Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: August 25, 2017

Z. Zhang
Juniper Networks, Inc.
H. Tsunoda
Tohoku Institute of Technology
February 21, 2017

L2L3 VPN Multicast MIB
draft-ietf-bess-l2l3-vpn-mcast-mib-06

Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes common managed objects used by other MIB modules which are designed for monitoring and/or configuring both Layer 2 and Layer 3 Virtual Private Networks (VPN) that support multicast.

Table of Contents

1. Introduction

[RFC7117] and [RFC6513] specify procedures for supporting multicast in Border Gateway Protocol/MultiProtocol Label Switching (BGP/MPLS) Layer 2 (L2) and Layer 3 (L3) VPN (Virtual Private Network), respectively.

Multicast service in BGP/MPLS L2 and L3 VPN can be achieved by using various kinds of transport mechanism for forwarding a packet to all or a subset of Provider Edge routers (PEs) across service provider networks. Such transport mechanisms are referred to as provider tunnels (P-tunnels).

The signaling of P-tunnel choice is very similar for multicast in both L2 and L3 VPNs. [RFC7117] and [RFC6513] describe BGP-based mechanisms for Virtual Private LAN Service (VPLS) and Multicast VPN (MVPN), respectively. [RFC6514] defines the Provider Multicast Service Interface (PMSI) tunnel attribute, a BGP attribute that specifies information of a P-tunnel. The PMSI tunnel attribute is advertised/received by PEs in BPG auto-discovery (A-D) routes. [RFC6513] also proposes a UDP-based signaling mechanism.

This document defines a textual conventions (TC) that can be used to represent types of P-tunnels used for multicast in BGP/MPLS L2 or L3 VPN within MIB module specifications.

This document also describes common managed objects used by other MIB modules which are designed for monitoring and/or configuring both L2 and L3 VPN that support multicast.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

1.1. Terminology

This document adopts the definitions, acronyms and mechanisms described in [RFC6513] [RFC6514] [RFC7117] and other documents that they refer to. Familiarity with Multicast, MPLS, L3 VPN, MVPN (Multicast VPN) concepts and/or mechanisms is assumed. Some terms specifically related to this document are explained below.

The term "Multicast VPN (MVPN)" [RFC6513] refers to a BGP/MPLS L3 (IP) VPN service that supports multicast.

"Provider Multicast Service Interface (PMSI)" [RFC6513] is a conceptual interface instantiated by a P-tunnel, a transport mechanism used to deliver multicast traffic. A PE uses to send customer multicast traffic to all or some PEs in the same VPN.

There are two kinds of PMSI: "Inclusive PMSI (I-PMSI)" and "Selective PMSI (S-PMSI)" [RFC6513]. An I-PMSI is a PMSI that enables a PE attached to a particular MVPN to transmit a message to all PEs in the same VPN. An S-PMSI is a PMSI that enables a PE attached to a particular MVPN to transmit a message to some of the PEs in the same VPN.

Throughout this document, we will use the term "I/S-PMSI" to refer both "I-PMSI" and "S-PMSI".

[RFC6513] describes following tunnel setup techniques that can be used to create the P-tunnels that instantiate the PMSIs.

- Protocol Independent Multicast tree
  - Sparse Mode (PIM-SM) tree [RFC4601]
  - Source Specific Multicast (PIM-SSM) tree [RFC4601]
  - Bidirectional Protocol Independent Multicast (BIDIR-PIM) tree [RFC5015]
- Label Distribution Protocol Extension for Multipoint Label Switched Paths (mLDP) [RFC6388]
  - Point-to-MultiPoint (mLDP P2MP)
  - Point-to-MultiPoint (mLDP MP2MP)

- Resource Reservation Protocol - Traffic Engineering Point-to-Multipoint (RSVP-TE P2MP) Label Switched Path [RFC4875]

- Ingress Replication through Unicast Tunnels [RFC6513]

A created tunnel will be identified by Tunnel Identifier. The length of the identifier differs depending on the setup technique that is used to create the tunnel.

2. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

3. Summary of MIB Module

This document defines two MIB modules: L2L3-VPN-MCAST-TC-MIB and L2L3-VPN-MCAST-MIB.

- L2L3-VPN-MCAST-TC-MIB contains a Textual Convention L2L3VpnMcastProviderTunnelType that provides an enumeration of the provider tunnel types.

