

# Point-to-Multipoint MPLS-TE MIB

The point-to-multipoint (P2MP) Multiprotocol Label Switching (MPLS)-traffic engineering (TE) MIB describes the Label Switched Path (LSP) in an IP MPLS network. An administrator can use the P2MP MPLS-TE MIB to determine optimal branch points in the network so that optimal links are used.

The P2MP MPLS-TE MIB has the following benefits:

- Provides a standards-based Simple Network Management Protocol (SNMP) interface for retrieving information about P2MP MPLS-TE tunnels.
- Shows traffic flow information for P2MP MPLS-TE tunnels.
- Shows P2MP MPLS-TE tunnel routes, including the configured route, the Interior Gateway Protocol (IGP) calculated route, and the actual route traversed.
- Shows tunnel reroute information in the event of a link failure in accordance with the Interfaces MIB.
- Shows information about the configured resources used for an P2MP MPLS-TE tunnel.
- Supports the generation of notifications. These notifications call attention to major changes in the operational status of P2MP MPLS-TE tunnels.
- Forwards notification messages to a designated network management server (NMS) for evaluation or action by administrators.


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# Restrictions for Point-to-Multipoint MPLS-TE MIB

The P2MP MPLS-TE MIB supports read-only access to the objects.

# Information About the Point-to-Multipoint MPLS-TE MIB

## Point-to-Multipoint MPLS-TE MIB Cisco Implementation

The P2MP MPLS-TE MIB is based on the Internet Engineering Task Force (IETF) draft MIB entitled *draft-ietf-mpls-p2mp-te-mib-09* , which includes objects describing features that support P2MP MPLS-TE.

The SNMP objects defined in the P2MP MPLS-TE MIB can be displayed by any standard SNMP utility. All supported P2MP MPLS-TE MIB objects are based on the IETF draft MIB; thus, no specific Cisco SNMP application is required to support the functions and operations pertaining to the P2MP MPLS-TE MIB.

The P2MP MPLS-TE LSP determines optimal branch points in the IP and MPLS network and must be managed using SNMP.

MPLS was defined in RFC 3031, and a signaling protocol for P2MP MPLS-TE, that is, TE extensions to the Resource Reservation Protocol (RSVP-TE) was defined in RFC 3209. RSVP-TE is extended for use in a P2MP MPLS-TE environment by RFC 4875 following the requirements set out in RFC 4461.

RFC 3812 provides a MIB module for modeling and controlling P2MP MPLS-TE in conjunction with Textual Conventions defined in RFC 3811. In addition, RFC 3813 defines a MIB module for modeling and controlling an MPLS Label Switching Router (LSR) that may support MPLS-TE. An overview of MPLS MIB modules can be found in RFC 4221.

In addition, there is a description for how to use the LSR MIB module RFC 3813 to model and control an LSR that supports P2MP MPLS-TE.

## Functionality Supported by the Point-to-Multipoint MPLS-TE MIB

- The ability to generate and queue notification messages that signal changes in the operational status of P2MP MPLS-TE tunnels.
- The ability to enable, disable, and configure notification messages for P2MP MPLS-TE tunnels through extensions to existing SNMP commands. .
- The ability to specify the name or the IP address of a network management station (NMS) in the operating environment to which notification messages are to be sent.
- The ability to write notification configurations into nonvolatile memory.

## Notification Generation Events for the Point-to-Multipoint MPLS-TE MIB

When P2MP MPLS-TE notifications are enabled (see the **snmp-server enable traps mpls p2mp-traffic-eng** command), notification messages relating to specific events within Cisco software are generated and sent to a specified NMS in the network. For example, an mplsTeP2mpTunnelDestUp notification is sent to an NMS when an P2MP MPLS-TE tunnel is configured and the tunnel transitions from an operationally “down” state to an “up” state. Conversely, an mplsTeP2mpTunnelDestDown notification is generated and sent to an NMS when an MPLS-TE tunnel transitions from an operationally “up” state to a “down” state.

