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Multiprotocol Label Switching (MPLS) Management Overview

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Abstract

This memo describes the Multi-Protocol Label Switching (MPLS) [RFC3031] management architecture and the inter-relationships between the different management information bases (MIBs).

1. Introduction

This memo defines a Management Architecture for Multi-Protocol Label Switching. In particular, it describes how various managed objects defined in various Management Information Base (MIB) documents model different aspects of Multi-Protocol Label Switching (MPLS) [MPLSArch]. Furthermore, this document explains the interactions and dependencies between each of these documents.

Comments should be made directly to the MPLS mailing list at mpls@uu.net.

This memo does not, in its draft form, specify a standard for the Internet community.

2. Terminology

This document uses terminology from the MPLS architecture document [MPLSArch] and various MPLS-related MIBs such as the MPLS-TC-MIB [TCMIB], MPLS-LSR-MIB [LSRMIB], MPLS-TE-MIB

[TEMIB], MPLS-LDP-MIB [LDPMIB], MPLS-FTN-MIB [FTNMIB], and

the MPLS-LINK-BUNDLING-MIB [LBMIB].

3. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in RFC 2571 [RFC2571].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIv1 and described in STD 16, RFC 1155 [RFC1155], STD 16, RFC 1212 [RFC1212] and STD 16, RFC 1215 [RFC1215]. The second version, called SMIv2, is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [RFC1157]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [RFC1901] and RFC 1906 [RFC1906]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [RFC1906], RFC 2572 [RFC2572] and RFC 2574 [RFC2574].
- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [RFC1157]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [RFC1905].
- A set of fundamental applications described in RFC 2573 [RFC2573] and the view-based access control mechanism described in RFC 2575 [RFC2575].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [RFC2570].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined

in the SMI.

4. MIBs Addressed by the MPLS Management Framework

This section will briefly explain what the purpose of each MPLS-related MIB is and what it can be used for. Each section contains a subsection that details the interdependencies between that MIB and any of the other MPLS MIBs.

4.1. MPLS-TC-MIB

The MPLS-TC-MIB [TC-MIB] describes textual conventions [SMIv2TC] and object identities that may be common to MPLS-related MIBs. For example, the textual convention for representing an MPLS label should be commonly represented and used by all MPLS-related MIBs.

4.2. MPLS-LSR-MIB

The MPLS-LSR-MIB describes managed objects for modeling a Multi-Protocol Label Switching (MPLS) [MPLSArch, MPLSFW] Label Switch Router (LSR). In particular, this MIB is used to model and manage the basic label switching behavior and the label forwarding information base (LFIB) of an MPLS LSR. In doing so, the MIB provides a view of the LSPs that are being switched by the LSR in question.

This MIB is the basis for many of the MPLS MIBs, since basic MPLS label switching is common to all MPLS applications. In general, the MPLS-LSR-MIB provides a model of incoming labels on MPLS-enabled interfaces being mapped to outgoing labels on MPLS-enabled interfaces via a conceptual object called an MPLS cross-connect. MPLS cross-connect entries and their properties are represented in the MPLS cross-connect table (mplsXCTable) in the LSR MIB. MPLS cross-connect entries are typically referred to by other MIBs in order to reference the underlying MPLS LSP.

For example, the MPLS-TE-MIB [TEMIB] models traffic engineered tunnels. These tunnels map to one more underlying MPLS LSPs. Thus, the MPLS-TE-MIB's tunnel table (mplsTunnelTable) entries refer to the underlying LSP by pointing to entries in mplsXCTable.

4.2.1. Dependencies

This MIB does not directly depend upon any other MPLS MIBs.
It does represent MPLS-enabled interfaces as entries in the

Interfaces MIB [RFC2233] Interface Table (ifTable). This MIB imports several textual conventions from the MPLS-TC-MIB [TCMIB].

4.3. MPLS-LDP-MIB

The MPLS-LDP-MIB describes managed objects used to model and manage the Multiprotocol Label Switching Label Distribution Protocol (LDP).

4.3.1. Dependencies

Forward Equivalency Class (FEC) entries in the LDP MIBÆs xxxx table () are mapped to LSPs by pointing to an entry in mplsXCTable in the MPLS-LSR-MIB. This MIB also imports several textual conventions from the MPLS-TC-MIB [TCMIB].

4.4. MPLS-TE-MIB

The MPLS-TE-MIB [TEMIB] describes managed objects that are used to model and manage MPLS Traffic Engineered (TE) Tunnels. The MIB is based around a table that represents TE tunnels that either originate at the LSR in question or traverse via or terminate on the LSR. Note that the later case is optional, as only tunnel "heads" are required to be represented. This MIB provides statistics and configuration objects needed for TE tunnels.

