

**BGP/MPLS Layer 3 VPN Multicast Management Information Base
draft-ietf-bess-mvpn-mib-07**

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 managed objects to configure and/or monitor Multicast communication over IP Virtual Private Networks (VPNs) supported by MultiProtocol Label Switching/Border Gateway Protocol (MPLS/BGP) on a Provider Edge router.

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[1.](#) Introduction

[[RFC6513](#)], [[RFC6514](#)], and [[RFC6625](#)] specify procedures for supporting multicast in Border Gateway Protocol/MultiProtocol Label Switching (BGP/MPLS) Layer 3 (IP) Virtual Private Networks (VPNs). Throughout this document, we will use the term "Multicast VPN" (MVPN) [[RFC6513](#)] to refer to a BGP/MPLS IP VPN that supports multicast.

Provider Edge routers (PEs) attaching to a particular MVPN exchange customer multicast (C-multicast) routing information with neighboring PEs. In [[RFC6513](#)], two basic methods for exchanging C-multicast routing information are defined (1) Protocol Independent Multicast (PIM) [[RFC7761](#)] and (2) BGP.

In the rest of this document we will use the term "PIM-MVPN" to refer to the case where PIM is used for exchanging C-multicast routing information, and "BGP-MVPN" to refer to the case where BGP is used for exchanging C-multicast routing information.

This document describes managed objects to configure and/or monitor MVPNs. Most of the managed objects are common to both PIM-MVPN and BGP-MVPN, and some managed objects are BGP-MVPN specific.

[1.1.](#) Terminology

This document adopts the definitions, acronyms and mechanisms described in [[RFC4364](#)], [[RFC6513](#)], and [[RFC6514](#)]. Familiarity with Multicast, MPLS, Layer 3 (L3) VPN, MVPN concepts and/or mechanisms is

assumed. Some terms specifically related to this document are explained below.

An MVPN can be realized by using various kinds of transport mechanisms for forwarding a packet to all or a subset of PEs across service provider networks. Such transport mechanisms are referred to as provider tunnels (P-tunnels).

A "Provider Multicast Service Interface" (PMSI) [[RFC6513](#)] is a conceptual interface instantiated by a P-tunnel. A PE uses a PMSI 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 enables a PE attached to a particular MVPN to transmit a message to all PEs in the same MVPN. An S-PMSI enables a PE to transmit a message to a selected set of PEs in the same MVPN.

As described in [[RFC4382](#)], each PE maintains one default forwarding table and zero or more "Virtual Routing and Forwarding tables" (VRFs). Throughout this document, we will use the term "multicast VRF" (MVRF) to refer to a VRF that contains multicast routing information.

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](#)].

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. MCAST-VPN-MIB

This document defines MCAST-VPN-MIB, a MIB module for monitoring and/or configuring MVPNs on PEs. This MIB module will be used in

conjunction with MPLS-L3VPN-STD-MIB [[RFC4382](#)] and IPMCAST-MIB [[RFC5132](#)].

3.1. Summary of MIB Module

MCAST-VPN-MIB provides the following functionalities.

- o Monitoring attributes of MVPNs on a PE
- o Configuring timers and thresholds related to an MVPN on a PE
- o Notifying creation, deletion, and modification of MVRFs on a PE
- o Monitoring PMSI attributes
- o Monitoring statistics of advertisements exchanged by a PE
- o Monitoring routing information for multicast destinations
- o Monitoring next-hops for each multicast destination

To provide these functionalities, MCAST-VPN-MIB defines following tables.

- o mvpnGenericTable

This table contains generic information about MVPNs on a PE. Each entry in this table represents an instance of an MVPN on a PE and contains generic information related to the MVPN. For each entry in this table there MUST be a corresponding VRF in MPLS-L3VPN-STD-MIB [[RFC4382](#)].

- o mvpnBgpTable

This table contains information specific to BGP-MVPNs. Each BGP-MVPN on a PE will have an entry in this table.

- o mvpnPmsiTable

This table contains managed objects representing attribute information that is common to I-PMSIs and S-PMSIs on a PE.

- o mvpnSpmsiTable

This table contains managed objects representing attribute information specific to S-PMSIs. An S-PMSI represented in this table will have a corresponding entry in mvpnPmsiTable.

- o mvpnAdvStatsTable

This table contains statistics pertaining to I-PMSI and S-PMSI advertisements sent/received.

- o mvpnMrouteTable

This table contains multicast routing information in MVRFs on a PE.

- o mvpnMrouteNextHopTable

This table contains information on the next-hops for routing IP multicast datagrams in MVPNs on a PE.

