MPLS Traffic Engineering (TE)—Automatic Bandwidth Adjustment for TE Tunnels

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The MPLS Traffic Engineering (TE)—Automatic Bandwidth Adjustment for TE Tunnels feature allows you to automatically adjust the bandwidth allocation for traffic engineering tunnels based on the tunnel's measured traffic load. The configured bandwidth in the running configuration is changed due to the automatic bandwidth behavior.

Finding Feature Information

For the latest feature information and caveats, see the release notes for your platform and 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 "Feature Information for MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels" section on page 18.

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

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Prerequisites for MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels

Your network must support the following Cisco IOS XE features before configure the MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels feature:

- Multiprotocol Label Switching (MPLS) traffic engineering tunnels
- Cisco Express Forwarding
- Intermediate System-to-Intermediate System (IS-IS) or Open Shortest Path First (OSPF)

Restrictions for MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels

- The automatic bandwidth adjustment feature treats each tunnel for which it has been enabled independently. That is, it adjusts the bandwidth for each such tunnel according to the adjustment frequency configured for the tunnel and the sampled output rate for the tunnel since the last adjustment without regard for any adjustments previously made or pending for other tunnels.
- If a tunnel is brought down to calculate a new label switched path (LSP) because the LSP is not operational, the configured bandwidth is not saved. If the router is reloaded, the last saved automatic bandwidth value is used.
- You cannot configure MPLS TE over the logical generic routing encapsulation (GRE) tunnel interface.
- MPLS traffic engineering supports only a single IGP process/instance. Multiple IGP processes/instances are not supported and MPLS traffic engineering should not be configured in more than one IGP process/instance.

Information About MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels

MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels Overview

Traffic engineering autobandwidth samples the average output rate for each tunnel marked for automatic bandwidth adjustment. For each marked tunnel, the feature periodically (for example, once per day) adjusts the tunnel's allocated bandwidth to be the largest sample for the tunnel since the last adjustment.

The frequency with which tunnel bandwidth is adjusted and the allowable range of adjustments is configurable on a per-tunnel basis. In addition, the sampling interval and the interval over which to average tunnel traffic to obtain the average output rate is user-configurable on a per-tunnel basis.

MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels Benefits

The automatic bandwidth feature makes it easy to configure and monitor the bandwidth for MPLS TE tunnels. If automatic bandwidth is configured for a tunnel, TE automatically adjusts the tunnel's bandwidth.

How to Configure MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels

Configuring a Platform to Support Traffic Engineering Tunnels

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip cef distributed**
4. **mpls traffic-eng tunnels**
5. **exit**

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	**ip cef distributed** **Example:** `Router(config)# ip cef distributed`	Enables distributed Cisco Express Forwarding operation.
Step 4	**mpls traffic-eng tunnels** **Example:** `Router(config)# mpls traffic-eng tunnels`	Enables the MPLS traffic engineering tunnel feature on a device.
Step 5	**exit** **Example:** `Router(config)# exit`	Exits to privileged EXEC mode.

Configuring IS-IS for MPLS Traffic Engineering

Note MPLS traffic engineering supports only a single IGP process/instance. Multiple IGP processes/instances are not supported and MPLS traffic engineering should not be configured in more than one IGP process/instance.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis**
4. **mpls traffic-eng level-1**
5. **mpls traffic-eng router-id loopback0**
6. **metric-style wide**
7. **exit**
8. **exit**

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	**router isis** **Example:** `Router(config)# router isis`	Enables IS-IS routing and specifies an IS-IS process for IP. This command places you in router configuration mode.
Step 4	**mpls traffic-eng level-1** **Example:** `Router(config-router)# mpls traffic-eng level-1`	Turns on MPLS traffic engineering for IS-IS level 1.
Step 5	**mpls traffic-eng router-id loopback0** **Example:** `Router(config-router)# mpls traffic-eng router-id loopback0`	Specifies that the traffic engineering router identifier for the node is the IP address associated with interface loopback0.
Step 6	**metric-style wide** **Example:** `Router(config-router)# metric-style wide`	Configures a router to generate and accept only new-style type, length, value objects (TLVs).
Step 7	**exit** **Example:** `Router(config-router)# exit`	Exits to global configuration mode.
Step 8	**exit** **Example:** `Router(config)# exit`	Exits to privileged EXEC mode.

