



## Configuring LSP Attributes for MPLS TE

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This chapter describes how to configure label switched path (LSP) attributes for path options that are associated with Multiprotocol Label Switching (MPLS) traffic engineering (TE) tunnels on Cisco NX-OS devices.

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- [Finding Feature Information, page 14-212](#)
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### 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 LSP Attributes for MPLS TE

You can configure an LSP attribute list and associate it with one or more MPLS TE tunnels. This LSP attribute list supports multiple LSP attributes such as bandwidth and priority. You can also configure a TE tunnel to fall back temporarily to use path options that can reduce bandwidth constraints.

A port-profile can be used to provide a template of configuration for an entire tunnel. The attribute list can be used to apply a template for the configuration for one or more path options.

This section includes the following topics:

- [LSP Attribute Lists, page 14-213](#)
- [Autobandwidth, page 14-213](#)
- [Path Option Selection for MPLS TE Tunnel LSPs, page 14-214](#)

## LSP Attribute Lists

Cisco NX-OS tunneling interfaces have many parameters that are associated with MPLS TE. Typically, you configure these parameters on an interface. Many of these attributes determine tunnel-specific properties, such as load sharing for the tunnel. These parameters are unrelated to the particular LSP in use by the tunnel. However, some of the tunneling parameters apply to the LSP that the tunnel uses.

You can configure the LSP-specific properties using an LSP attribute list. An LSP attribute list can contain values for each LSP-specific parameter that is configurable for a TE tunnel. You can specify the following LSP attributes in an attribute list:

- Attribute flags for links that make up the LSP
- Automatic bandwidth configuration
- LSP bandwidth from the global pool
- Disabling reoptimization of the LSP
- LSP priority
- Protection failure
- Recording the route used by the LSP

You can relist all attributes or remove specific attributes from an LSP attribute list.

Based on your requirements, you can configure LSP attribute lists with different sets of attributes for different path options. LSP attribute lists also provide an easy way to configure multiple TE tunnels to use the same LSP attributes. You can reference the same LSP attribute list to configure LSP-specific parameters for one or more TE tunnels.

## Autobandwidth

If you configure TE automatic bandwidth (autobandwidth) adjustment for a tunnel, traffic engineering automatically adjusts the bandwidth allocation for the TE tunnel based on its measured usage of the bandwidth of the tunnel.

TE autobandwidth samples the average output rate for each tunnel that is marked for automatic bandwidth adjustment. For each marked tunnel, TE periodically adjusts the allocated bandwidth for the tunnel to be the largest sample for the tunnel since the last adjustment. The default reoptimization setting for TE autobandwidth is every 24 hours.

You can configure the frequency with which the tunnel bandwidth is adjusted and the allowable range of adjustments per tunnel. You can also configure the sampling interval and the interval over which to average the tunnel traffic to obtain the average output rate per tunnel.

For more information on automatic bandwidth adjustment for TE tunnels, see the “MPLS Traffic Engineering (TE)—Automatic Bandwidth Adjustment for TE Tunnels” chapter.

You can also select a path option to override the bandwidth that is configured on a TE tunnel. This feature enables you to override the bandwidth that is configured or recalculated by the automatic bandwidth adjustment if you have enabled the path option with the bandwidth override. See the “[Path Option Selection with Bandwidth Override](#)” section on page 14-215.

**Note**

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You cannot configure both the bandwidth in the LSP attribute list and the bandwidth override because they are mutually exclusive.

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## Path Option Selection for MPLS TE Tunnel LSPs

This section includes the following topics:

- [Constraint-Based Routing and Path Option Selection](#), page 14-214
- [Tunnel Reoptimization and Path Option Selection](#), page 14-215
- [Path Option Selection with Bandwidth Override](#), page 14-215

## Constraint-Based Routing and Path Option Selection

MPLS TE automatically establishes and maintains LSPs across the backbone by using the Resource Reservation Protocol (RSVP). The path that an LSP uses is determined by the LSP resource requirements and network resources, such as bandwidth. TE tunnels are calculated at the LSP head based on a fit between required and available resources (constraint-based routing).