- L2L3-VPN-MCAST-MIB defines a table l2L3VpnMcastPmsiTunnelAttributeTable. An entry of this table corresponds with a PMSI Tunnel Attribute (PTA) advertised/received by PE routers. The entry of the table will be used by other MIB modules which are designed for monitoring and/or configuring both L2 and L3 VPN that support multicast.
  The table index is composed of multiple attributes that depend on the tunnel type and uniquely identify a tunnel.
  The table may also be used in conjunction with other MIBs, such as MPLS Traffic Engineering MIB (MPLS-TE-STD-MIB) [RFC3812], to obtain the other details of a tunnel by following the row pointer of the corresponding tunnel's row in this table. It may also be used in conjunction with Interfaces Group MIB (IF-MIB) [RFC2863] to obtain the other details of a corresponding interface that

tunnel uses by following the row pointer of the corresponding tunnel's row in this table.

4. Definitions

4.1. L2L3-VPN-MCAST-TC-MIB Object Definitions

```
L2L3-VPN-MCAST-TC-MIB DEFINITIONS ::= BEGIN

IMPORTS
  MODULE-IDENTITY, mib-2
     FROM SNMPv2-SMI                              -- [RFC2578]

  TEXTUAL-CONVENTION
     FROM SNMPv2-TC;                              -- [RFC2579]

l2L3VpnMcastTCMIB MODULE-IDENTITY
  LAST-UPDATED "201702211200Z"  -- 21th February, 2017
  ORGANIZATION "IETF BESS Working Group."
  CONTACT-INFO
        "        Zhaohui Zhang
                 Juniper Networks, Inc.
                 10 Technology Park Drive
                 Westford, MA 01886
                 USA
                 Email: zzhang@juniper.net

                 Hiroshi Tsunoda
                 Tohoku Institute of Technology
                 35-1, Yagiyama Kasumi-cho
                 Taihaku-ku, Sendai, 982-8577
                 Japan
                 Email: tsuno@m.ieice.org

                 Comments and discussion to bess@ietf.org"
  DESCRIPTION
      "This MIB module contains textual conventions for
       Border Gateway Protocol/MultiProtocol Label
       Switching (BGP/MPLS) Layer 2 (L2) and Layer 3
       (L3) VPN (Virtual Private Network).
       Copyright (C) The Internet Society (2017)."


  -- Revision history.

  REVISION "201702211200Z"  -- 21th February, 2017
  DESCRIPTION
      "Initial version, published as RFC XXXX."
```

```
    -- RFC Ed. replace XXXX with actual RFC number and remove this note

    ::= { mib-2 AAAA }

    -- IANA Reg.: Please assign a value for "AAAA" under the
    -- 'mib-2' subtree and record the assignment in the SMI
    -- Numbers registry.

    -- RFC Ed.: When the above assignment has been made, please
    -- remove the above note
    -- replace "AAAA" here with the assigned value and
    -- remove this note.

  -- Textual convention

  L2L3VpnMcastProviderTunnelType ::= TEXTUAL-CONVENTION
    STATUS       current
    DESCRIPTION
        "Types of provider tunnels used for multicast in
         BGP/MPLS L2 or L3 VPN."
    REFERENCE
        "RFC6514, Section 5"
    SYNTAX       INTEGER
         { noTunnelId         (0), -- No tunnel information present
           rsvpP2mp           (1), -- RSVP-TE P2MP LSP
           ldpP2mp            (2), -- mLDP P2MP LSP
           pimSsm             (3), -- PIM-SSM Tree
           pimAsm             (4), -- PIM-SM Tree
           pimBidir           (5), -- BIDIR-PIM Tree
           ingressReplication (6), -- Ingress Replication
           ldpMp2mp           (7)  -- mLDP MP2MP LSP
         }

  END
```

