



## CHAPTER 12

# Multiprotocol Label Switching “MPLS”

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This chapter describes the level of support that Cisco ANA provides for MPLS, as follows:

- [Technology Description, page 12-1](#)
- [Inventory and Information Model Objects \(IMOs\), page 12-2](#)
- [Network Topology, page 12-4](#)
- [Service Alarms, page 12-4](#)

## Technology Description

### MPLS

Multi-Protocol Label Switching (MPLS) was originally presented as a way of improving the forwarding speed of routers but is now emerging as a crucial standard technology that offers new capabilities for large scale IP networks. Traffic Engineering (TE), the ability of network operators to dictate the path that traffic takes through their network, and Virtual Private Network (VPN) support are examples of two key applications where MPLS is superior to any currently available IP technology. It integrates Layer 2 information about network links (bandwidth, latency, utilization) into Layer 3 (IP) within a particular autonomous system, or ISP, in order to simplify and improve IP packet exchange, while giving network operators a great deal of flexibility to divert and route traffic around link failures, congestion, and bottlenecks.

When packets enter a MPLS-based network, Label Edge Routers (LERs) give them a label (identifier). These labels not only contain information based on the routing table entry (i.e., destination, bandwidth, delay, and other metrics), but also refer to the IP header field (source IP address), Layer 4 socket number information, and differentiated service. Once this classification is complete and mapped, different packets are assigned to corresponding Labeled Switch Paths (LSPs), where Label Switch Routers (LSRs) place outgoing labels on the packets.

# Inventory and Information Model Objects (IMOs)

This section includes the following tables:

- [MPLS Interface \(IMpls\)](#)
- [Label Switching Entity \(ILse\)](#)
- [Equivalent Label Switching Entry \(ILSEEntries\)](#)
- [MPLS Entry \(IMplsEntry\)](#)
- [MPLS Aggregate Entry \(IMplsAggregateEntry\)](#)

## MPLS Interface

The following Network/Data Link layer [MPLS Interface](#) object, represent an MPLS configuration in a router interface. It is bound by its Containing Termination Points attribute to a Data Link Layer Interface object, and is primarily being accessed by Network layer [IP Interface](#), bound by its Contained Connection Termination Points attribute. It is also being accessed by [Label Switching Entity](#).

**Table 12-1** *MPLS Interface (IMpls)*

| Attribute Name                          | Attribute Description                                                 |
|-----------------------------------------|-----------------------------------------------------------------------|
| Distribution Protocol                   | Distribution protocol ( <i>Null, LDP, TDP, RSVP, TDP and LDP</i> )    |
| Outer and Inner Labels                  | Outer and inner labels for PathTracer                                 |
| Traffic Engineering Properties          | Traffic engineering properties ( <a href="#">MPLS TE Properties</a> ) |
| IANA Type                               | IANA type of the sub/layer                                            |
| Containing Termination Points           | Underlying termination points (connection or physical)                |
| Contained Connection Termination Points | Bound Connection Termination Points                                   |

## Label Switching Entity

The following [Label Switching Entity](#) object describes the label distribution protocol independent Label Switching forwarding component of a Label Switching Router (LSR), which is bound by its Logical Sons attribute to all Network or Data Link layer [MPLS Interface](#) objects, which IP Packets are being switched between by this [Label Switching Entity](#).

**Table 12-2** *Label Switching Entity (ILse)*

| Attribute Name       | Attribute Description                                                                      |
|----------------------|--------------------------------------------------------------------------------------------|
| MPLS Table           | Array of <a href="#">Equivalent Label Switching Entries</a> between MPLS Interfaces        |
| MPLS Aggregate Table | Array of <a href="#">Equivalent Label Switching Entries</a> from MPLS Interfaces into VRFs |

**Table 12-2** *Label Switching Entity (ILse) (continued)*

|                      |                                                                                                                                            |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| MPLS Tunnel Segments | Array of switched MPLS TE tunnel segments (GUI usage) (see <a href="#">Multi Protocol Label Switching Traffic Engineering (MPLS-TE)</a> )  |
| Logical Sons         | Array of all <a href="#">MPLS Interfaces</a> , which IP packets are being switched between, by this <a href="#">Label Switching Entity</a> |

## Equivalent Label Switching Entry

The following [Equivalent Label Switching Entry](#), [MPLS Entry](#) and [MPLS Aggregate Entry](#) objects describe an MPLS Label Switching Table’s entries, each as an array of either [MPLS Entries](#) or [MPLS Aggregate Entries](#) sharing a single ingress label.

**Table 12-3** *Equivalent Label Switching Entry (ILSEEntries)*

| Attribute Name          | Attribute Description                                                                                                   |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Label Switching Entries | Array of either <a href="#">MPLS Entries</a> or <a href="#">MPLS Aggregate Entries</a> (sharing a single ingress label) |

## MPLS Entry

**Table 12-4** *MPLS Entry (IMplsEntry)*

| Attribute Name               | Attribute Description                                                         |
|------------------------------|-------------------------------------------------------------------------------|
| Incoming Label               | Incoming label                                                                |
| Outgoing Interface and Label | Outgoing interface and label                                                  |
| Switching Action             | Switching action ( <i>Null, Pop, Swap, Aggregate, Untagged, Pop and Act</i> ) |
| Next Hop IP Address          | Next hop IP address                                                           |

## MPLS Aggregate Entry

**Table 12-5** *MPLS Aggregate Entry (IMplsAggregateEntry)*

| Attribute Name               | Attribute Description                                                         |
|------------------------------|-------------------------------------------------------------------------------|
| Virtual Routing Entity       | Virtual Routing (VRF) entity                                                  |
| Incoming Label               | Incoming label                                                                |
| Outgoing Interface and Label | Outgoing interface and label                                                  |
| Switching Action             | Switching action ( <i>Null, Pop, Swap, Aggregate, Untagged, Pop and Act</i> ) |
| Next Hop IP Address          | Next hop IP address                                                           |

# Network Topology

The discovery of Multi Protocol Label Switching (MPLS) network layer topology is done by searching for the existence of the local IP subnet in any one hop away remote side’s [MPLS Interface](#). In particular a comparison is made between the local and remote IP subnets gathered from the upper IP network layers.

## Service Alarms

The following alarms are supported for this technology:

- Broken LSP Discovered
- MPLS Black Hole Found/MPLS Black Hole Cleared
- MPLS Interface Removed/MPLS Interface Add

**Note**

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For a detailed description of these alarms and for information about correlation see the *Cisco Active Network Abstraction MPLS User Guide, 3.6*.

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