A TE tunnel establishes an LSP based on dynamic or explicit path options in order of preference. However, the bandwidth and other attributes configured on the TE tunnel allow the setup of an LSP only if LSP path options satisfy the constraints. If a path cannot be found that satisfies the configured path options, then the tunnel is not set up.

You can configure the path option for bandwidth override as a fallback path option that allows overriding the bandwidth configured on the TE tunnel interface. For example, you can configure a path option that sets the bandwidth to zero (0), which effectively removes the bandwidth constraint imposed by the constraint-based routing calculation.

If the bandwidth is the only LSP attribute that you need to set on the path option, use the path option for the bandwidth override, which is the simplest way to configure multiple path options with decreasing bandwidth constraints.

**Note**

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You cannot configure both the bandwidth in the LSP attribute list and the bandwidth override because they are mutually exclusive.

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## Tunnel Reoptimization and Path Option Selection

Reoptimization occurs when a device with TE tunnels periodically examines tunnels with established LSPs to learn if better LSPs are available. If a better LSP is available, the device signals the better LSP. If the signaling is successful, the device replaces the older LSP with the new, better LSP.

You can trigger reoptimization using a configurable timer, a reoptimize command, or a configuration change that requires the resignaling of a tunnel. Autobandwidth, for example, uses a timer to set the frequency of reoptimization based on the bandwidth path option attribute. The path option for bandwidth override can switch between the bandwidth that is configured on the TE tunnel interface and the bandwidth that is configured on a specific path option. This override increases the success of signaling an LSP for the TE tunnel.

When you configure the bandwidth override on a path option, TE reoptimizes the bandwidth every 30 seconds to reestablish the bandwidth that is configured on the tunnel (see the [“Configuring a Path Option for Bandwidth Override”](#) section on page 14-224).

You can disable reoptimization of an LSP in an LSP attribute list and apply this LSP attribute list to a path option.

## Path Option Selection with Bandwidth Override

When you enable the bandwidth override path option, you can configure bandwidth parameters on a specific path option. When an LSP is signaled using a path option with a configured bandwidth, the bandwidth that is associated with the path option is signaled instead of the bandwidth that is configured directly on the tunnel.

You can configure multiple path options that reduce the bandwidth constraint each time the headend of a tunnel fails to establish an LSP.

The following example shows three **path-option** commands:

```
bandwidth 1000
path-option 1 explicit name path1
path-option 2 explicit name path2 bandwidth 500
path-option 3 dynamic bandwidth 0
```

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

- The device signals an LSP using path options that start with path option 1.  
The device signals an LSP with the 1000-kbps bandwidth configured on the tunnel interface because path option 1 has no bandwidth configured.
- If 1000 kbps is not available, the device tries to establish an LSP using path option 2.  
Path option 2 has a 500-kbps bandwidth configured, which reduces the bandwidth constraint from the original 1000-kbps configured on the tunnel interface.
- If 500 kbps is not available, the device tries to establish an LSP using path option 3.  
Path option 3 is configured as dynamic and has a bandwidth of 0. The device establishes the LSP if an IP path exists to the destination and all other tunnel constraints are met.

# Licensing Requirements for LSP Attributes for MPLS TE

The following table shows the licensing requirements for this feature:

Product	License Requirement
Cisco NX-OS	The MPLS TE LSP attributes 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 <i>Cisco NX-OS Licensing Guide</i> .

## Prerequisites for LSP Attributes for MPLS TE

LSP attributes for MPLS TE tunnels have the following prerequisite:

- You must enable the MPLS TE feature. See the [“Configuring MPLS TE” section on page 10-139](#).

## Guidelines and Limitations for LSP Attributes for MPLS TE

LSP attributes for MPLS TE tunnels have the following configuration guidelines and limitations:

- You must explicitly configure the LSP attributes.

## Default Settings for LSP Attributes for MPLS TE

[Table 14-1](#) lists the default settings for LSP attributes.

**Table 14-1** Default Settings for LSP Attributes

Parameters	Default
Affinity	0, mask 0
Auto bandwidth	disabled
Bandwidth	0
Priority	7 7
Protection fast reroute	Disabled
Record route	Disabled

## Configuring LSP Attributes for MPLS TE

This section includes the following topics:

- [Configuring LSP Attributes in an MPLS TE Tunnel, page 14-217](#)
- [Configuring an LSP Attribute List, page 14-219](#)
- [Associating an LSP Attribute List with an MPLS TE Tunnel, page 14-222](#)
- [Configuring a Path Option for Bandwidth Override, page 14-224](#)

## Configuring LSP Attributes in an MPLS TE Tunnel

You can configure LSP attributes in an MPLS TE tunnel. These values are overridden by an LSP attribute list that is associated with this MPLS TE tunnel.