An up or down trap is generated per sub-LSP when a sub-LSP up or down event is triggered. The traps have two Varbinds:

- cmplsTeP2mpTunnelDestAdminStatus
- cmplsTeP2mpTunnelDestOperStatus

Each trap object is indexed by 12 indices:

- mplsTunnelIndex
- mplsTunnelInstance
- mplsTunnelIngressLsrId
- mplsTunnelEgressLsrId
- mplsTeP2mpTunnelDestSrcSubGroupOriginType
- mplsTeP2mpTunnelDestSrcSubGroupOrigin
- mplsTeP2mpTunnelDestSrcSubGroupID
- mplsTeP2mpTunnelDestSubGroupOriginType
- mplsTeP2mpTunnelDestSubGroupOrigin
- mplsTeP2mpTunnelDestSubGroupID
- mplsTeP2mpTunnelDestDestinationType
- mplsTeP2mpTunnelDestDestination

# Supported Objects in the Point-to-Multipoint MPLS-TE MIB

Using any standard SNMP network management application, you can retrieve and display information from the P2MP MPLS-TE MIB (CISCO-IETF-MPLS-TE-P2MP-MIB) by using GET operations; similarly, you can traverse information in the MIB database for display by using GETNEXT operations.



**Note** The **show mpls traffic-eng tunnels** command can be used to see the value of various objects discussed in this section through the CLI.

The point-to-multipoint MIB tables and objects supported in Cisco IOS releases follow. Important MIB tables (those highlighted in bold type) are described briefly in accompanying text.

Following is a list and description of each entry for the supported P2MP MPLS-TE MIB Scalar objects:

- mplsTeP2mpTunnelConfigured—Total number of P2MP MPLS-TE tunnels configured on this device. A tunnel is considered configured if the mplsTunnelRowStatus in MPLS-TE-STD-MIB is active.
- mplsTeP2mpTunnelActive—Total number of P2MP MPLS-TE tunnels active on this device.

### mplsTeP2mpTunnelTable

The mplsTeP2mpTunnelTable allows new P2MP MPLS-TE tunnels to be created between an LSR and one or more remote endpoints, and existing P2MP MPLS-TE tunnels to be reconfigured or removed. This table augments the mplsTunnelTable in the MPLS-TE-STD-MIB so that the entries in that table can be flagged as

point-to-multipoint, and can be configured and monitored appropriately. The mplsTeP2mpTunnelTable is indexed by four indices similar to the mplsTunnelTable:

- mplsTunnelIndex
- mplsTunnelInstance
- mplsTunnelIngressLSRId
- mplsTunnelEgressLSRId

The mplsTunnelEgressLSRId maps to the P2MP MPLS-TE subgroup-id of the sub-lsp. The subgroup-id is zero for the P2MP MPLS-TE LSP virtual interface (VIF). Therefore, the mplsTunnelEgressLSRId has a zero value for the P2MP MPLS-TE LSP VIF. The mapping of the remainder of the indices is similar to those found in the MPLS-TE MIB.

The following is a list and description of each supported mplsTeP2mpTunnelTable object:

- mplsTeP2mpTunnelBranchRole—Supplements the value in the object mplsTunnelRole in MPLS-TE-STD-MIB that indicates the role of this LSR in the tunnel represented by this entry in mplsTeP2mpTunnelTable. This object supports the head, transit, and tail in order to describe the role of LSR for the tunnel. The following objects describe the mplsTunnelRole:
  - RRR_MGMT_TUN_ROLE_HEAD–Contains the value D_cmplsTeP2mpTunnelBranchRole_notBranch.
  - RRR_MGMT_TUN_ROLE_MID–Contains the value D_cmplsTeP2mpTunnelBranchRole_branch.
  - RRR_MGMT_TUN_ROLE_TAIL–Contains the value D_cmplsTeP2mpTunnelBranchRole_notBranch.
- mplsTeP2mpTunnelP2mpXcIndex– Contains the value of mplsXCIndex, the primary index of the mplsXCTable for all cross-connect entries for this P2MP MPLS-TE LSP.
- mplsTeP2mpTunnelRowStatus– Contains the variable used to create, modify, and delete a row in this table. The row in this table is in the active state only and no objects in that row can be modified by the agent except for the mplsTeP2mpTunnelRowStatus and mplsTeP2mpTunnelStorageType.
- mplsTeP2mpTunnelStorageType– Contains the storage type for this tunnel entry that may or may not be marked “volitile” because this value may or may not be persisted.

