



# Configuring Automatic Bandwidth Adjustment for MPLS TE Tunnels

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

This chapter includes the following sections:

- [Finding Feature Information, page 12-166](#)
- [Information About Automatic Bandwidth Adjustment for TE Tunnels, page 12-167](#)
- [Licensing Requirements for Automatic Bandwidth Adjustment for TE Tunnels, page 12-167](#)
- [Prerequisites for Automatic Bandwidth Adjustment for TE Tunnels, page 12-167](#)
- [Guidelines and Limitations for Automatic Bandwidth Adjustment for TE Tunnels, page 12-168](#)
- [Default Settings for Automatic Bandwidth Adjustment for TE Tunnels, page 12-168](#)
- [Configuring Automatic Bandwidth Adjustment for TE Tunnels, page 12-168](#)
- [Verifying the Automatic Bandwidth Configuration, page 12-171](#)
- [Configuration Examples for Automatic Bandwidth Adjustment for TE Tunnels, page 12-173](#)
- [Additional References, page 12-174](#)
- [Feature History for Automatic Bandwidth Adjustment for TE Tunnels, page 12-175](#)

## 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 Automatic Bandwidth Adjustment for TE Tunnels

The automatic bandwidth adjustment for TE tunnels feature allows you to configure MPLS to automatically monitor and adjust the bandwidth allocation for TE tunnels based on their measured traffic load. The automatic bandwidth behavior changes the configured bandwidth in the running configuration. If automatic bandwidth is configured for a tunnel, TE automatically adjusts the tunnel's bandwidth.

The automatic bandwidth adjustment feature samples the average output rate for each tunnel that is marked for automatic bandwidth adjustment. For each marked tunnel and for the time frequency configured, the feature adjusts the tunnel's allocated bandwidth to be the largest sample for the tunnel since the last adjustment.

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

This feature adjusts the TE tunnel's bandwidth, which is the amount of bandwidth requested by a tunnel. Tunnels only use links with enough bandwidth left to accommodate this request. (TE link bandwidth is the pool of bandwidth from which TE tunnels allocate requested amount. Tunnels can traverse only those links with enough bandwidth left to satisfy the requirement.)

## Licensing Requirements for Automatic Bandwidth Adjustment for TE Tunnels

The following table shows the licensing requirements for this feature:

Product	License Requirement
Cisco NX-OS	Automatic bandwidth adjustment for TE tunnels requires an MPLS license. For a complete explanation of the NX-OS licensing scheme and how to obtain and apply licenses, see the <i>Cisco NX-OS Licensing Guide</i> .

## Prerequisites for Automatic Bandwidth Adjustment for TE Tunnels

The automatic bandwidth adjustment for TE tunnels feature has the following prerequisites:

- You must enable the MPLS TE feature. MPLS TE can be enabled or disabled by the **[no] feature mpls traffic-eng** command and is enabled by default.
- You must configure the MPLS TE feature by using the **mpls traffic-eng bandwidth** command on each link that a tunnel crosses.

If the **bandwidth** command is configured for the tunnel, the command configures the initial tunnel bandwidth, which is adjusted by the automatic bandwidth operation.

**Note**

If you configure a tunnel's bandwidth with the **bandwidth** command and configure the minimum amount of automatic bandwidth with the **auto-bw** command, the minimum amount of automatic bandwidth adjustment is the lower of those two configured values.

## Guidelines and Limitations for Automatic Bandwidth Adjustment for TE Tunnels

The automatic bandwidth adjustment feature has the following configuration guidelines and limitations:

- The automatic bandwidth adjustment feature adjusts the bandwidth for each tunnel according to the adjustment frequency configured for the tunnel and the sampled output rate for the tunnel since the last adjustment. The adjustment feature does not consider 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 removed. If the router is reloaded, the system gives a new configured bandwidth.
- You cannot configure MPLS TE over the logical generic routing encapsulation (GRE) tunnel interface.
- MPLS traffic engineering should not be configured in more than one IGP process/instance.

## Default Settings for Automatic Bandwidth Adjustment for TE Tunnels

Table 12-1 lists the default settings for automatic bandwidth adjustment for TE tunnels.

