MPLS TE on a TE tunnel egress interface.

Prerequisites

You must have the MPLS TE feature enabled (see the "Configuring MPLS TE" section on page 10-139).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **interface** *type slot/port*
3. **mpls traffic-eng tunnels**
4. **mpls traffic-eng bandwidth** [*interface-kbps* | **percent** *percentage*]

5. **no shut**
6. (Optional) **show interface** *type slot/port*
7. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	**configure terminal** **Example:** switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	**interface** *type slot*/*port* **Example:** switch(config)# interface ethernet 2/1 switch(config-if)#	Configures an interface type and enters interface configuration mode. Use **?** to see a list of supported interfaces.
Step 3	**mpls traffic-eng tunnels** **Example:** switch(config-if)# mpls traffic-eng tunnels	Enables MPLS TE tunnels on an interface.
Step 4	**mpls traffic-eng bandwidth** [*interface-kbps* | **percent** *percentage*] **Example:** switch(config-if)# mpls traffic-eng bandwidth 1000	Allocates the MPLS TE bandwidth pool for the interface. The *interface-kbps* argument specifies the maximum amount of bandwidth (in kbps) that may be allocated by TE flows. The range is from 1 to 10000000. The *percentage* argument specifies the maximum percentage of the link bandwidth that may be allocated by TE flows. The range is from 1 to 100.
Step 5	**no shut** **Example:** switch(config-if)# no shut	Activates the interface.
Step 6	**show interface** *type slot*/*port* **Example:** switch(config-if)# show interface ethernet 2/1	(Optional) Displays information about an interface. Use **?** to see a list of supported interfaces.
Step 7	**copy running-config startup-config** **Example:** switch(config-if)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Configuring an MPLS TE Tunnel

You can configure an MPLS TE tunnel with a preferred explicit path or a backup dynamic path option.

Note This configuration applies only to the TE headend node.

Prerequisites

You must have the MPLS TE feature enabled (see the "Configuring MPLS TE" section on page 10-139).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **interface tunnel-te** *number*
3. **ip unnumbered** *type slot/port*
4. **destination** {*ip-address*}
5. (Optional) **bandwidth** *bandwidth*
6. (Optional) **auto-bw**
7. **path-option** [**protect**] *preference-number* {**dynamic** | **explicit** {**identifier** *id* | **name** *name*} [**verbatim**]} [**lockdown**] [**bandwidth** *kbps*] [**attributes** *listname*]
8. (Optional) **autoroute announce**
9. (Optional) priority
10. **no shutdown**
11. (Optional) **show running-config interface** *int*
12. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose

Step 1	**configure terminal**
	
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface tunnel-te** *number*
	
	Example:
	`switch(config)# interface tunnel-te 1`
	`switch(config-if-te)#`
		Enters TE interface configuration mode. The *number* argument range is from 0 to 65503.

Step 3	**ip unnumbered** *type slot/port* **Example:** `switch(config-if-te)# ip unnumbered loopback 0`	Gives the tunnel interface an IP address that is the same as that of the configured interface. An MPLS TE tunnel interface should use a stable address such as one obtained from a loopback interface. Use **?** to see a list of supported interfaces. **Note** This command is not effective until Lookback0 has been configured with an IP address.
Step 4	**destination** {*ip-address*} **Example:** `switch(config-if-te)# destination 10.3.3.3`	Specifies the destination for a tunnel. The destination must be the MPLS TE router ID of the destination device or the hostname. The *ip-address* is in dotted-decimal notation.
Step 5	**bandwidth** *bandwidth* **Example:** `switch(config-if-te)# bandwidth 250`	(Optional) Configures the bandwidth for the MPLS TE tunnel. The *bandwidth* argument is the bandwidth, in kilobits per second, set for the MPLS TE tunnel. The range is from 1 to 4294967295. The default is 0. If automatic bandwidth is configured for the tunnel, you can use the **bandwidth** command to configure the initial tunnel bandwidth, which will be adjusted by the auto bandwidth mechanism.
Step 6	**auto-bw** **Example:** `switch(config-if-te)# auto-bw`	(Optional) Enables automatic bandwidth changes for the tunnel. You can use the **bandwidth** command to configure the initial tunnel bandwidth, which will be adjusted by the auto bandwidth mechanism.