4.2. L2L3-VPN-MCAST-MIB Object Definitions

```
  L2L3-VPN-MCAST-MIB DEFINITIONS ::= BEGIN

  IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, mib-2
       FROM SNMPv2-SMI                          -- [RFC2578]

    MODULE-COMPLIANCE, OBJECT-GROUP
       FROM SNMPv2-CONF                         -- [RFC2580]

    RowPointer
       FROM SNMPv2-TC                           -- [RFC2579]
```

```
    MplsLabel
       FROM MPLS-TC-STD-MIB                        -- [RFC3811]

    L2L3VpnMcastProviderTunnelType
       FROM L2L3-VPN-MCAST-TC-MIB;

  l2L3VpnMcastMIB MODULE-IDENTITY
    LAST-UPDATED "201702211200Z"  -- 21th February, 2017
    ORGANIZATION "IETF BESS Working Group."
    CONTACT-INFO
          "        Zhaohui Zhang
                   Juniper Networks, Inc.
                   10 Technology Park Drive
                   Westford, MA 01886
                   USA
                   Email: zzhang@juniper.net

                   Hiroshi Tsunoda
                   Tohoku Institute of Technology
                   35-1, Yagiyama Kasumi-cho
                   Taihaku-ku, Sendai, 982-8577
                   Japan
                   Email: tsuno@m.ieice.org

                   Comments and discussion to bess@ietf.org"
    DESCRIPTION
        "This MIB module will be used by other MIB modules designed for
         managing multicast in Layer 2 (L2) VPNs [RFC7117] and
         Layer 3 (L3) VPNs [RFC6513], [RFC6514].
         Copyright (C) The Internet Society (2017)."

    -- Revision history.

    REVISION "201702211200Z"  -- 21th February, 2017
    DESCRIPTION
        "Initial version, published as RFC XXXX."

    -- RFC Ed. replace XXXX with actual RFC number and remove this note

    ::= { mib-2 BBBB }

    -- IANA Reg.: Please assign a value for "BBBB" under the
    -- 'mib-2' subtree and record the assignment in the SMI
    -- Numbers registry.

    -- RFC Ed.: When the above assignment has been made, please
    -- remove the above note
    -- replace "BBBB" here with the assigned value and
```

```
    -- remove this note.

  -- Top level components of this MIB.
  l2L3VpnMcastObjects     OBJECT IDENTIFIER
                          ::= { l2L3VpnMcastMIB 1 }
  l2L3VpnMcastStates      OBJECT IDENTIFIER
                          ::= { l2L3VpnMcastObjects 1 }
  l2L3VpnMcastConformance OBJECT IDENTIFIER
                          ::= { l2L3VpnMcastMIB 2 }

  -- tables, scalars, conformance information
  -- Table of PMSI Tunnel Attributes

  l2L3VpnMcastPmsiTunnelAttributeTable OBJECT-TYPE
     SYNTAX        SEQUENCE OF L2L3VpnMcastPmsiTunnelAttributeEntry
     MAX-ACCESS    not-accessible
     STATUS        current
     DESCRIPTION
         "An entry of this table corresponds with a
          PMSI Tunnel attribute and is created by a PE router
          that advertises and receives the attribute.
          The entry in the table will be referred by other MIB modules
          which are designed for monitoring and/or configuring
          both L2 and L3 VPN that support multicast."
     REFERENCE
         "RFC6514, Section 5"
     ::= { l2L3VpnMcastStates 1 }

  l2L3VpnMcastPmsiTunnelAttributeEntry OBJECT-TYPE
     SYNTAX        L2L3VpnMcastPmsiTunnelAttributeEntry
     MAX-ACCESS    not-accessible
     STATUS        current
     DESCRIPTION
         "A conceptual row corresponding to a PTA
          that is advertised/received on this router."
     REFERENCE
         "RFC6514, Section 5"
     INDEX {
             l2L3VpnMcastPmsiTunnelAttributeFlags,
             l2L3VpnMcastPmsiTunnelAttributeType,
             l2L3VpnMcastPmsiTunnelAttributeLabel,
             l2L3VpnMcastPmsiTunnelAttributeId
           }
     ::= { l2L3VpnMcastPmsiTunnelAttributeTable 1 }

  L2L3VpnMcastPmsiTunnelAttributeEntry ::=
      SEQUENCE {
          l2L3VpnMcastPmsiTunnelAttributeFlags
```

```
            OCTET STRING,
         l2L3VpnMcastPmsiTunnelAttributeType
            L2L3VpnMcastProviderTunnelType,
         l2L3VpnMcastPmsiTunnelAttributeLabel
            MplsLabel,
         l2L3VpnMcastPmsiTunnelAttributeId
            OCTET STRING,
         l2L3VpnMcastPmsiTunnelPointer
            RowPointer,
         l2L3VpnMcastPmsiTunnelIf
            RowPointer
     }

  l2L3VpnMcastPmsiTunnelAttributeFlags OBJECT-TYPE
     SYNTAX        OCTET STRING (SIZE (1))
     MAX-ACCESS    not-accessible
     STATUS        current
     DESCRIPTION
         "Denotes the Flags field in a PMSI Tunnel attribute
          with the following format.

               0 1 2 3 4 5 6 7
              +-+-+-+-+-+-+-+-+
              |  reserved   |L|
              +-+-+-+-+-+-+-+-+

              L: Leaf Information Required

          When BGP-based I/S-PMSI signaling is used, the value of
          this object corresponds with the Flags field in
          an advertised/received I/S-PMSI auto-discovery (A-D) route.

          When UDP-based S-PMSI signaling is used, the value of
          this object is zero."
     REFERENCE
         "RFC6514, Section 5"
     ::= { l2L3VpnMcastPmsiTunnelAttributeEntry 1 }

  l2L3VpnMcastPmsiTunnelAttributeType OBJECT-TYPE
     SYNTAX        L2L3VpnMcastProviderTunnelType
     MAX-ACCESS    not-accessible
     STATUS        current
     DESCRIPTION
         "Denotes the Tunnel Type field that identifies
          the type of the tunneling technology used to
          establish the provider tunnel, in a PMSI Tunnel
          attribute.
```

```
          When BGP-based I/S-PMSI signaling is used, the value of
          this object corresponds with the Tunnel Type field in
          an advertised/received I/S-PMSI A-D route.

          When UDP-based S-PMSI signaling is used, the value of
          this object will be one of pimAsm (3), pimSsm (4), or
          pimBidir (5)."
      REFERENCE
          "RFC6514, Section 5"
      ::= { l2L3VpnMcastPmsiTunnelAttributeEntry 2 }

  l2L3VpnMcastPmsiTunnelAttributeLabel OBJECT-TYPE
      SYNTAX        MplsLabel
      MAX-ACCESS    not-accessible
      STATUS        current
      DESCRIPTION
          "Denotes the MPLS Label field that contains
          an MPLS label, in a PMSI Tunnel attribute.

          When BGP-based I/S-PMSI signaling is used, the value of
          this object corresponds with the MPLS Label field in
          an advertised/received I/S-PMSI A-D route.

          When UDP-based S-PMSI signaling is used, the value of
          this object is zero that indicates absence of MPLS
          Label."
      REFERENCE
          "RFC6514, Section 5"
      ::= { l2L3VpnMcastPmsiTunnelAttributeEntry 3 }

  l2L3VpnMcastPmsiTunnelAttributeId OBJECT-TYPE
      SYNTAX        OCTET STRING ( SIZE (0|4|8|12|16|17|24|29|32) )
      MAX-ACCESS    not-accessible
      STATUS        current
      DESCRIPTION
          "Denotes the Tunnel Identifier field that uniquely
          identifies a created tunnel, in a PMSI Tunnel
          attribute.
          The size of the identifier depends on address family
          (IPv4 or IPv6) and the value of
          l2L3VpnMcastPmsiTunnelAttributeType, i.e., the type of
          the tunneling technology used to establish the provider
          tunnel.

          The size of the identifier for each tunneling technology
          is summarized below.

           Size (in octets)   l2L3VpnMcastPmsiTunnelAttributeType
```