### 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. **destination** {*ip-address*}
4. (Optional) **autoroute announce**
5. (Optional) **bandwidth** *kbps*
6. (Optional) **priority** *setup-priority* [*hold-priority*]
7. (Optional) **show interface tunnel-te** *number*
8. (Optional) **show mpls traffic-eng tunnels tunnel-te** *number*
9. (Optional) **show running-config interface tunnel-te** *number*
10. (Optional) **copy running-config startup-config**

## 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 number</b>  <b>Example:</b> switch(config)# interface tunnel-te 1	Enters TE interface configuration mode. The <i>number</i> argument identifies the tunnel number to be configured.
Step 3	<b>destination {ip-address}</b>  <b>Example:</b> switch(config-if-te)# destination 10.10.10.12	Specifies the destination of the tunnel for this path option. The <i>ip-address</i> argument is the IP address of the host destination expressed in decimal in four-part, dotted notation.
Step 4	<b>autoroute announce</b>  <b>Example:</b> 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 5	<b>bandwidth kbps</b>  <b>Example:</b> switch(config-if-te)# bandwidth 1000	(Optional) Configures the bandwidth required for an MPLS TE tunnel and assigns it to the global pool. The <i>kbps</i> argument is the bandwidth, in kilobits per second, set aside for the MPLS TE tunnel. The range is from 1 to 4294967295.
Step 6	<b>priority setup-priority [hold-priority]</b>  <b>Example:</b> switch(config-if-te)# priority 1 1	(Optional) Sets the priority to be used when the system determines which existing tunnels are eligible to be preempted.  The <i>setup-priority</i> 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 nonzero priority.  The <i>hold-priority</i> 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 7	<b>show interface tunnel-te number</b>  <b>Example:</b> switch(config-if-te)# show interface tunnel-te 1	(Optional) Displays information about the TE tunnel.
Step 8	<b>show mpls traffic-eng tunnels tunnel-te number</b>	(Optional) Displays the MPLS TE tunnels for the configured tunnel <i>number</i> .

	Command	Purpose
Step 9	<code>show running config interface tunnel-te number</code>	(Optional) Displays the running configuration of the interface MPLS TE tunnels for the configured tunnel <i>number</i> .
Step 10	<code>copy running-config startup-config</code>  <b>Example:</b> <code>switch(config-if-te)# copy running-config startup-config</code>	(Optional) Copies the running configuration to the startup configuration.

## Configuring an LSP Attribute List

You can configure an LSP attribute list with the desired attributes to apply on a path option. You can also add or modify an attribute in an existing LSP attribute list, or use the **no** subcommand to remove an attribute from an existing attribute list.



### Note

You cannot configure both the bandwidth in the LSP attribute list and the path-option bandwidth override because they are mutually exclusive.

### 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. **mpls traffic-eng configuration**
3. **lsp attributes name**
4. (Optional) **affinity value [mask value]**
5. (Optional) **auto-bw [frequency secs] [max-bw kbps] [min-bw kbps] [collect-bw]**
6. (Optional) **bandwidth kbps**
7. (Optional) **list**
8. (Optional) **lockdown**
9. (Optional) **priority setup-priority [hold-priority]**
10. (Optional) **protection fast-reroute**
11. (Optional) **record-route**
12. (Optional) **no sub-command**
13. (Optional) **show mpls traffic-eng lsp attributes [name]**
14. (Optional) **show running mpls traffic-eng**
15. (Optional) **show mpls traffic-eng tunnels tunnel-te number**
16. (Optional) **show running config interface tunnel-te number**
17. (Optional) **copy running-config startup-config**



