

Multiprotocol Label Switching Traffic Engineering

This chapter describes the level of support that Cisco ANA provides for Multiprotocol Label Switching Traffic Engineering (MPLS TE), as follows:

- [Technology Description, page 16-1](#)
- [Information Model Objects \(IMOs\), page 16-2](#)
- [Vendor-Specific Inventory and IMOs](#)
- [Service Alarms, page 16-5](#)

Technology Description

This section provides the following MPLS TE technology descriptions:

- [MPLS TE](#)
- [MPLS TE FRR](#)

Please see Part 1: Cisco VNEs in this guide for information about which devices support the various technologies.

MPLS TE

MPLS TE software enables an MPLS backbone to replicate and expand upon the traffic engineering capabilities of Layer 2 ATM and Frame Relay networks. MPLS TE is in wide use on service-provider backbone networks where extreme levels of efficient resource usage and failure recovery are essential.

MPLS TE lets network operators route traffic using *constraint-based routing*. In this type of routing, the path for traffic flow is the shortest path that meets the resource requirements (or constraints) of the traffic flow. These constraints can include bandwidth requirements, media requirements, priority versus other flows, and so on. MPLS TE gracefully recovers from link or node failures that change the topology of the backbone by adapting to the new set of constraints.

MPLS TE is founded on the MPLS integration of Layer 2 and Layer 3 technologies. By making traditional Layer 2 features available to Layer 3, MPLS enables traffic engineering. Providers can offer in a one-tier network what could be achieved otherwise only by overlaying a Layer 3 network on a Layer 2 network.

MPLS TE tunnel paths are calculated at the tunnel head based on a fit between required and available resources (constraint-based routing). The IGP automatically routes the traffic into these tunnels. Typically, a packet crossing the MPLS traffic engineering backbone travels on a single tunnel that connects the ingress point to the egress point.

Cisco ANA does not support discovery of MPLS TE Network layer topology.

MPLS TE FRR

MPLS TE FRR protects the functionality of MPLS networks by permitting fast rerouting of traffic to a backup LSP whenever a link or node along an LSP fails.

Information Model Objects (IMOs)

This section describes the following IMOs:

- [MPLS TE Tunnel Interface \(IMplsTETunnel\)](#)
- [MPLS TE Properties \(IMplsTEProperties\)](#)
- [MPLS TE Allocation Entry \(IMplsTEPropertiesAllocationEntry\)](#)
- [MPLS TE Tunnel Segment \(IMplsTESegment\)](#)

MPLS TE Tunnel Interface

The network/data link layer [MPLS TE Tunnel Interface](#) object is bound by its Containing Termination Points attribute to a data link layer interface object. It is accessed primarily by the Network layer [IP Interface](#) object bound by its Contained Connection Termination Points attribute. It is also accessed by the [Label Switching Entity](#).

Table 16-1 MPLS TE Tunnel Interface (IMplsTETunnel)

| Attribute Name | Attribute Description | Scheme | Polling Interval |
|--|--|--------|------------------|
| Destination Address | Destination IP address | IpCore | Configuration |
| Outgoing Interface and Label | Outgoing interface and label | IpCore | Configuration |
| LSP Identification | Label Switching Path (LSP) identifier | IpCore | Configuration |
| Requested Bandwidth | Requested bandwidth | IpCore | Configuration |
| Measured Average, Burst and Peak Bandwidth | Measured average, burst, and peak bandwidth | IpCore | Configuration |
| Setup and Hold Priority | Setup and hold priority of the tunnel | IpCore | Configuration |
| Affinity Bits and Mask | Required traffic engineering affinity bits and mask attributes of the tunnel's links | IpCore | Configuration |
| Automatic Route Announcement Status | Automatic route announcement status (<i>Enable, Disable</i>) | IpCore | Configuration |
| Optimization Lock Down Status | Label switching path optimization lock down status (<i>Enable, Disable</i>) | IpCore | Configuration |
| Path Option | Label switching path option (<i>Explicit, Dynamic</i>) | IpCore | Configuration |