IPv4	IPv6	(tunneling technology)	
0	0	noTunnelId	(No tunnel information present)
12	24	rsvpP2mp	(RSVP-TE P2MP LSP)
17	29	ldpP2mp	(mLDP P2MP LSP)
8	32	pimSsm	(PIM-SSM Tree)
8	32	pimAsm	(PIM-SM Tree)
8	32	pimBidir	(BIDIR-PIM Tree)
4	16	ingressReplication	(Ingress Replication)
17	29	ldpMp2mp	(mLDP MP2MP LSP)

When l2L3VpnMcastPmsiTunnelAttributeType is set to noTunnelId, the PMSI Tunnel attribute does not have tunnel information. Thus, the size of this object is zero.

When l2L3VpnMcastPmsiTunnelAttributeType is set to rsvpP2mp, the Tunnel Identifier is composed of Extended Tunnel ID (4 octets in IPv4, 16 octets in IPv6), Reserved (2 octets), Tunnel ID (2 octets), and P2MP ID (4 octets). Thus, the size of this object is 12 octets in IPv4 and 24 octets in IPv6.

When l2L3VpnMcastPmsiTunnelAttributeType is set to ldpP2mp, the Tunnel Identifier is a 17 octets (in IPv4) or 29 octets (in IPv6) P2MP Forwarding Equivalence Class (FEC) Element.

When l2L3VpnMcastPmsiTunnelAttributeType is set to pimSsm, PimAsm, or PimBidir, the Tunnel Identifier is a pair of source and group IP addresses. Thus, the size of this object is 16 octets in IPv4 and 32 octets in IPv6.

When l2L3VpnMcastPmsiTunnelAttributeType is set to ingressReplication, the Tunnel Identifier is the unicast tunnel endpoint IP address of the local PE. Thus, the size of this object is 4 octets in IPv4 and 16 octets in IPv6.

When l2L3VpnMcastPmsiTunnelAttributeType is set to ldpMp2mp, the Tunnel Identifier is a 17 octets (in IPv4) or 29 octets (in IPv6) MP2MP FEC Element.