	Command	Purpose
Step 7	**path-option** [**protect**] *preference-number* {**dynamic** | **explicit** {**identifier** *id* | **name** *name*} [**verbatim**]} [**lockdown**] [**bandwidth** *kbps*] [**attributes** *listname*] **Example:** switch(config-if-te)# path-option 10 explicit name Link5	Configures the tunnel to use a named IP explicit path or a path dynamically calculated from the TE topology database. The *preference-number* range is from 1 to 1000. The *id* range is from 1 to 65535 (with lower numbers preferred). The *name* is any case-sensitive, alphanumeric string. The *kbps* range is from 1 to 4294967295. The *listname* is any case-sensitive, alphanumeric string up to 63 characters. **Note** You can configure multiple path options. TE signals the lowest numbered path option that is valid and meets the constraints. For example, you can specify an explicit path option, and then a less preferred dynamic path option. If the explicit path is not available, then the less preferred dynamic path option is tried.
Step 8	**autoroute announce** **Example:** switch(config-if-te)# autoroute announce	(Optional) Specifies that the IGP should use the tunnel (if the tunnel is up) in its enhanced shortest path first (SPF) calculation.
Step 9	priority Example: switch(config-if-te)# priority	(Optional) Assigns a priority to traffic.
Step 10	**no shutdown** **Example:** switch(config-if-te)# no shutdown	Activates the interface.
Step 11	**show running-config interface** *int* **Example** switch(config-if-te)# show running-config interface tunnel-ts 1	(Optional) Displays information about the interface configuration.
Step 12	**copy running-config startup-config** **Example:** switch(config-if-te)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Configuring Cost Limit

The following are the steps to configure cost limit for an individual TE tunnel:

Step 1 Enter global configuration mode:

switch# **configure terminal**

Step 2 Enter TE interface configuration mode:

switch(config)# **interface tunnel-te** *number*

Step 3 Enter the maximum permitted cost for the tunnel path:

switch(config-if)# **cost-limit** *max-cost*

Configuring an Explicit Path

You can configure an explicit LSP path on the headend router.

Prerequisites

You must have the MPLS TE feature enabled (see "Configuring MPLS TE" section on page 10-139).

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

SUMMARY STEPS

1. **configure terminal**
2. **mpls traffic-eng configuration**
3. **explicit-path** {**identifier** *id* | **name** *name*}
4. [**index** *number*] {**next-address** [**loose** | **strict**] | **exclude-address**} *address*
5. Repeat step 4 for each router in the path.
6. (Optional) **shutdown**
7. (Optional) **show running-config mpls**
8. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	**configure terminal** **Example:** switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	**mpls traffic-eng configuration** **Example:** switch(config)# mpls traffic-eng configuration switch(config-te)#	Enters MPLS TE configuration mode.
Step 3	**explicit-path** {**identifier** *id* | **name** *name*} **Example:** switch(config-te)# explicit-path name Link5	Enters explicit path configuration mode and creates or modifies the specified path. The *id* range is from 1 to 65535. The *name* is any case-sensitive, alphanumeric string.
Step 4	[**index** *number*] {**next-address** [**loose** | **strict**] | **exclude-address**} *address* **Example:** switch(config-te-expl-path)# index 10 next-address 10.3.3.3	Inserts or modifies a path entry at a specific index. The number range is from 1 to 65535. The *address* represents the node ID and is an IP address in dotted-decimal notation. If you omit the **index** *number* option, multiple command statements are applied in the order in which they are entered. • **Loose** specifies that the previous address (if any) in the explicit path does not need to be directly connected to the next IP address, and that the router is free to determine the path from the previous address (if any) to the next IP address. • **Strict** specifies that the previous address (if any) in the explicit path must be directly connected to the next IP address. • **Exclude-address** excludes an address from subsequent partial path segments. You can enter the IP address of a link or the router ID of a node.
Step 5	Repeat step 4 for each router in the path.	—
Step 6	**shutdown** **Example:** switch(config-te-expl-path)# shutdown	(Optional) Disables the explicit path without deleting the configuration.