3.2. MIB Module Definitions

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

```
IMPORTS
```

```
    MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
    Counter32, Counter64, Gauge32, Unsigned32, TimeTicks,
    mib-2
    FROM SNMPv2-SMI                                -- [RFC2578]
```

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

```
    RowPointer, TimeStamp, DateAndTime
    FROM SNMPv2-TC                                  -- [RFC2579]
```

```
    InterfaceIndex, InterfaceIndexOrZero
    FROM IF-MIB                                     -- [RFC2863]
```

```
    InetAddress, InetAddressType, InetAddressPrefixLength
    FROM INET-ADDRESS-MIB                          -- [RFC2851]
```

```
    mplsL3VpnVrfName, MplsL3VpnRouteDistinguisher
    FROM MPLS-L3VPN-STD-MIB                        -- [RFC4382]
```

```
    IANAipRouteProtocol, IANAipMRouteProtocol
    FROM IANA-RTPROTO-MIB                         -- [RTPROTO]
```

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

```
mvpnMIB MODULE-IDENTITY
```

```
    LAST-UPDATED "201807231200Z" -- 23th July 2018 12:00:00 GMT
```


ORGANIZATION "IETF BESS Working Group."

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Comments and discussion to bess@ietf.org"

DESCRIPTION

"This MIB module contains managed object definitions to
configure and/or monitor Multicast communication over IP
Virtual Private Networks (VPNs) supported by MultiProtocol
Label Switching/Border Gateway Protocol (MPLS/BGP) on a
Provider Edge router (PE).
Copyright (C) The Internet Society (2018).
"

-- Revision history.

REVISION "201807231200Z" -- 23th July, 2018

DESCRIPTION

"Initial version, published as RFC XXXX."

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

::= { mib-2 YYYY }

-- IANA Reg.: Please assign a value for "YYYY" 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 "YYYY" here with the assigned value and
-- remove this note.

-- Top level components of this MIB module.

mvpnNotifications OBJECT IDENTIFIER ::= { mvpnMIB 0 }

-- scalars, tables

mvpnObjects OBJECT IDENTIFIER ::= { mvpnMIB 1 }

-- conformance information


```
mvpnConformance    OBJECT IDENTIFIER ::= { mvpnMIB 2 }

-- mvpn Objects
mvpnScalars        OBJECT IDENTIFIER ::= { mvpnObjects 1 }

-- Scalar Objects

mvpnMvrf OBJECT-TYPE
    SYNTAX          Gauge32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The total number of Multicast Virtual Routing and
        Forwarding tables (MVRFs) that are present on
        this Provider Edge router (PE). This includes MVRFs
        for IPv4, IPv6, and mLDP C-Multicast.
        "
    ::= { mvpnScalars 1 }

mvpnV4Mvrf OBJECT-TYPE
    SYNTAX          Gauge32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The number of MVRFs for IPv4 C-Multicast on this PE.
        "
    ::= { mvpnScalars 2 }

mvpnV6Mvrf OBJECT-TYPE
    SYNTAX          Gauge32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The number of MVRFs for IPv6 C-Multicast on this PE.
        "
    ::= { mvpnScalars 3 }

mvpnMldpMvrf OBJECT-TYPE
    SYNTAX          Gauge32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The number of MVRFs on this PE that use BGP for
        exchanging Multipoint Label Distribution Protocol (mLDP)
        C-Multicast routing information.
        "
    ::= { mvpnScalars 4 }
```


mvpnPimV4Mvrf OBJECT-TYPE

SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The number of MVRFs on this PE that use Provider
Independent Multicast (PIM) for exchanging IPv4
C-Multicast routing information.
"

::= { mvpnScalars 5 }

mvpnPimV6Mvrf OBJECT-TYPE

SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The number of MVRFs on this PE that use PIM for
exchanging IPv6 C-Multicast routing information.
"

::= { mvpnScalars 6 }

mvpnBgpV4Mvrf OBJECT-TYPE

SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The number of MVRFs on this PE that use BGP for
exchanging IPv4 C-Multicast routing information.
"

::= { mvpnScalars 7 }

mvpnBgpV6Mvrf OBJECT-TYPE

SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The number of MVRFs on this PE that use BGP for
exchanging IPv6 C-Multicast routing information.
"

::= { mvpnScalars 8 }

mvpnSPTunnelLimit OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)
MAX-ACCESS read-write
STATUS current

DESCRIPTION

"The maximum number of selective provider tunnels that
this PE allows for a particular MVPN on this PE."


```
"
REFERENCE
  "RFC6513, Section 13"
::= { mvpnScalars 9 }

mvpnBgpCmcastRouteWithdrawalTimer OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS        "milliseconds"
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "A configurable timer to control the delay
         of C-multicast route withdrawal advertisements."
    "
REFERENCE
  "RFC6514, Section 16.1.1"
::= { mvpnScalars 10 }

mvpnBgpSrcSharedTreeJoinTimer OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS        "milliseconds"
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "A configurable timer to control the delay
         of Source/Shared Tree Join C-multicast route
         advertisements."
    "
REFERENCE
  "RFC6514, Section 16.1.2"
::= { mvpnScalars 11 }

-- Generic MVRF Information Table

mvpnGenericTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MvpnGenericEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "A conceptual table containing generic information about MVPNs
         on this PE."
    "
    ::= { mvpnObjects 2 }

mvpnGenericEntry OBJECT-TYPE
    SYNTAX      MvpnGenericEntry
    MAX-ACCESS   not-accessible
    STATUS       current
```