Configuring OSPF for MPLS Traffic Engineering

Note MPLS traffic engineering supports only a single IGP process/instance. Multiple IGP processes/instances are not supported and MPLS traffic engineering should not be configured in more than one IGP process/instance.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router ospf** *process-id*
4. **mpls traffic-eng area** *number*
5. **mpls traffic-eng router-id loopback0**
6. **exit**
7. **exit**

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	**router ospf** *process-id* **Example:** `Router(config)# router ospf 200`	Configures an OSPF routing process for IP and enters router configuration mode. • The *process-id* is an internally used identification parameter for an OSPF routing process. It is locally assigned and can be any positive integer. Assign a unique value for each OSPF routing process.
Step 4	**mpls traffic-eng area** *number* **Example:** `Router(config-router)# mpls traffic-eng area 0`	Turns on MPLS traffic engineering for the indicated OSPF area.
Step 5	**mpls traffic-eng router-id loopback0** **Example:** `Router(config-router)# mpls traffic-eng router-id loopback0`	Specifies that the traffic engineering router identifier for the node is the IP address associated with interface loopback0.
Step 6	**exit** **Example:** `Router(config-router)# exit`	Exits to global configuration mode.
Step 7	**exit** **Example:** `Router(config)# exit`	Exits to privileged EXEC mode.

Configuring an MPLS Traffic Engineering Tunnel

The MPLS TE tunnel has two path setup options: a preferred explicit path and a backup dynamic path.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface tunnel** *number*
4. **ip unnumbered** *interface-type interface-number*
5. **tunnel destination** *ip-address*
6. **tunnel mode mpls traffic-eng**
7. **tunnel mpls traffic-eng bandwidth** *bandwidth*
8. **tunnel mpls traffic-eng path-option** [**protect**] *number* {**dynamic** | **explicit** {**name** *path-name* | **identifier** *path-number*}} [**lockdown**]
9. **exit**
10. **exit**

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 tunnel** *number* **Example:** `Router(config)# interface tunnel 1`	Configures a tunnel interface and enters interface configuration mode.
Step 4	**ip unnumbered** *interface-type interface-number* **Example:** `Router(config-if)# ip unnumbered loopback 0`	Gives the tunnel interface an IP address that is the same as that of interface Loopback0. • An MPLS traffic engineering tunnel interface should be unnumbered because it represents a unidirectional link. **Note** This command is not effective until Lookback0 has been configured with an IP address.
Step 5	**tunnel destination** *ip-address* **Example:** `Router(config-if)# tunnel destination 10.3.3.3`	Specifies the destination for a tunnel. The destination must be the MPLS traffic engineering router ID of the destination device.

	Command or Action	Purpose
Step 6	**tunnel mode mpls traffic-eng** **Example:** `Router(config-if)# tunnel mode mpls traffic-eng`	Sets the encapsulation mode of the tunnel to MPLS traffic engineering.
Step 7	**tunnel mpls traffic-eng bandwidth** *bandwidth* **Example:** `Router(config-if)# tunnel mpls traffic-eng bandwidth 250`	Configures the bandwidth for the MPLS traffic engineering tunnel. • The bandwidth argument is the bandwidth, in kilobits per second, set aside for the MPLS traffic engineering tunnel. Range is from 1 to 4294967295. The default is 0. • If automatic bandwidth is configured for the tunnel, the **tunnel mpls traffic-eng bandwidth** command configures the initial tunnel bandwidth, which will be adjusted by the autobandwidth mechanism. **Note** If you configure a tunnel's bandwidth with the **tunnel mpls traffic-eng bandwidth** command and the minimum amount of automatic bandwidth with the **tunnel mpls traffic-eng auto-bw** command, the minimum amount of automatic bandwidth adjustment is the lower of those two configured values.
Step 8	**tunnel mpls traffic-eng path-option** [**protect**] *number* {**dynamic** | **explicit** {**name** *path-name* | **identifier** *path-number*}}[**lockdown**] **Example:** `Router(config-if)# tunnel mpls traffic-eng path-option 10 explicit avoid-protected-link`	Configures the tunnel to use a named IP explicit path or a path dynamically calculated from the traffic engineering topology database. • A dynamic path is used if an explicit path is currently unavailable.
Step 9	**exit** **Example:** `Router(config-if)# exit`	Exits to global configuration mode.
Step 10	**exit** **Example:** `Router(config)# exit`	Exits to privileged EXEC mode.

Troubleshooting Tips

Each **tunnel mpls traffic-eng auto-bw** command supersedes the previous one. Therefore, if you want to specify multiple options for a tunnel, you must specify them all in a single **tunnel mpls traffic-eng auto-bw** command.