	Command	Purpose
Step 7	**show running-config mpls** **Example:** `switch(config-te-expl-path)# show running-config mpls`	(Optional) Displays information about the MPLS configuration.
Step 8	**copy running-config startup-config** **Example:** `switch(config-te-expl-path)# copy running-config startup-config`	(Optional) Copies the running configuration to the startup configuration.

Verifying the MPLS TE Configuration

To display the MPLS TE configuration, perform one of the following tasks:

Command	Purpose
show mpls traffic-eng	Displays information about MPLS TE.
show mpls traffic-eng tunnels	Displays information about configured MPLS TE tunnels at the head and signaled TE LSPs at other hops.
show run mpls traffic-eng	Displays information about the running configuration of the MPLS TE feature.
show mpls traffic-eng link-management summary	Displays summary information about the MPLS TE link management.
show mpls traffic-eng explicit-paths	Displays information about the MPLS TE explicit paths.
show mpls traffic-eng tunnels brief	Displays brief information about MPLS TE tunnels.
show ip route	Displays the MPLS TE ip route.

For detailed information about the fields in the output from these commands, see the *Cisco NX-OS MPLS Command Reference*.

Logging Label Switched Path (LSP) Events

Logging helps you monitor your networks. You can configure logging of different events related to tunnels and Label Switched Paths.

All log messages include the following information:

- Name of the tunnel
- Signaled name of the tunnel
- LSP ID of the current LSP

All log messages can be configured on a per-tunnel basis or globally for all TE tunnels. If logging is enabled globally, you cannot disable it for an individual tunnel.

Configuring Tunnel-State Logging

You can configure the generation of syslogs (system messages) when a TE tunnel changes its operational state. A system message is logged to indicate that the tunnel has come up or gone down when either of these events occur. This is in addition to any system message generated by the interface management infrastructure.

No system message is logged if this feature is not configured.

In addition to the information included for all the tunnel log messages, this log contains the new state of the tunnel.

DETAILED STEPS

The following are the steps to configure tunnel-state logging for an individual TE tunnel:

Step 1 Enter global configuration mode:

```
switch# configure terminal
```

Step 2 Enter TE interface configuration mode:

```
switch(config)# interface tunnel-te number
```

Step 3 Configure tunnel state logging:

```
switch(config-te-if)# logging tunnel state
```

The following are the steps to configure tunnel state logging for all the TE tunnels:

Step 1 Enter global configuration mode:

```
switch(config)# configure terminal
```

Step 2 Enter traffic engineering global configuration mode:

```
switch(config)# mpls traffic-eng configuration
```

Step 3 Configure tunnel-state logging:

```
switch(config-te)# logging tunnel state
```

Configuring Tunnel Reoptimization Logging

You can configure a TE tunnel to generate system logs when it is reoptimized successfully. If this feature is configured, and a tunnel is reoptimized, a system message is logged.

Reoptimization messages are not logged under the following conditions:

- Reoptimization Logging feature is not configured
- If a reoptimization attempt does not result in a better path than the current one.
- If a reoptimization is abandoned before completion.

In addition to the information included for all the tunnel log messages, this message includes:

- The ID of the previously used LSP (the LSP that is replaced by reoptimization)

- The reoptimization trigger that caused this attempt.

The following are the steps to configure system logs for an individual tunnel when it attempts reoptimization:

Step 1 Enter global configuration mode:

```
switch# configure terminal
```

Step 2 Enter TE interface configuration mode:

```
switch(config)# interface tunnel-te number
```

Step 3 Configure reoptimization logging:

```
switch(config-te-if)# logging tunnel reoptimize
```

The following are the steps to configure system logs for all tunnels when they are successfully reoptimized:

Step 1 Enter global configuration mode:

```
switch(config)# configure terminal
```

Step 2 Enter traffic engineering global configuration mode:

```
switch(config)# mpls traffic-eng configuration
```

Step 3 Configure re-optimization logging:

```
switch(config-te)# logging tunnel reoptimize
```

Configuring Tunnel Reroute Logging

You can configure a TE tunnel to generate system logs when its reroute-pending state changes. If this feature is configured, and the tunnel has either entered or exited reroute-pending state, a system message is logged.