**mplsTeP2mpTunnelDestTable**

An entry in this table represents a destination of a P2MP MPLS-TE tunnel. Entries in this table share some index fields with the mplsTeP2mpTunnelTable and the mplsTunnelTable in MPLS-TE-STD-MIB. Entries in this table have no meaning unless there is a corresponding entry in mplsTeP2mpTunnelTable (which, itself, depends on a corresponding entry in mplsTunnelTable). This table shows information about sub-LSPs (one entry per destination of the tunnel). An entry to a destination is considered as sub-lsp.

The first three mplsTeP2mpTunnelDestTable indices are the same as the MPLS-TE MIB:

- mplsTunnelIndex
- mplsTunnelInstance
- mplsTunnelIngressLSRId

The fourth index entry, mplsTunnelEgressLSRId maps to the P2MP MPLS-TE ID. The remainder of the indices are as follows:

- mplsTeP2mpTunnelDestSrcSubGroupOriginType
- mplsTeP2mpTunnelDestSrcSubGroupOrigin
- mplsTeP2mpTunnelDestSrcSubGroupID
- mplsTeP2mpTunnelDestSubGroupOriginType
- mplsTeP2mpTunnelDestSubGroupOrigin
- mplsTeP2mpTunnelDestSubGroupID
- mplsTeP2mpTunnelDestDestinationType
- mplsTeP2mpTunnelDestDestination

The following is a list and description of each supported mplsTeP2mpTunnelDestTable object:

- mplsTeP2mpTunnelDestSrcSubGroupOriginType—Identifies the IPv4 address carried in mplsTeP2mpTunnelDestSrcSubGroupOrigin object at a transit or egress LSR and has a value unknown (0) for an ingress LSR.
- mplsTeP2mpTunnelDestSrcSubGroupOrigin—Contains the TE Router ID (reachable and stable IP address) of the originator of the P2MP MPLS-TE subgroup as received on a Path message by a transit or egress LSR. This object maps to the ingress LSR ID for a egress and transit LSR and unknown (0) for ingress LSR.
- mplsTeP2mpTunnelDestSrcSubGroupID—Contains the unique identifier assigned by the subgroup originator for this subgroup of this P2MP MPLS-TE tunnel as received on a Path message by a transit or egress LSR. This object maps to the subgroup ID for the sub-LSP to this destination for an egress and transit LSR ID and 0 for Ingress. The rrr_get_lsp_id_p2mp_subgroup_id (lsp_id) is used to fetch the value at egress or transit.
- mplsTeP2mpTunnelDestSubGroupOriginType—Identifies the IPv4 address carried in the mplsTeP2mpTunnelDestSubGroupOrigin object.
- mplsTeP2mpTunnelDestSubGroupOrigin—Contains the TE Router ID (reachable and stable IP address) of the originator of the P2MP MPLS-TE subgroup. In many cases, this is the ingress LSR of the P2MP MPLS-TE tunnel and is the received signaled value as available in mplsTeP2mpTunnelDestSrcSubGroupOrigin object. This object maps to Ingress LSR ID.



**Note** The **show mpls traffic-eng tunnels** command can be used to list the source address for tunnel that maps to this object's value.