4.4.1. Dependencies

This MIB depends on the MPLS-LSR-MIB [LSRMIB] and Interfaces MIB [RFC2233]. Tunnel entries in the MPLS-TE-MIBÆs mplsTunnelTable refer to entries in mplsXCTable in the MPLS-LSR-MIB. When MPLS TE tunnels are represented as interfaces, entries for such tunnels in mplsTunnelTable have corresponding entries in the Interfaces MIBÆs [RFC2233] Interfaces Table (ifTable). This MIB also imports several textual conventions from the MPLS-TC-MIB [TCMIB].

4.5. MPLS-FTN-MIB

The MPLS-FTN-MIB [FTNMIB] describes managed objects that are used to model and manage the MPLS FEC-to-NHLFE mappings which take place at any LSR that is on the edge between an MPLS domain and a non-MPLS domain. On each such edge LSR,

to map traffic from the non-MPLS domain into the MPLS domain, the FEC-to-NHLFE mapping objects in the MPLS-FTN-

MIB must be supported. In the case of an IP-to-MPLS mapping, the FEC objects describe IP 5-tuples representing IP source and destination ranges, protocol ranges etc. Matching IP packets can be mapped to an NHLFE which can either be an MPLS LSP or an MPLS TE tunnel.

4.5.1. Dependencies

This MIB relies directly on the MPLS-LSR-MIB [LSRMIB] and MPLS-TE-MIB [TEMIB]. FECs can be mapped to two types of NHLFEs by the MPLS-FTN-MIB. When the NHLFE is an LSP, the FEC-to-NHLFE mapping is accomplished by referring to a corresponding entry in mplsXCTable in the MPLS-LSR-MIB. When the NHLFE is an MPLS TE tunnel, this mapping is accomplished by referring to a corresponding entry in mplsTunnelTable in MPLS-TE-MIB.

4.6. MPLS-LINK-BUNDLING-MIB

The MPLS-LINK-BUNDLING-MIB [LBMIB] describes managed objects that are used to model and manage the MPLS TE interfaces, as well as the link bundling relationship that may exist between those interfaces.

4.6.1. Dependencies

The MPLS-LINK-BUNDLING-MIB [LBMIB] interacts directly only with the Interfaces MIB [RFC2233]; it references MPLS TE interfaces that are modeled by entries in the interfaces table (ifTable) in the Interfaces MIB [RFC2233].

4.7. PPVPN-MPLS-VPN-MIB

The PPVPN-MPLS-VPN-MIB [VPNMIB] describes managed objects that are used to model and manage RFC2277bis MPLS VPNs. This MIB contains tables which model virtual routing forwarding entries (VRFs), as well as the interfaces associated with those VRFs.

4.7.1. Dependencies

This MIB currently has not direct dependencies to any of the MPLS MIBs. This MIB does model MPLS VPN interfaces as entries in the Interfaces MIB [RFC2233]. This MIB may be modified in the future to import textual conventions from the MPLS-TC-MIB [TCMIB].

5. Dependencies on Other IETF Working Groups

This section will detail the broad interactions between other working groups and the MPLS MIBs.

5.1. Pseudo Wire Emulation Edge to Edge MIBs

The Pseudo Wire Emulation Edge to Edge (pwe3) working group has produced a framework [PWE3ARCH] describes a framework for PWE3 MIBs. Since the PWE3 architecture includes the use of MPLS as an emulated service and as a PSN service, the MPLS MIBs described above may be leveraged. This framework document describes the interactions between the MPLS MIBs and the PWE3 MIBs.

5.2. Provider Provisioned Virtual Private Network MIBs

At present, the Provider Provisioned Virtual Private Network (PPVPN) working group has not included a discussion of how the MPLS MIBs interact with the MIBs being produced by that working group. The authors of this draft hope to make a forthcoming addition to their framework [PPVPNFW] document detailing these interactions. At the moment, there is only a single MIB produced which interacts with the MPLS MIBs, as this MIB is described above in section

5.3. Common Control and Measurement Plane (ccamp) WG

At present, there are no MIBs produced by the CCAMP working group that interact directly with the MPLS MIBs. However, in the future, the existing MPLS MIBs will need to be extended and augmented to facilitate the technology being produced by this working group.

6. Security Considerations

This document describes the inter-relationships amongst the different MIBs relevant to MPLS management and as such does not have any security implications beyond those imposed by these MIBs themselves.

7. Acknowledgments

TBD.

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