## DETAILED STEPS

	Command	Purpose
Step 1	<p><b>configure terminal</b></p> <p><b>Example:</b> switch# configure terminal switch(config)#</p>	Enters global configuration mode.
Step 2	<p><b>mpls traffic-eng configuration</b></p> <p><b>Example:</b> switch(config)# mpls traffic-eng configuration switch(config-te)#</p>	Enters MPLS TE configuration mode.
Step 3	<p><b>lsp attributes string</b></p> <p><b>Example:</b> switch(config-te)# lsp attributes 1 switch(config-lsp-attr)#</p>	Configures an LSP attribute list and enters LSP attributes configuration mode. The <i>name</i> argument identifies a specific LSP attribute list and can be any case-sensitive, alphanumeric string up to 63 characters.
Step 4	<p><b>affinity value [mask value]</b></p> <p><b>Example:</b> switch(config-lsp-attr)# affinity 0 mask 0</p>	<p>(Optional) Specifies attribute flags for links that comprise an LSP. The <i>value</i> argument is a value required for links that make up an LSP. Values of the bits are either 0 or 1.</p> <p>The <b>mask value</b> keyword argument combination indicates which attribute values should be checked.</p> <p>If a bit in the mask is 0, an attribute value of the link or that bit is irrelevant.</p> <p>If a bit in the mask is 1, the attribute value of that link and the required affinity of the LSP for that bit must match.</p>
Step 5	<p><b>auto-bw [frequency secs] [max-bw kbps] [min-bw kbps] [collect-bw]</b></p> <p><b>Example:</b> switch(config-lsp-attr)# auto-bw</p>	<p>(Optional) Specifies automatic bandwidth configuration with the following options:</p> <ul style="list-style-type: none"> <li>• The <b>frequency secs</b> keyword argument combination specifies the interval between bandwidth adjustments. The range is from 300 to 604800 seconds.</li> <li>• The <b>max-bw kbps</b> keyword argument combination specifies the maximum automatic bandwidth, in kbps, for this path option. The range is from 1 to 4294967295.</li> <li>• The <b>min-bw kbps</b> keyword argument combination specifies the minimum automatic bandwidth, in kbps, for this path option. The range is from 1 to 4294967295.</li> <li>• The <b>collect-bw</b> keyword collects output rate information for the path option but does not adjust the bandwidth of the path option.</li> </ul>
Step 6	<p><b>bandwidth kbps</b></p> <p><b>Example:</b> switch(config-lsp-attr)# bandwidth 5000</p>	(Optional) Specifies the LSP bandwidth. The <i>kbps</i> argument is the number of kilobits per second set aside for the path option. The range is from 1 to 4294967295.

	Command	Purpose
Step 7	<b>list</b>  <b>Example:</b> switch(config-lsp-attr)# list	(Optional) Displays the contents of the LSP attribute list.
Step 8	<b>lockdown</b>  <b>Example:</b> switch(config-lsp-attr)# lockdown	(Optional) Disables reoptimization of the LSP.
Step 9	<b>priority</b> <i>setup-priority</i> [ <i>hold-priority</i> ]  <b>Example:</b> switch(config-lsp-attr)# priority 1 1	(Optional) Specifies the LSP priority. The <i>setup-priority</i> argument is used when signaling an LSP to determine which existing LSPs can be preempted. The range is from 0 to 7, where a lower number indicates a higher priority. Therefore, an LSP with a setup priority of 0 can preempt any LSP with a nonzero priority.  The <i>hold-priority</i> argument is associated with an LSP to determine if it should be preempted by other LSPs that are being signaled. The range is from 0 to 7, where a lower number indicates a higher priority.
Step 10	<b>protection fast-reroute</b>  <b>Example:</b> switch(config-lsp-attr)# protection fast-reroute	(Optional) Enables failure protection on the LSP.
Step 11	<b>record-route</b>  <b>Example:</b> switch(config-lsp-attr)# record-route	(Optional) Records the route used by the LSP.
Step 12	<b>no</b> <i>sub-command</i>  <b>Example:</b> switch(config-lsp-attr)# no record-route	(Optional) Removes a specific attribute from the LSP attributes list. The <i>sub-command</i> argument names the LSP attribute to remove from the attributes list.
Step 13	<b>show mpls traffic-eng lsp attributes</b> [ <i>name</i> ]  <b>Example:</b> switch(config)# show mpls traffic-eng lsp attributes	(Optional) Displays information about configured LSP attribute lists. Use the <b>show mpls traffic-eng lsp attributes</b> command to verify that the LSP attribute list was deleted from the switch.
Step 14	show running mpls traffic-eng  <b>Example:</b> switch(config)# show running mpls traffic-eng	(Optional) Displays information about the running configuration of the MPLS TE feature.
Step 15	<b>show mpls traffic-eng tunnels tunnel-te</b> <i>number</i>  <b>Example:</b> switch(config)# show mpls traffic-eng tunnels tunnel-te 12	(Optional) Displays the MPLS TE tunnels for the configured tunnel number.