- mplsTeP2mpTunnelDestSubGroupOrigin—Contains the unique identifier assigned by the subgroup originator for this subgroup of this P2MP MPLS-TE tunnel. This object has the value of subgroup ID of the sub-LSP. At egress, this contains the value of mplsTeP2mpTunnelDestSrcSubGroupID.
- mplsTeP2mpTunnelDestDestinationType—Identifies the IPv4 address carried in the mplsTeP2mpTunnelDestDestination object.
- mplsTeP2mpTunnelDestDestination—Identifies the single destination of this P2MP MPLS-TE tunnel that is the TE address of a leaf that can be routed. This is often the TE Router ID of the leaf, but can be any interface address. When a signaling protocol is used, this object corresponds to the S2L sub-LSP

destination address field in the S2L_SUB_LSP object. This object maps to the destination address of the sub-LSP.

- mplsTeP2mpTunnelDestBranchOutSegment—Identifies the outgoing branch from this LSR towards the destination represented by this table entry. It must be a unique identifier within the scope of this tunnel. This object contains an index into mplsOutSegmentTable object. This value maps to mplsOutSegmentIndex of the MPLS-LSR-STD-MIB. The LSR MIB shows the outgoing branches at a bud node. This outsegmentindex value (for each outsegment) is mapped to each sub-LSP.
- mplsTeP2mpTunnelDestHopTableIndex—Provides the index into the mplsTunnelHopListIndex of mplsTunnelHopTable of RFC TE MIB entry that specifies the explicit route hops for this destination of the P2MP MPLS-TE tunnel. This index is only valid for head entries. For nonhead entries the value is zero.
- mplsTeP2mpTunnelDestPathInUse—Contains the value that denotes the configured path that was chosen as the explicit path to this destination of this P2MP MPLS-TE tunnel. This value reflects the secondary index into mplsTunnelHopTable where the primary index comes from mplsTeP2mpTunnelDestHopTableIndex. This object maps to mplsTunnelPathOptionIndex of RFC TE MIB. TE only supports one path-option to be configured per sub-LSP, so the mplsTeP2mpTunnelDestPathInUse object is always 1.
- mplsTeP2mpTunnelDestCHopTableIndex—Provides the index into the mplsTunnelCHopTable that identifies the explicit path for this destination of the P2MP MPLS-TE tunnel. This object maps to mplsTunnelCHopListIndex of RFC TE MIB.
- mplsTeP2mpTunnelDestARHopTableIndex—Provides the index into the mplsTunnelARHopTable that identifies the actual hops traversed to this destination of the P2MP MPLS-TE tunnel. This is automatically updated by the agent when the actual hops become available. This object maps to mplsTunnelARHopTableIndex of RFC TE MIB.
- mplsTeP2mpTunnelDestAdminStatus—Indicates the desired operational status of this destination of this P2MP MPLS-TE tunnel. Status can be up or down.
- mplsTeP2mpTunnelDestOperStatus—Indicates the actual operational status of this destination of this P2MP MPLS-TE tunnel.
- mplsTeP2mpTunnelDestRowStatus—Creates, modifies, and/or deletes a row in this table. When a row in this table is in the active (1) state, no objects in that row can be modified by SET operations except mplsTeP2mpTunnelDestAdminStatus and mplsTeP2mpTunnelDestStorageType.
- mplsTeP2mpTunnelDestStorageType—Indicates the storage type for this table entry which is permanent. Conceptual rows having the value “permanent” do not allow write-access to any columnar objects in the row.

**mplsTeP2mpTunnelBranchPerfBranch**

An entry in this table provides information about P2MP MPLS-TE Tunnel. The mapping of the first four indices is similar to mplsTeP2mpTunnelTable. The table shows the outsegment information for head and transit entries. For tail entries, the entries are shown to display that tails are configured but values for objects are not provided.

