CHAPTER 16

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

This section provides the following MPLS TE technology descriptions:

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.

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 (*Enable, Disable*)	IPCore	Configuration
Optimization Lock Down Status	Label switching path optimization lock down status (*Enable, Disable*)	IPCore	Configuration
Path Option	Label switching path option (*Explicit, Dynamic*)	IPCore	Configuration
Name	Interface name	IPCore	Configuration

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

Attribute Name	Attribute Description	Scheme	Polling Interval
Description	Interface description	IPCore	Configuration
Administrative Status	Administrative status (*Unknown, Up, Down*)	IPCore	Status
Operational Status	Operational status (*Unknown, Up, Down*)	IPCore	Status
IsFRREnabled	Indicates whether Fast Reroute is enabled on this tunnel (*true*, *false*)	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 (*None, RSVP, CR-LDP, Other*)	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 (*0-7*)	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 (*Head, Intermediate, Tail*).	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
FRRTunnelName	Name of the Fast Reroute backup TE tunnel for the given MPLS TE tunnel segment.	IPCore	Configuration
FRRTunnelState	Indicates the status of the Fast Reroute backup tunnel: *ready* when the primary tunnel is in working condition; *active* when there is a failure in the primary tunnel and the backup is in use; *not configured* if the primary has no designated backup tunnel.	IPCore	Configuration
AverageBandwidth	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.

Network Topology

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

Service Alarms

The following alarms are supported for this technology:

- MPLS TE Tunnel Down, page 41-49
- MPLS TE FRR State Changed, page 41-49