**Table 12-1** Default Settings for Automatic Bandwidth Adjustment for TE Tunnels

Parameters	Default
Frequency	86400 seconds

## Configuring Automatic Bandwidth Adjustment for TE Tunnels

This section includes these topics:

- [Enabling Automatic Bandwidth Adjustment on a Platform, page 12-168](#)
- [Enabling Automatic Bandwidth Adjustment for a TE Tunnel, page 12-170](#)

### Enabling Automatic Bandwidth Adjustment on a Platform

You can enable automatic bandwidth adjustment on a platform and initiate sampling of the output rate for tunnels that are configured for bandwidth adjustment.

**Note**

This task applies only to the TE headend router. The configuration applies to all locally configured TE headend interfaces.

**Prerequisites**

You must enable the MPLS TE feature (see the “[Configuring MPLS TE](#)” section on page 11-145). Ensure that you are in the correct VDC (or use the **switchto vdc** command).

**SUMMARY STEPS**

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

## DETAILED STEPS

	Command	Purpose
Step 1	<code>configure terminal</code>  <b>Example:</b> <code>switch# configure terminal</code> <code>switch(config)#</code>	Enters global configuration mode.
Step 2	<code>mpls traffic-eng</code>  <b>Example:</b> <code>switch(config)# mpls traffic-eng</code> <code>switch(config-te)#</code>	Enters traffic engineering global configuration mode.
Step 3	<code>auto-bw timers [frequency seconds]</code>  <b>Example:</b> <code>switch(config-te)# auto-bw timers frequency 300</code>	Enables automatic bandwidth adjustment on a platform and begins sampling the output rate for tunnels that have been configured for automatic bandwidth adjustment.  The <i>seconds</i> argument specifies the interval, in seconds, for sampling the output rate of each tunnel configured for the automatic bandwidth adjustment. The range is from 1 through 604800. The recommended value is 300.
Step 4	<code>no auto-bw timers</code>  <b>Example:</b> <code>switch(config-te)# no auto-bw timers</code>	(Optional) Disables the automatic bandwidth adjustment on a platform.  Use the <b>no</b> version of the command, which terminates the output rate sampling and bandwidth adjustment for tunnels. In addition, the <b>no</b> form of the command restores the configured bandwidth for each tunnel where the configured bandwidth is determined as follows: <ul style="list-style-type: none"> <li>• If the tunnel bandwidth was explicitly configured with the <b>bandwidth</b> command after the running configuration was written to the startup configuration, the configured bandwidth is the bandwidth specified by that command.</li> <li>• If the tunnel bandwidth was not explicitly configured with the <b>bandwidth</b> command, the configured bandwidth is the bandwidth specified for the tunnel in the startup configuration.</li> </ul>
Step 5	<code>end</code>  <b>Example:</b> <code>switch(config-te)# end</code> <code>switch#</code>	Exits to EXEC mode.

## Enabling Automatic Bandwidth Adjustment for a TE Tunnel

You can enable the automatic bandwidth adjustment for a tunnel and specify the range of automatic bandwidth adjustments applied to the tunnel.



## Tip

Each **auto-bw** command supersedes the previous one. To specify multiple options for a tunnel, you must specify them all in a single **auto-bw** command.

## SUMMARY STEPS

1. **configure terminal**
2. **interface tunnel-te *number***
3. **auto-bw [collect-bw] [[frequency *seconds*] [min-bw *kbps*] [max-bw *kbps*]]**
4. **end**

## DETAILED STEPS

	Command	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	<b>interface tunnel-te <i>number</i></b>  <b>Example:</b> switch(config)# interface tunnel-te 1 switch(config-if-te)#	Enters TE interface configuration mode.  The <i>number</i> argument identifies the tunnel number to be configured.
Step 3	<b>auto-bw [collect-bw] [[frequency <i>seconds</i>] [min-bw <i>kbps</i>] [max-bw <i>kbps</i>]]</b>  <b>Example:</b> switch(config-if-te)# auto-bw max-bw 2000 min-bw 1000 frequency 300	Enables the automatic bandwidth adjustment for the tunnel and controls the manner in which the bandwidth for a tunnel is adjusted.  <b>NOTE:</b> The <b>collect-bw</b> and <b>min-bw/max-bw</b> variables are mutually exclusive because the switch does not perform an actual application when you specify <b>collect-bw</b> .
Step 4	<b>end</b>  <b>Example:</b> switch(config-if-te)# end switch#	Exits to EXEC mode.