Configuring Bandwidth on Each Link That the Tunnels Cross

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type slot/subslot/port*[**.***subinterface-number*]
4. **mpls traffic-eng tunnels**
5. **ip rsvp bandwidth** [*interface-kbps*] [*single-flow-kbps*] [**sub-pool** *kbps*]
6. **exit**
7. **exit**

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 slot/subslot/port*[**.***subinterface-number*] **Example:** `Router(config)# interface FastEthernet0/0/0`	Configures an interface type and enters interface configuration mode
Step 4	**mpls traffic-eng tunnels** **Example:** `Router(config-if)# mpls traffic-eng tunnels`	Enables MPLS traffic engineering tunnels on an interface.
Step 5	**ip rsvp bandwidth** [*interface-kbps*] [*single-flow-kbps*] [**sub-pool** *kbps*] **Example:** `Router(config-if)# ip rsvp bandwidth 1000 100`	Enables Resource reservation Protocol (RSVP) for IP on an interface. • The *interface-kbps* argument specifies the maximum amount of bandwidth (in kbps) that may be allocated by RSVP flows. The range is from 1 to 10,000,000. • The *single-flow-kbps* argument is the maximum amount of bandwidth, in kbps, that may be allocated to a single flow. The range is from 1 to 10,000,000.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Router(config-if)# exit`	Exits to global configuration mode.
Step 7	**exit** **Example:** `Router(config)# exit`	Exits to privileged EXEC mode.

Configuring a Platform to Support Automatic Bandwidth Adjustment

To enable automatic bandwidth adjustment on a platform and initiate sampling the output rate for tunnels configured for bandwidth adjustment, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls traffic-eng auto-bw timers** [**frequency** *seconds*]
4. **no mpls traffic-eng auto-bw timers**
5. **exit**

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	**mpls traffic-eng auto-bw timers** [**frequency** *seconds*] **Example:** `Router(config)# mpls traffic-eng auto-bw timers frequency 300`	Enables automatic bandwidth adjustment on a platform and begins sampling the output rate for tunnels that have been configured for automatic bandwidth adjustment. • The **frequency** keyword specifies the interval, in seconds, for sampling the output rate of each tunnel configured for automatic bandwidth. The range is 1 through 604800. The recommended value is 300.

	Command or Action	Purpose
Step 4	**no mpls traffic-eng auto-bw timers** **Example:** `Router(config)# no mpls traffic-eng auto-bw timers`	(Optional) Disables automatic bandwidth adjustment on a platform. • Use the **no** version of the command, which terminates output rate sampling and the bandwidth adjustment for tunnels. In addition, the **no** form of the command restores the configured bandwidth for each tunnel where configured bandwidth is determined as follows: – If the tunnel bandwidth was explicitly configured via the **tunnel mpls traffic-eng bandwidth** command after the running configuration was written (if at all) to the startup configuration, the "configured bandwidth" is the bandwidth specified by that command. – Otherwise, the configured bandwidth is the bandwidth specified for the tunnel in the startup configuration.
Step 5	**exit** **Example:** `Router(config)# exit`	Exits to privileged EXEC mode.

Configuring Automatic Bandwidth Adjustment for a Tunnel

To enable automatic bandwidth adjustment for a tunnel and constrain the range of automatic bandwidth adjustments applied to the tunnel, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface tunnel** *number*
4. **tunnel mpls traffic-eng auto-bw** [**max-bw** *number*] [**min-bw** *number*]
5. **exit**
6. **exit**

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 tunnel** *number* **Example:** `Router(config)# interface tunnel 1`	Configures a tunnel interface and enters interface configuration mode.
Step 4	**tunnel mpls traffic-eng auto-bw** [**max-bw** *number*] [**min-bw** *number*] **Example:** `Router(config-if)# tunnel mpls traffic-eng auto-bw max-bw 2000 min-bw 1000`	Enables automatic bandwidth adjustment for the tunnel. • The **max-bw** keyword specifies the maximum automatic bandwidth, in kbps, for this tunnel. The range is from 0 to 4294967295. • The **min-bw** keyword specifies the minimum automatic bandwidth, in kbps, for this tunnel. The range is from 0 to 4294967295.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Exits to global configuration mode.
Step 6	**exit** **Example:** `Router(config)# exit`	Exits to privileged EXEC mode.

Configuring the Interval for Computing Tunnel Average Output Rate

To specify the interval for computing the average output rate for an MPLS traffic engineering tunnel, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface tunnel** *number*
4. **load-interval** *seconds*
5. **exit**
6. **exit**

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 tunnel** *number* **Example:** `Router(config)# interface tunnel 1`	Configures a tunnel interface and enters interface configuration mode.
Step 4	**load-interval** *seconds* **Example:** `Router(config-if)# load-interval 90`	Configures the interval over which the input and output rates for the interface are averaged. • The *seconds* argument is the length of time for which data is used to compute load statistics. The value is a multiple of 30, from 30 to 600 (30, 60, 90, 120, and so on). The default is 300 seconds.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Exits to global configuration mode.
Step 6	**exit** **Example:** `Router(config)# exit`	Exits to privileged EXEC mode.