The reroute pending state bandwidth-change messages are not logged under the following conditions:

- Reroute logging feature is not configured.
- If the tunnel exits the reroute-pending state by going down.

In addition to the information included for all tunnel log messages, this message includes:

- The reason for the tunnel entering reroute-pending state
- The previous LSP's ID (on exit from the reroute-pending state).

The following are the steps to configure system logs for an individual tunnel when its reroute-pending changes:

Step 1 Enter global configuration mode:

```
switch# configure terminal
```

Step 2 Enter TE interface configuration mode:

switch(config)# **interface tunnel-te** *number*

Step 3 Configure reroute-pending change logging:

switch(config-te-if)# **logging tunnel reroute**

The following are the steps to configure system logs for all the tunnels when their reroute-pending changes:

Step 1 Enter global configuration mode:

switch(config)# **configure terminal**

Step 2 Enter traffic engineering global configuration mode:

switch(config)# **mpls traffic-eng configuration**

Step 3 Configure reroute-pending change logging:

switch(config-te)# **logging tunnel reroute**

Configuring Logging of All the TE Tunnel Events

You can configure generation of system logs for all TE tunnel events other than the ones listed above.

The following are the steps to configure all the system logs for an individual TE tunnel:

Step 1 Enter global configuration mode:

switch# **configure terminal**

Step 2 Enter TE interface configuration mode:

switch(config)# **interface tunnel-te** *number*

Step 3 Configure logging of all system logs:

switch(config-te-if)# **logging tunnel all**

The following are the steps to configure system logs for all tunnels when any event occurs:

Step 1 Enter global configuration mode:

switch(config)# **configure terminal**

Step 2 Enter traffic engineering global configuration mode:

switch(config)# **mpls traffic-eng configuration**

Step 3 Configure logging all system messages:

switch(config-te)# **logging tunnel all**

Logging Fast Reroute (FRR) Events

You can configure the logging of global messages that are not related to an individual tunnel. All these messages are configured globally. You cannot enable or disable a global message on a per-tunnel or per-interface basis.

Configuring Fast Reroute Backup Assignment Logging

You can configure the generation of system logs when a primary LSP is assigned an FRR backup.

If FRR backup and FRR-ready logging are both configured, the initial backup assignment for a new primary LSP will generate two separate system logs.

The information included in this log is:

- The name and current LSP ID of the backup tunnel.
- The signaled name, source, destination and LSP ID of the protected LSP.
- The type of protection.

The following are the steps to configure FRR backup assignment:

Step 1 Enter global configuration mode:

switch(config)# **configure terminal**

Step 2 Enter traffic engineering global configuration mode:

switch(config)# **mpls traffic-eng configuration**

Step 3 Configure FRR backup assignment logging:

switch(config-te)# **logging events frr-protection backup**

Configuring Fast Reroute-Ready Logging

You can configure the generation of system logs when a primary LSP moves to the FRR-ready state on assigning a backup tunnel.

A change in the backup tunnel for LSP does not trigger a system log.

The information included in this log are:

- The name and current LSP ISD of the backup tunnel.
- The signaled name, source, destination and LSP ID of the protected LSP.
- The type of protection.

The following are steps to configure FRR ready logging:

Step 1 Enter global configuration mode:

switch(config)# **configure terminal**

Step 2 Enter traffic engineering global configuration mode:

switch(config)# **mpls traffic-eng configuration**

Step 3 Configure FRR-ready logging:

switch(config-te)# **logging events frr-protection primary ready**

Configuring Fast Reroute-Active Logging

You can configure the generation of system logs when a protected primary LSP transitions to the FRR-active state.

A change in backup tunnel for LSP does not trigger a system log.

The information included in this log are:

- The name and current LSP-id of the backup tunnel.
- The signaled name, source, destination and LSP ID of the protected LSP.
- The type of protection.