When BGP-based I/S-PMSI signaling is used, the value of this object corresponds with the the Tunnel Identifier field in an advertised/received I/S-PMSI A-D route. Thus, the size of this object is determined

```
          by the above table.

          When UDP-based S-PMSI signaling is used, the value of
          this object is a pair of source and group IP addresses.
          Thus, the size of this object is 16 octets in IPv4
          and 32 octets in IPv6."
      REFERENCE
          "RFC6514, Section 5
           RFC4875, Section 19.1
           RFC6388, Section 2.2 and 2.3"
      ::= { l2L3VpnMcastPmsiTunnelAttributeEntry 4 }

  l2L3VpnMcastPmsiTunnelPointer OBJECT-TYPE
      SYNTAX        RowPointer
      MAX-ACCESS    read-only
      STATUS        current
      DESCRIPTION
          "The tunnel identified by l2L3VpnMcastPmsiTunnelAttributeId
           may be represented as an entry in other table, e.g,
           mplsTunnelTable [RFC3812]. If there is such entry,
           this object will point to the row pertaining to the entry.
           Otherwise, the pointer is null."
      ::= { l2L3VpnMcastPmsiTunnelAttributeEntry 5 }

  l2L3VpnMcastPmsiTunnelIf OBJECT-TYPE
      SYNTAX        RowPointer
      MAX-ACCESS    read-only
      STATUS        current
      DESCRIPTION
          "If the tunnel identified by l2L3VpnMcastPmsiTunnelAttributeId
           has a corresponding entry in the ifXTable [RFC2863],
           this object will point to the row pertaining to the entry
           in the ifXTable. Otherwise, the pointer is null."
      ::= { l2L3VpnMcastPmsiTunnelAttributeEntry 6 }

  -- Conformance Information

  l2L3VpnMcastGroups      OBJECT IDENTIFIER
                          ::= { l2L3VpnMcastConformance 1 }
  l2L3VpnMcastCompliances OBJECT IDENTIFIER
                          ::= { l2L3VpnMcastConformance 2 }

  -- Compliance Statements

  l2L3VpnMcastCompliance MODULE-COMPLIANCE
      STATUS  current
      DESCRIPTION
          "The compliance statement: no mandatory groups "
```

```
      MODULE  -- this module

      GROUP l2L3VpnMcastOptionalGroup
           DESCRIPTION
               "This group is optional."
      ::= { l2L3VpnMcastCompliances 1 }

  -- units of conformance

  l2L3VpnMcastOptionalGroup    OBJECT-GROUP
      OBJECTS {
          l2L3VpnMcastPmsiTunnelPointer,
          l2L3VpnMcastPmsiTunnelIf
          }
      STATUS      current
      DESCRIPTION
          "Support of these objects is not required."
      ::= { l2L3VpnMcastGroups 1 }

  END
```

5. Security Considerations

There are no management objects defined in this MIB module that have a MAX-ACCESS clause of read-write and/or read-create. So, if this MIB module is implemented correctly, then there is no risk that an intruder can alter or create any management objects of this MIB module via direct SNMP SET operations.

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

- l2L3VpnMcastPmsiTunnelPointer and l2L3VpnMcastPmsiTunnelIf in l2L3VpnMcastPmsiTunnelAttributeTable will point the corresponding entry of in other table containing configuration and/or performance information of a tunnel and an interface. If an Administrator does not want to reveal this information, then these objects should be considered sensitive/vulnerable.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), there is no control as to who on the secure network is allowed to

access and GET/SET (read/change/create/delete) the objects in this MIB module.

Implementations SHOULD provide the security features described by the SNMPv3 framework (see [RFC3410]), and implementations claiming compliance to the SNMPv3 standard MUST include full support for authentication and privacy via the User-based Security Model (USM) [RFC3414] with the AES cipher algorithm [RFC3826]. Implementations MAY also provide support for the Transport Security Model (TSM) [RFC5591] in combination with a secure transport such as SSH [RFC5592] or TLS/DTLS [RFC6353].

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

6. IANA Considerations

IANA is requested to root MIB objects in the MIB module contained in this document under the mib-2 subtree.

7. References

7.1. Normative References

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Authors' Addresses

Zhaohui (Jeffrey) Zhang
Juniper Networks, Inc.
10 Technology Park Drive
Westford, MA 01886
USA

Email: zzhang@juniper.net

Hiroshi Tsunoda
Tohoku Institute of Technology
35-1, Yagiyama Kasumi-cho
Taihaku-ku, Sendai 982-8577
Japan

Phone: +81-22-305-3411
Email: tsuno@m.ieice.org