	Command	Purpose
Step 16	<pre>show running config interface tunnel-te number</pre> <p><b>Example:</b>  <pre>switch(config)# show running config interface tunnel-te 12</pre></p>	(Optional) Displays the running configuration of the interface MPLS TE tunnels for the configured tunnel number.
Step 17	<pre>copy running-config startup-config</pre> <p><b>Example:</b>  <pre>switch(config-lsp-attr)# copy running-config startup-config</pre></p>	(Optional) Copies the running configuration to the startup configuration.

## Associating an LSP Attribute List with an MPLS TE Tunnel

You can associate an LSP attribute list with a path option for one or more MPLS TE tunnels.

Path option attributes for a TE tunnel are determined as follows:

- Attributes configured in an LSP attribute list on a path-option take precedence over the same attributes if they are configured directly in the tunnel interface configuration mode.
- If an attribute is not specified in the LSP attribute list, the device uses the attribute in the tunnel configuration. An LSP attribute list has no default values.
- If the attribute is not configured on the tunnel and not in the attribute list, the device uses the tunnel default attribute value. See the “[Default Settings for LSP Attributes for MPLS TE](#)” section on page 14-216.

### 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. **path-option** *number* { **dynamic** | **explicit** { **name** *path-name* | *path-number* } [**verbatim**] } [**attributes** *string*] [**bandwidth** *kbps*] [**lockdown**]
4. (Optional) **show interface tunnel-te** *number*
5. (Optional) **show mpls traffic-eng tunnels tunnel-te** *number*
6. (Optional) **show running config interface tunnel-te** *number*
7. (Optional) **copy running-config startup-config**

## DETAILED STEPS

	Command	Purpose
Step 1	<pre>configure terminal</pre> <p><b>Example:</b> switch# configure terminal switch(config)#</p>	Enters global configuration mode.
Step 2	<pre>interface tunnel-te number</pre> <p><b>Example:</b> switch(config)# interface tunnel-te 1</p>	Enters TE interface configuration mode. The <i>number</i> argument identifies the tunnel number to be configured.
Step 3	<pre>path-option number {dynamic   explicit {name path-name   path-number} [verbatim]} [attributes string] [bandwidth kbps] [lockdown]</pre> <p><b>Example:</b> switch(config-if-te)# path-option 1 dynamic attributes 1</p>	<p>Adds an LSP attribute list to specify LSP-related parameters for path options for an MPLS TE tunnel. The arguments are as follows:</p> <ul style="list-style-type: none"> <li>The <i>number</i> argument identifies the path option.</li> <li>The <b>dynamic</b> keyword indicates that the path option is dynamically calculated (the switch figures out the best path).</li> <li>The <b>explicit</b> keyword indicates that the path option is specified. You specify the IP addresses of the path.</li> <li>The <b>name path-name</b> keyword argument combination identifies the name of the explicit path option.</li> <li>The <i>path-number</i> argument identifies the number of the explicit path option.</li> <li>The <b>verbatim</b> keyword bypasses the topology database verification.</li> </ul> <p><b>Note</b> You can use the <b>verbatim</b> keyword only with the explicit path option.</p> <ul style="list-style-type: none"> <li>The <b>attributes string</b> keyword argument combination names an attribute list to specify path options for the LSP.</li> <li>The <b>bandwidth</b> keyword specifies LSP bandwidth.</li> <li>The <i>kbps</i> argument is the number of kilobits per second set aside for the tunnel when signaled with this path option. The range is from 1 to 4294967295.</li> <li>The <b>lockdown</b> keyword disables reoptimization of the LSP when the tunnel is signaled with this path option.</li> </ul>
Step 4	<pre>show interface tunnel-te number</pre> <p><b>Example:</b> switch(config-if-te)# show interface tunnel-te 1</p>	(Optional) Displays information about the TE tunnel.