The following are the steps to configure FRR-active logging:

Step 1 Enter global configuration mode:

switch(config)# **configure terminal**

Step 2 Enter traffic engineering global configuration mode:

switch(config)# **mpls traffic-eng configuration**

Step 3 Configure FRR-active logging:

switch(config-te)# **logging events frr-protection primary active**

Configuring All FRR Logging

You can configure the generation of system logs when an FRR event occurs. When configured, a system message is logged to indicate changes to FRR protection.

The information included in this log are:

- The name and current LSP ID of the backup tunnel.
- The signaled-name, source, destination and LSP ID of the protected LSP.
- The type of protection.

The following are the steps to configure all FRR logging:

Step 1 Enter global configuration mode:

switch(config)# **configure terminal**

Step 2 Enter traffic engineering global configuration mode:

switch(config)# **mpls traffic-eng configuration**

Step 3 Configure logging all events of FRR:

switch(config-te)# **logging events frr-protection all**

Configuring Logging of All Global Events

You can configure the generation of system logs for all non-tunnel TE events.

The following are the steps to configure logging of all nontunnel TE events:

Step 1 Enter global configuration mode:

switch(config)# **configure terminal**

Step 2 Enter traffic engineering global configuration mode:

switch(config)# **mpls traffic-eng configuration**

Step 3 Configure logging of all global events:

switch(config-te)# **logging events all**

Configuration Examples for MPLS TE

This section includes the following configuration examples:

Example: Enabling MPLS TE Using IS-IS

The following example shows how to enable MPLS TE with IS-IS routing:

Enter the following commands on every router or switch in the traffic-engineered portion of your network.

```
feature isis
feature mpls traffic-engineering
router isis 100
 mpls traffic-eng level-1
 mpls traffic-eng router-id loopback0
```

Example: Enabling MPLS TE Using OSPF

The following example shows how to enable MPLS TE with OSPF routing:

Enter the following commands on every router or switch in the traffic-engineered portion of your network.

```
feature ospf
feature mpls traffic-engineering
router ospf 100
 mpls traffic-eng area 0
 mpls traffic-eng router-id loopback0
```

Example: Configuring MPLS TE on an Interface

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

```
feature mpls traffic-engineering
interface Ethernet 9/1
 mpls traffic-eng tunnels
 mpls traffic-eng bandwidth 1000
 no shut
```

Note The interface must be configured to be used by the IGP. In ISIS, you would have something like the following syntax:

```
ip router isis p1
```

Example: Configuring an MPLS TE Tunnel

The following example shows how to configure a TE tunnel:

```
feature mpls traffic-engineering
interface tunnel-te 1
 ip unnumbered loopback 0
 destination 10.3.3.3
 bandwidth 250
 path-option 10 explicit name Link5
 path-option 20 dynamic
 autoroute announce
 no shut
```

Example: Creating an Explicit Path

The following example shows how to configure an explicit path:

```
feature mpls traffic-engineering
mpls traffic-eng configuration
explicit-path name Link5
 next-address 10.1.1.21
 next-address 10.1.1.10
 next-address 10.1.1.1
 next-address 10.1.1.14
```

Additional References for MPLS TE

For additional information related to implementing MPLS TE, see the following sections:

- Related Document, page 10-158

- MIBs, page 10-158

Related Document

Related Topic	Document Title
MPLS TE commands	*Cisco NX-OS MPLS Command Reference*
MPLS feature set	"Configuring the MPLS Feature Set" chapter

MIBs

MIB	MIBs Link
• CISCO-IETF-FRR-MIB • MPLS TE-STD-MIB	To locate and download Cisco MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: https://cfnng.cisco.com/mibs

Feature Information for MPLS TE

Table 10-2 lists the release history for this feature.

Table 10-2 Feature Information for MPLS TE

Feature Name	Releases	Feature Information
MPLS TE Cost Limit	7.3(0)D1(1)	This feature enables you to specify the maximum permitted total cost for a tunnel's path.
Logging FRR and LSP events	7.3(0)D1(1)	This feature enables you to generate system messages for different events related to TE tunnels and LSPs.
MPLS TE	5.2(1)	This feature was introduced.