## Verifying the Automatic Bandwidth Configuration

To verify the automatic bandwidth configuration, perform one of the following tasks:

Command	Purpose
<b>show mpls traffic-eng tunnels</b>	Displays information about tunnels. It includes automatic bandwidth information for tunnels that have the feature enabled.
<b>show running-config interface tunnel-te <i>id</i></b>	Verifies that the <b>tunnel mpls traffic-eng auto bw</b> command is set appropriately.

The following example shows how to display information about tunnels. The command output shows the following:

- The auto-bw line indicates that the automatic bandwidth adjustment is enabled for the tunnel.
- 86400 is the time, in seconds, between bandwidth adjustments.

- 86258 is the time, in seconds, remaining until the next bandwidth adjustment.
- 0 is the largest bandwidth sample since the last bandwidth adjustment.
- 0 is the last bandwidth adjustment and the bandwidth currently requested for the tunnel.

```
switch# show mpls traffic-eng tunnels tunnel-te 2

Name: N7K-Get-well-R1_t2                (tunnel-te2) Destination: 10.0.0.4
Status:
  Admin: up          Oper: up          Path: valid          Signalling: connected
  path option 1, type explicit path2(Basis for Setup, path weight 80)

Config Parameters:
  Bandwidth: 500          kbps (Global) Priority: 7 7  Affinity: 0x0/0xffff
  Metric Type: TE (default)
  AutoRoute: disabled LockDown: disabled
  auto-bw: (300/245) 583 Bandwidth Requested: 555
  Samples Missed 1: Samples Collected 1
Active Path Option Parameters:
  State: explicit path option 1 is active
  BandwidthOverride: disabled LockDown: disabled Verbatim: disabled

InLabel : -
OutLabel : Ethernet1/26, 2003
RSVP Signalling Info:
  Src 10.0.0.2, Dst 10.0.0.4, Tun_Id 2, Tun_Instance 2
RSVP Path Info:
  My Address: 10.0.0.2
  Explicit Route: 24.0.0.2.26.0.0.1.26.0.0.2 10.0.0.4
  Record Route: NONE
  Tspec: ave rate=555 kbits, burst=1000 bytes, peak rate=555 kbits
RSVP Resv Info:
  Record Route: 24.0.0.2 26.0.0.2
  Fspec: ave rate=555 kbits, burst=1000 bytes, peak rate=555 kbits
Shortest Unconstrained Path Info:
  Path Weight: 80 (TE)
  Explicit Route: 22.0.0.1 22.0.0.2 25.0.0.1 25.0.0.2
                  10.0.0.4
History:
Tunnel:
  Time since created: 7 minutes, 43 seconds
  Time since path change: 2 minutes, 21 seconds
  Number of LSP IDs (Tun_Instances) used: 2
Current LSP:
  Uptime: 1 minutes, 23 seconds
  Selection: reoptimization
Prior LSP:
  ID: pat option 1 [1]
  Removal trigger: configuration changed
```