This table has five indices:

- mplsTunnelIndex
- mplsTunnelInstance

- mplsTunnelIngressLSRId
- mplsTunnelEgressLSRId
- mplsTunnelBranchPerfBranch

The following is a list and description of each supported mplsTeP2mpTunnelBranchPerfBranch object:

- mplsTeP2mpTunnelBranchPerfBranch—Identifies an outgoing branch from this LSR for this tunnel. Its value is unique within the context of the tunnel. If MPLS-LSR-STD-MIB is implemented, this object should contain an index into mplsOutSegmentTable. Under all circumstances, this object should contain the same value as mplsTeP2mpTunnelDestBranchOutSegment for destinations reached on this branch. This value maps to mplsOutSegmentIndex of MPLS-LSR-STD-MIB.
- mplsTeP2mpTunnelBranchPerfPackets—Displays the number of packets forwarded by the tunnel onto this branch. This object should represents the 32-bit value of the least significant part of the 64-bit value if both mplsTeP2mpTunnelBranchPerfHCPackets is returned. This object should be read in conjunction with mplsTeP2mpTunnelBranchDiscontinuityTime object.



**Note** The **show interface tunnel** command can be used to see the value of packets.

- mplsTeP2mpTunnelBranchPerfHCPackets—Displays the High Capacity counter for number of packets forwarded by the tunnel onto this branch.
- mplsTeP2mpTunnelBranchPerfErrors—Displays the number of packets dropped because of errors or for other reasons, that were supposed to be forwarded onto this branch for this tunnel. This object should be read in conjunction with mplsTeP2mpTunnelBranchDiscontinuityTime object.
- mplsTeP2mpTunnelBranchPerfBytes—Displays the number of bytes forwarded by the tunnel onto this branch. This object should represent the 32-bit value of the least significant part of the 64-bit value if both mplsTeP2mpTunnelBranchPerfHCBytes is returned. This object should be read in conjunction with mplsTeP2mpTunnelBranchDiscontinuityTime object.



**Note** The **show mpls forwarding-table** command can be used to verify the values.

- cmplsTeP2mpTunnelBranchLocalLabel—Displays the local MPLS label for this branch.



**Note** Use the **show mpls traffic-eng forwarding path-set** and **show cef path set detail** commands can also be used to view label information.

- cmplsTeP2mpTunnelBranchOutIfIndex—Displays the index of outgoing TE link physical interface for the P2MP MPLS-TE egress tunnel branch. It is nonzero when the P2MP MPLS-TE tunnel's outgoing branch has been signaled.
- cmplsTeP2mpTunnelBranchOutLabel—Displays the outgoing MPLS label for this branch.

**Note** Use the **show mpls traffic-eng forwarding path-set** and **show cef path set detail** commands can also be used to view label information.

- cmplsTeP2mpTunnelBranchInIfIndex—Displays the index of incoming TE link physical interface for the P2MP MPLS-TE ingress tunnel branch. It is nonzero when the P2MP MPLS-TE tunnel's incoming branch has been signaled and it is applicable only on midpoint routers for tunnels having out-segment up and running.

# How to Configure the Point-to-Multipoint MPLS-TE MIB

## Configuring the Router to Send SNMP Notifications to a Host for Monitoring Point-to-Multipoint MPLS-TE

Although you can set the *community-string* argument using the **snmp-server host** command by itself, we recommend that you define this string using the **snmp-server community** command prior to using the **snmp-server host** command.

Perform this task to configure the router to send SNMP notifications to a host to monitor P2MP MPLS-TE. The ability to display SNMP notifications helps in managing P2MP MPLS-TE sessions by determining if any P2MP MPLS-TE sessions between peers are up or down.

The **snmp-server host** command specifies which hosts receive notifications or traps. The **snmp-server enable traps** command globally enables the trap production mechanism for the specified traps.

For a host to receive a trap, an **snmp-server host** command must be configured for that host, and, generally, the trap must be enabled globally through the **snmp-server enable traps** command.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server host** *host-address community-string* **udp-port** *port* **p2mp-traffic-eng**
4. **snmp-server enable traps mpls p2mp-traffic-eng** [**down** | **up**]
5. **end**