Verifying the Automatic Bandwidth Configuration

SUMMARY STEPS

1. **enable**
2. **show mpls traffic-eng tunnels**
3. **show running-config**
4. **exit**

DETAILED STEPS

Step 1 **enable**

Use this command to enter privileged EXEC mode. Enter you password if prompted. For example:

```
Router> enable
Router#
```

Step 2 **show mpls traffic-eng tunnels**

Use this command to show information about tunnels, including automatic bandwidth information for tunnels that have the feature enabled. For example:

```
Router# show mpls traffic-eng tunnels

Name:tagsw4500-9_t1                       (Tunnel1) Destination:10.0.0.11
  Status:
    Admin:up         Oper:up     Path:valid       Signalling:connected

    path option 1, type explicit pbr_south (Basis for Setup, path weight 30)
    path option 2, type dynamic

  Config Parameters:
    Bandwidth:5000     kbps (Global)  Priority:7  7   Affinity:0x0/0xFFFF
    AutoRoute: disabled  LockDown:disabled  Loadshare:5000     bw-based
    auto-bw:(86400/85477) 5347 Bandwidth Requested:5000
```

In the command output:

- The auto-bw line indicates that automatic bandwidth adjustment is enabled for the tunnel.
- 86400 is the time, in seconds, between bandwidth adjustments.
- 85477 is the time, in seconds, remaining until the next bandwidth adjustment.
- 5347 is the largest bandwidth sample since the last bandwidth adjustment.
- 5000 is the last bandwidth adjustment and the bandwidth currently requested for the tunnel.

Step 3 **show running-config**

Use this command to verify that the MPLS TE automatic bandwidth command is as you expected. For example:

```
Router# show running-config
.
.
.
interface tunnel1
  ip unnumbered loopback 0
  tunnel destination 192.168.17.17 255.255.255.0
  tunnel mode mpls traffic-eng
  tunnel mpls traffic-eng bandwidth 1500
  tunnel mpls traffic-eng priority 1 1
  tunnel mpls traffic-eng path-option 1 dynamic
  tunnel mpls traffic-eng auto bw max-bw 2000 min-bw 1000   !Enable automatic bandwidth
.
.
.
```

The sample output from the **show running-config** command shows that the value 1500, in the **tunnel mpls traffic-eng bandwidth 1500** command, changes after an adjustment is made.

Step 4 **exit**

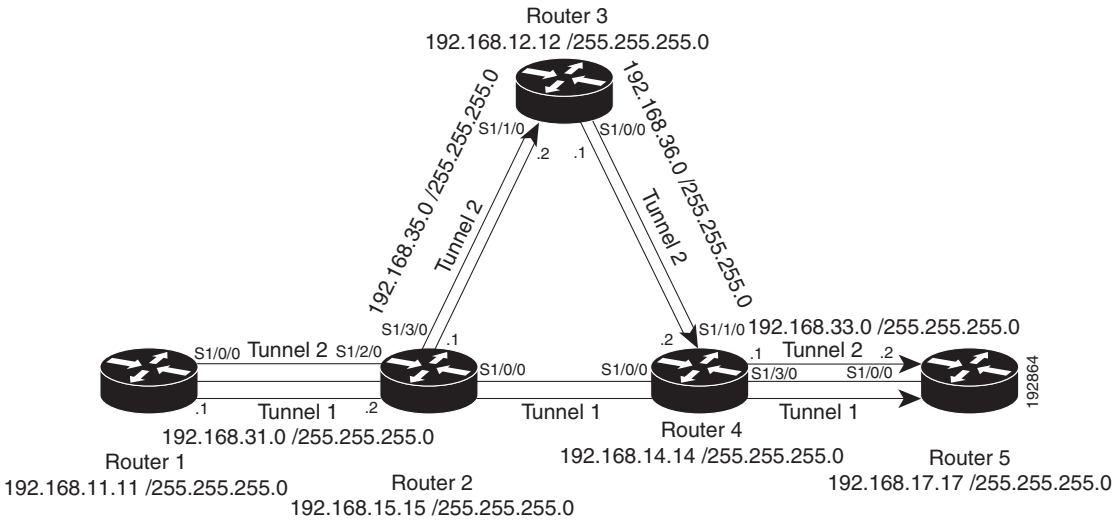
Use this command to exit to user EXEC mode. For example:

```
Router# exit
Router>
```

Configuration Examples for MPLS TE—Automatic Bandwidth Adjustments for TE Tunnels

Figure 1 illustrates a sample MPLS topology. The following sections contain sample configuration examples to configure automatic bandwidth adjustment for MPLS traffic engineering tunnels originating on Router 1 and to enable automatic bandwidth adjustment for Tunnel1.