	Command	Purpose
Step 5	<pre>show mpls traffic-eng tunnels tunnel-te number</pre> <p><b>Example:</b>  <pre>switch(config-if-te)# show mpls traffic-eng tunnels tunnel-te 12</pre></p>	(Optional) Displays the MPLS TE tunnels for TE for the configured tunnel number.
Step 6	<pre>show running config interface tunnel-te number</pre> <p><b>Example:</b>  <pre>switch(config-if-te)# show running config interface tunnel-te 12</pre></p>	(Optional) Displays the running configuration of the interface MPLS TE tunnels for the configured tunnel number.
Step 7	<pre>copy running-config startup-config</pre> <p><b>Example:</b>  <pre>switch(config-if-te)# copy running-config startup-config</pre></p>	(Optional) Copies the running configuration to the startup configuration.

## Configuring a Path Option for Bandwidth Override

You can configure fallback bandwidth path options for a TE tunnel using the bandwidth parameter in the path option. You can configure path options that reduce the bandwidth constraint each time the headend of a tunnel fails to establish an LSP.

The bandwidth path option override is a temporary reduction in the bandwidth constraint. You can also use this feature to increase the bandwidth requirement. To force immediate reoptimization of all TE tunnels, use the global **reoptimize** command. You can also configure the **lockdown** command with the bandwidth override to prevent automatic reoptimization.



### Note

Once you configure the bandwidth as a path-option parameter, you can no longer configure an LSP attribute list as a path-option parameter.

## SUMMARY STEPS

1. **configure terminal**
2. **interface tunnel-te** *number*
3. **path-option** *number* { **dynamic** | **explicit** { **name** *path--name* | *path-number* } [**verbatim**]} [**attributes** *string*] [**bandwidth** *kbps*] [**lockdown**]
4. (Optional) **show interface tunnel-te** *number*
5. (Optional) **show mpls traffic-eng tunnels tunnel-te** *number*
6. (Optional) **show running config interface tunnel-te** *number*
7. (Optional) **copy running-config startup-config**

## DETAILED STEPS

	Command	Purpose
Step 1	<pre>configure terminal</pre> <p><b>Example:</b> switch# configure terminal switch(config)#</p>	Enters global configuration mode.
Step 2	<pre>interface tunnel-te number</pre> <p><b>Example:</b> switch(config)# interface tunnel-te 1</p>	Enters TE interface configuration mode.  The <i>number</i> argument identifies the tunnel number to be configured.
Step 3	<pre>path-option number {dynamic   explicit {name path-name   path-number} [verbatim]} [attributes string] [bandwidth kbps] [lockdown]</pre> <p><b>Example:</b> switch(config-if-te)# path-option 1 dynamic attributes 1</p>	<p>Adds an LSP attribute list to specify LSP-related parameters for path options for an MPLS TE tunnel. The arguments are as follows:</p> <ul style="list-style-type: none"> <li>The <i>number</i> argument identifies the path option.</li> <li>The <b>dynamic</b> keyword indicates that the path option is dynamically calculated (the switch figures out the best path).</li> <li>The <b>explicit</b> keyword indicates that the path option is specified. You specify the IP addresses of the path.</li> <li>The <b>name path-name</b> keyword argument combination identifies the name of the explicit path option.</li> <li>The <i>path-number</i> argument identifies the number of the explicit path option.</li> <li>The <b>verbatim</b> keyword bypasses the topology database verification.</li> </ul> <p><b>Note</b> You can use the <b>verbatim</b> keyword only with the explicit path option.</p> <ul style="list-style-type: none"> <li>The <b>attributes string</b> keyword argument combination names an attribute list to specify path options for the LSP.</li> <li>The <b>bandwidth</b> keyword specifies the LSP bandwidth.</li> <li>The <i>kbps</i> argument is the number of kilobits per second set aside for the path option. The range is from 1 to 4294967295.</li> <li>The <b>lockdown</b> keyword disables reoptimization of the LSP.</li> </ul>
Step 4	<pre>show interface tunnel-te number</pre> <p><b>Example:</b> switch(config-if-te)# show interface tunnel-te 1</p>	(Optional) Displays information about the TE tunnel.