The following example shows how to verify that the **tunnel mpls traffic-eng auto bw** command is set appropriately. The command output shows that the bandwidth value has changed after adjustment (the **bandwidth is 1500**).

```
switch# show running-config interface tunnel-te1
!Time: Mon Nov 25 19:32:35 2013
.
version 6.2(6)
.
interface tunnel-te1
 ip unnumbered loopback0
 no shutdown
 destination 10.0.0.4
```

```

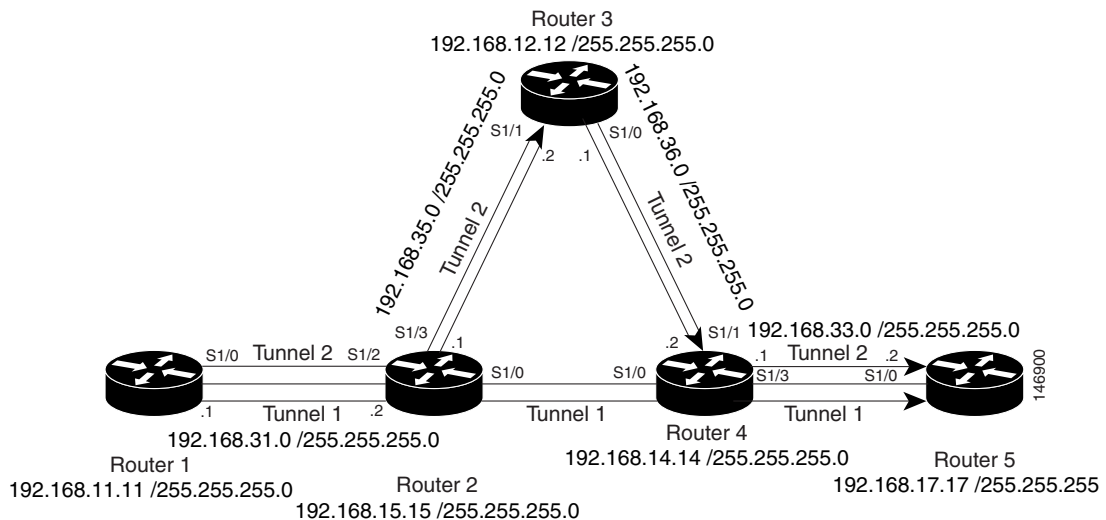
auto-bw frequency 300 min-bw 300
autoroute announce
bandwidth 583
path-option 1 explicit name path1
record-route

```

## Configuration Examples for Automatic Bandwidth Adjustment for TE Tunnels

Figure 12-1 shows a sample MPLS topology. The following sections contain sample configuration examples about configuring an automatic bandwidth adjustment for MPLS TE tunnels that originate on Router 1 and enabling automatic bandwidth adjustment for Tunnel 1.

**Figure 12-1** Sample MPLS Traffic Engineering Tunnel Configuration



This section provides the following configuration examples based on Figure 12-1:

- [Example: Configuring the MPLS Traffic Engineering Automatic Bandwidth, page 12-173](#)
- [Example: Tunnel Configuration for Automatic Bandwidth, page 12-174](#)

The examples omit some configuration required for MPLS TE, such as the required Resource Reservation Protocol (RSVP) and Interior Gateway Protocol (IGP), and either Intermediate System-to-Intermediate System (IS-IS) or Open Shortest Path First (OSPF) configuration. The examples show the configuration for automatic bandwidth adjustment.

### Example: Configuring the MPLS Traffic Engineering Automatic Bandwidth

The following example shows how to use the **auto-bw timers** command to enable an 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
!
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 **auto-bw** command to enable an automatic bandwidth adjustment for Tunnel 1. The command specifies a maximum allowable bandwidth of 2000 kbps, a minimum allowable bandwidth of 1000 kbps, and a default automatic bandwidth adjustment frequency of once a day.

```

interface tunnel-te1
ip unnumbered loopback 0
destination 192.168.17.17
bandwidth 1500
priority 1 1
path-option 1 dynamic
auto-bw max-bw 2000 min-bw 1000 !Enable automatic bandwidth
!adjustment for Tunnell

```

## Additional References

The following sections provide references related to the automatic bandwidth adjustment for TE tunnels feature.

## Related Documents

Related Topic	Document Title
IS-IS and OSPF commands	<a href="#">Cisco NX-OS Unicast Routing Command Reference</a>
MPLS commands	<a href="#">Cisco NX-OS Multiprotocol Label Switching Command Reference</a>
Quality of service commands	<a href="#">Cisco NX-OS Quality of Service Commands</a>
Quality of service solutions configuration	<a href="#">Quality of Service Overview</a>

## 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 NX-OS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

## RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified.	—

# Feature History for Automatic Bandwidth Adjustment for TE Tunnels

Table 12-2 lists the release history for this feature.

**Table 12-2** Feature History for MPLS Traffic Engineering—Automatic Bandwidth Adjustment for TE Tunnels

Feature Name	Releases	Feature Information
Automatic Bandwidth Adjustment for TE Tunnels	6.2(6)	This feature was introduced.