### DETAILED STEPS

**Procedure**

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

| | Command or Action | Purpose |
|---|---|---|
| **Step 2** | **configure terminal**<br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **snmp-server host** *host-address community-string* **udp-port** *port* **p2mp-traffic-eng**<br>**Example:**<br>`Router(config)# snmp-server host 172.20.2.160 comp2mppublic udp-port 162 p2mp-traffic-eng` | Specifies the recipient of an SNMP notification operation.<br>• The *host-address* argument specifies the name or Internet address of the host (the targeted recipient).<br>• The *community-string* argument is a password-like community string sent with the notification operation.<br>• The **udp-port** *port* keyword-argument pair names the UDP port of the host to use. The default is 162.<br>• The **p2mp-traffic-eng** keyword specifies that P2MP MPLS-TE SNMP traps are allowed to be sent to the host. |
| **Step 4** | **snmp-server enable traps mpls p2mp-traffic-eng** [**down** \| **up**]<br>**Example:**<br>`Router(config)# snmp-server enable traps mpls p2mp-traffic-eng` | Enables the router to send P2MP MPLS-TE SNMP traps.<br>• (Optional) The **down** keyword enables or disables P2MP MPLS-TE tunnel down trap notifications (mplsTeP2mpTunnelDestDown). This message is generated when a P2MP MPLS-TE tunnel between the router and its destination is terminated.<br>• (Optional) The **up** keyword enables or disables P2MP MPLS-TE tunnel up trap notifications (mplsTeP2mpTunnelDestUp). This notification is generated when the router establishes a P2MP MPLS-TE tunnel between the router and its destination is established. |
| **Step 5** | **end**<br>**Example:**<br>`Router(config)# end` | (Optional) Exits to privileged EXEC mode. |

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| Cisco IOS commands | Cisco IOS Master Commands List, All Releases |
| MPLS commands | Cisco IOS Multiprotocol Label Switching Command Reference |

| Related Topic | Document Title |
|---|---|
| MPLS: Embedded Management and MIBs | *MPLS: Embedded Management and MIBs Configuration Guide* |

### Standards and RFCs

| Standard/RFC | Title |
|---|---|
| draft-ietf-mpls-p2mp-te-mib-09 | *Point-to-Multipoint Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) Management Information Base (MIB) module* |
| RFC 3031 | *Multiprotocol Label Switching Architecture* |
| RFC 3209 | *RSVP-TE: Extensions to RSVP for LSP Tunnels* |
| RFC 3811 | *Definitions of Textual Conventions (TCs) for Multiprotocol Label Switching (MPLS) Management* |
| RFC 3812 | *Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) Management Information Base (MIB)* |
| RFC 3813 | *Multiprotocol Label Switching (MPLS) Label Switching Router (LSR) Management Information Base (MIB)* |
| RFC 4221 | *Multiprotocol Label Switching (MPLS) Management Overview* |
| RFC 4875 | *Extensions to Resource Reservation Protocol - Traffic Engineering (RSVP-TE) for Point-to-Multipoint TE Label Switched Paths (LSPs)* |
| RFC4461 | *Signaling Requirements for Point-to-Multipoint Traffic-Engineered MPLS Label Switched Paths (LSPs)* |

### MIBs

| MIB | MIBs Link |
|---|---|
| CISCO-IETF-MPLS-TE-P2MP-MIB (draft-ietf-mpls-p2mp-te-mib-09)<br>MPLS-TE-MIB<br>Interfaces MIB<br>MPLS-TE-STD-MIB | To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL:<br>http://www.cisco.com/go/mibs |

### 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 Point-to-Multipoint MPLS-TE MIB

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

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

*Table 1: Feature Information for Point-to-Multipoint MPLS-TE MIB*

| Feature Name | Releases | Feature Information |
|---|---|---|
| Point-to-Multipoint MPLS-TE MIB | 15.2(1)S | The point-to-multipoint (P2MP) Multiprotocol Label Switching (MPLS)-traffic engineering (TE) MIB describes the Label Switched Path (LSP) in the IP and MPLS network. An administrator can use the P2MP MPLS-TE MIB to determine optimal branch points in the network so that optimal links are used.<br><br>This feature was introduced in Cisco IOS Release 15.2(1)S.<br><br>The following commands were introduced or modified: **snmp-server enable traps mpls p2mp-traffic-eng**, **snmp-server host udp-port p2mp-traffic-eng** |