Table 16-1 *MPLS TE Tunnel Interface (IMplsTETunnel) (continued)*

| Attribute Name | Attribute Description | Scheme | Polling Interval |
|---|--|--------|------------------|
| Name | Interface name | IpCore | Configuration |
| Description | Interface description | IpCore | Configuration |
| Administrative Status | Administrative status (<i>Unknown, Up, Down</i>) | IpCore | Status |
| Operational Status | Operational status (<i>Unknown, Up, Down</i>) | IpCore | Status |
| IsFRREnabled | Indicates whether Fast Reroute is enabled on this tunnel (<i>true, false</i>) | IpCore | Configuration |
| IANA Type | Internet Assigned Numbers Authority (IANA) type of the sublayer | N/A | N/A |
| Containing Termination Points | Underlying termination points (MPLS Interface) | IpCore | N/A |
| Contained Connection Termination Points | Bound connection termination points (IP Interface or MPLS Interface) | IpCore | N/A |

MPLS TE Properties

The [MPLS TE Properties](#) object and its [MPLS TE Allocation Entry](#) objects describe the traffic engineering properties of an [MPLS Interface](#) object, to which they bound are by the [MPLS Interface](#) object's Traffic Engineering Properties attribute.

Table 16-2 *MPLS TE Properties (IMplsTEProperties)*

| Attribute Name | Attribute Description | Scheme | Polling Interval |
|---|--|--------|------------------|
| Administrative Weight | Administrative weight | IpCore | Configuration |
| Attributes Identifier | Attributes list identifier | IpCore | Configuration |
| signaling Protocol | signaling protocol (<i>None, RSVP, CR-LDP, Other</i>) | IpCore | Configuration |
| Available, Physical and Reserveable Bandwidth | Available, physical, and reserveable bandwidth | IpCore | Configuration |
| Reserved Bandwidth | Array of instances of MPLS TE Allocation Entry | IpCore | Configuration |

MPLS TE Allocation Entry

Table 16-3 *MPLS TE Allocation Entry (IMplsTEPropertiesAllocationEntry)*

| Attribute Name | Attribute Description | Scheme | Polling Interval |
|------------------------------------|---|--------|------------------|
| Priority Level | Allocation priority level (<i>0-7</i>) | IpCore | Configuration |
| Allocated and Cumulative Bandwidth | Allocated and cumulative bandwidth at, and up to, this priority level | IpCore | Configuration |

MPLS TE Tunnel Segment

The [MPLS TE Tunnel Segment](#) object describes the properties of a single segment of an MPLS TE Tunnel. Cisco ANA uses this object to help users visualize MPLS TE Tunnels networks, and it affects the VNE logic implementation. Tunnel segments are aggregated in the MPLS TE Tunnel Segments table of the Label Switching Entity.

Table 16-4 MPLS TE Tunnel Segment (IMplsTESegment)

| Attribute Name | Attribute Description | Scheme | Polling Interval |
|--|---|--------|------------------|
| Segment Type | Segment type (<i>Head, Intermediate, Tail</i>). | IpCore | Configuration |
| Measured Average, Burst and Peak Bandwidth | Measured average, burst, and peak bandwidth. | IpCore | Configuration |
| LSP Identification | Label Switching Path (LSP) identifier. | IpCore | Configuration |
| Name | Segment name. | IpCore | Configuration |
| FRR Tunnel Name | Name of the Fast Reroute backup TE tunnel for the given MPLS TE tunnel segment. | IpCore | Configuration |
| FRR Tunnel State | Indicates the status of the Fast Reroute backup tunnel: <i>ready</i> when the primary tunnel is in working condition; <i>active</i> when there is a failure in the primary tunnel and the backup is in use; <i>not configured</i> if the primary has no designated backup tunnel. | IpCore | Configuration |
| Average Bandwidth | The current bandwidth used to automatically allocate the tunnel's bandwidth. | IpCore | Configuration |
| In Interface | Incoming interface (if not a head segment). | IpCore | Configuration |
| In Label | Incoming label (if not a head segment). | IpCore | Configuration |
| Out Interface | Outgoing interface (if not a tail segment). | IpCore | Configuration |
| Out Label | Outgoing label (if not a tail segment). | IpCore | Configuration |
| Source Address | Source IP address of the tunnel. | IpCore | Configuration |
| Destination Address | Destination IP address of the tunnel. | IpCore | Configuration |

Vendor-Specific Inventory and IMOs

There are no vendor-specific inventory or IMOs for this technology.

Service Alarms

The following alarms are supported for this technology:

- [MPLS TE Tunnel Down, page 41-51](#)
- [MPLS TE FRR State Changed, page 41-51](#)