	Command	Purpose
Step 5	<pre>show mpls traffic-eng tunnels tunnel-te number</pre> <p><b>Example:</b> switch(config-if-te)# show mpls traffic-eng tunnels tunnel-te 1</p>	(Optional) Displays the MPLS TE tunnels for the configured tunnel number.
Step 6	<pre>show running config interface tunnel-te number</pre> <p><b>Example:</b> switch(config-if-te)# show running config interface tunnel-te 1</p>	(Optional) Displays the running configuration of the interface MPLS TE tunnels for the configured tunnel number.
Step 7	<pre>copy running-config startup-config</pre> <p><b>Example:</b> switch(config-if-te)# copy running-config startup-config</p>	(Optional) Copies the running configuration to the startup configuration.

## Verifying the Configuration for LSP Attributes for MPLS TE

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

Command	Purpose
<pre>show mpls traffic-eng lsp attributes [string] [details]</pre>	Displays information about LSP attribute lists.
<pre>show mpls traffic-eng tunnels tunnel-interface [brief]</pre>	Displays information about MPLS TE tunnel attributes and path options.

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

## Configuration Examples for LSP Attributes for MPLS TE

This section includes the following topics:

- [Example: LSP Attribute List on a TE Tunnel, page 14-226](#)
- [Example: Path Option for Bandwidth Override, page 14-227](#)

### Example: LSP Attribute List on a TE Tunnel

The following example shows how to configure an LSP attribute list and associate it with an MPLS TE tunnel:

```
configuration terminal
feature mpls traffic-engineering
mpls traffic-eng configuration
lsp attributes 3
affinity 0x3 mask 0xff
```

```

bandwidth 1000
priority 1 1

interface Tunnel-te 1
 ip unnumbered Ethernet2/1
 destination 10.112.0.12
 affinity 1
 bandwidth 5000
 path-option 1 dynamic attributes 3

```

## Example: Path Option for Bandwidth Override

The following example shows how to configure a path option to override the bandwidth:



### Note

Once you configure the bandwidth as a path-option parameter, you can no longer configure an LSP attribute list as a path-option parameter.

```

configuration terminal
feature mpls traffic-engineering
interface Tunnel-te 1
 ip unnumbered Loopback0
 destination 10.10.10.12
 autoroute announce
 priority 1 1
 bandwidth 1000
 path-option 1 explicit name path1
 path-option 2 explicit name path2 bandwidth 500
 path-option 3 dynamic bandwidth 0

```

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

- The device tries to signal an LSP using path options starting with path option 1.  
The device tries to signal an LSP with the 1000-kbps bandwidth configured on the tunnel interface because path option 1 has no bandwidth configured.
- If 1000 kbps is not available, the device tries to establish an LSP using path option 2.  
Path option 2 has 500 kbps configured, which reduces the bandwidth constraint from the original 1000-kbps configured on the tunnel interface.
- If 500 kbps is not available, the device tries to establish an LSP using path option 3.  
Path option 3 is configured as dynamic and has a bandwidth of 0. The device establishes the LSP if an MPLS TE path exists to the destination and all other tunnel constraints are met.  
If explicit path option 1 and explicit path option 2 both fail, dynamic path option 3 is attempted with 0 bandwidth, so it should succeed if any path exists. This option is a fallback to best effort.

## Additional References for MPLS TE

The following sections provide references related to the LSP Attributes feature.



## Related Documents

Related Topic	Document Title
CLI commands	<i>Cisco Nexus 7000 Series NX-OS MPLS Command Reference</i>

## MIBs

MIB	MIBs Link
<ul style="list-style-type: none"> <li>CISCO-IETF-FRR-MIB</li> <li>MPLS TE-STD-MIB</li> </ul>	<p>To locate and download Cisco MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</p> <p><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></p>

## Feature History for LSP Attributes for MPLS TE

Table 14-2 lists the release history for this feature.

**Table 14-2** Feature History for LSP Attributes for MPLS TE Tunnels

Feature Name	Releases	Feature Information
LSP attributes for MPLS TE tunnels	5.2(1)	This feature was introduced.