Figure 1 Sample MPLS Traffic Engineering Tunnel Configuration



This section provides the following configuration examples based on Figure 1:

- Example: Configuring MPLS Traffic Engineering Automatic Bandwidth, page 15
- Example: Tunnel Configuration for Automatic Bandwidth, page 16

The examples omit some configuration required for MPLS traffic engineering, such as the required RSVP and Interior Gateway Protocol (IGP) (IS-IS or OSPF) configuration, because the purpose of these examples is to illustrate the configuration for automatic bandwidth adjustment.

Example: Configuring MPLS Traffic Engineering Automatic Bandwidth

The following example shows how to use the **mpls traffic-eng auto-bw timers** command to enable automatic bandwidth adjustment for Router 1. The command specifies that the output rate is to be sampled every 10 minutes for tunnels configured for automatic bandwidth adjustment.

```
configure terminal
!
```

```
ip cef distributed
mpls traffic-eng tunnels
mpls traffic-eng auto-bw timers frequency 600  !Enable automatic bandwidth adjustment
interface loopback 0
ip address 192.168.11.11 255.255.255.0
```

Example: Tunnel Configuration for Automatic Bandwidth

The following example shows how to use the **tunnel mpls traffic-eng auto-bw** command to enable automatic bandwidth adjustment for Tunnel1. The command specifies a maximum allowable bandwidth of 2000 kbps, a minimum allowable bandwidth of 1000 kbps, and that the default automatic bandwidth adjustment frequency of once a day be used.

```
interface tunnel1
  ip unnumbered loopback 0
  tunnel destination 192.168.17.17 255.255.255.0
  tunnel mode mpls traffic-eng
  tunnel mpls traffic-eng bandwidth 1500
  tunnel mpls traffic-eng priority 1 1
  tunnel mpls traffic-eng path-option 1 dynamic
  tunnel mpls traffic-eng auto bw max-bw 2000 min-bw 1000   !Enable automatic bandwidth
                                                            !adjustment for Tunnel1
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	*Cisco IOS Master Commands List, All Releases*
IS-IS and OSPF commands	*Cisco IOS IP Routing Protocols Command Reference*
MPLS commands	*Cisco IOS Multiprotocol Label Switching Command Reference*
Quality of service solutions commands	*Cisco IOS Quality of Service Solutions Command Reference*
Quality of service solutions configuration	*Quality of Service Overview*

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
MPLS Traffic Engineering MIB	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 feature, and support for existing RFCs has not been modified.	—

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 TE—Automatic Bandwidth Adjustment for TE Tunnels

Table 1 lists the features in this module and provides links to specific configuration information.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note Table 1 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.

Table 1 Feature Information for MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels

Feature Name	Releases	Feature Information
MPLS Traffic Engineering (TE)—Automatic Bandwidth Adjustment for TE Tunnels	Cisco IOS XE Release 2.3	The MPLS Traffic Engineering (TE)—Automatic Bandwidth Adjustment for TE Tunnels feature provides the means to automatically adjust the bandwidth allocation for traffic engineering tunnels based on their measured traffic load. The configured bandwidth in the running configuration is changed due to the automatic bandwidth behavior. In Cisco IOS XE Release 2.1, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers. The following sections provide information about this feature: • MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels Overview, page 2 • MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels Benefits, page 3 • Configuring a Platform to Support Traffic Engineering Tunnels, page 3 • Configuring IS-IS for MPLS Traffic Engineering, page 4 • Configuring an MPLS Traffic Engineering Tunnel, page 7 • Configuring Bandwidth on Each Link That the Tunnels Cross, page 9 • Configuring a Platform to Support Automatic Bandwidth Adjustment, page 10 • Configuring Automatic Bandwidth Adjustment for a Tunnel, page 11

Table 1 Feature Information for MPLS TE—Automatic Bandwidth Adjustment for TE Tunnels (continued)

Feature Name	Releases	Feature Information
		• Configuring the Interval for Computing Tunnel Average Output Rate, page 12 • Verifying the Automatic Bandwidth Configuration, page 13 The following commands were introduced or modified: **clear mpls traffic-eng auto-bw timers**, **mpls traffic-eng auto-bw timers**, **tunnel mpls traffic-eng auto-bw**.