DESCRIPTION

"A conceptual row that represents an MVPN on this PE.
 The MVPN represented by this entry will have one or more
 corresponding P-Multicast Service Interfaces (PMSIs)
 and a corresponding VRF in MPLS-L3VPN-STD-MIB [[RFC4382](#)].
 "

```
INDEX {
    mplsL3VpnVrfName
}
::= { mvpnGenericTable 1 }
```

```
MvpnGenericEntry ::= SEQUENCE {
    mvpnGenMvrfLastAction      INTEGER,
    mvpnGenMvrfLastActionTime  DateAndTime,
    mvpnGenMvrfCreationTime    DateAndTime,
    mvpnGenCmcastRouteProtocol INTEGER,
    mvpnGenIpmsiInfo           RowPointer,
    mvpnGenInterAsPmsiInfo     RowPointer,
    mvpnGenUmhSelection         INTEGER,
    mvpnGenCustomerSiteType    INTEGER
}
```

mvpnGenMvrfLastAction OBJECT-TYPE

```
SYNTAX      INTEGER {
                                createdMvrf      (1),
                                deletedMvrf      (2),
                                modifiedMvrfIpmsiConfig (3),
                                modifiedMvrfSpmsiConfig (4)
                            }
```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object describes the last action pertaining
 to the MVPN represented by this entry.

The enumerated action types and the corresponding
 descriptions are as follows:

createdMvrf:

MVRF was created for this MVPN on the PE.

deletedMvrf:

MVRF for this MVPN was deleted from the PE.

A conceptual row in this table will never have
 mvpnGenMvrfLastAction equal to deletedMvrf,
 because in that case the row itself will not exist
 in the table.

This value for mvpnGenMvrfLastAction is defined

solely for use in mvpnMvrfActionChange notification.

modifiedMvrfIpmsiConfig:

an I-PMSI for this MVPN was configured, deleted or changed.

modifiedMvrfSpmsiConfig:

an S-PMSI for this MVPN was configured, deleted or changed.

"

::= { mvpnGenericEntry 2 }

mvpnGenMvrfLastActionTime OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The timestamp when the last action, given in the corresponding mvpnGenMvrfLastAction object, was carried out.

"

::= { mvpnGenericEntry 3 }

mvpnGenMvrfCreationTime OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The timestamp when the MVRF was created for the MVPN represented by this entry.

"

::= { mvpnGenericEntry 4 }

mvpnGenCmcastRouteProtocol OBJECT-TYPE

SYNTAX INTEGER {
pim (1),
bgp (2)
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The protocol used to signal C-multicast routing information across the provider core for the MVPN represented by this entry.

The enumerated protocols and the corresponding descriptions are as follows:


```
        pim : PIM (PIM-MVPN)
        bgp : BGP (BGP-MVPN)
    "
REFERENCE
    "RFC6513, Section 5"
::= { mvpnGenericEntry 5 }

mvpnGenIpmsiInfo OBJECT-TYPE
    SYNTAX      RowPointer
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "A pointer to a conceptual row representing
        the corresponding I-PMSI in mvpnPmsiTable.
        If there is no I-PMSI for the MVPN
        represented by this entry, the
        value of this object will be zeroDotZero.
        "
    ::= { mvpnGenericEntry 6 }

mvpnGenInterAsPmsiInfo OBJECT-TYPE
    SYNTAX      RowPointer
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "A pointer to a conceptual row representing
        the corresponding segmented Inter-AS I-PMSI in mvpnPmsiTable.
        If there is no segmented Inter-AS I-PMSI for the MVPN,
        the value of this object will be zeroDotZero.
        "
    ::= { mvpnGenericEntry 7 }

mvpnGenUmhSelection OBJECT-TYPE
    SYNTAX      INTEGER {
                                highestPeAddress (1),
                                cRootGroupHashing (2),
                                ucastUmhRoute     (3)
                            }
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The Upstream Multicast Hop (UMH) selection method for the MVPN
        represented by this entry.

        The enumerated methods and the corresponding
        descriptions are as follows:

        highestPeAddress : PE with the highest address
```



```

                                (see RFC6513, Section 5.1.3)
    cRootGroupHashing : hashing based on (c-root, c-group)
    ucastUmhRoute      : per unicast route towards c-root
"
REFERENCE
    "RFC6513, Section 5.1"
::= { mvpnGenericEntry 8 }

mvpnGenCustomerSiteType OBJECT-TYPE
    SYNTAX      INTEGER {
                                senderReceiver (1),
                                receiverOnly   (2),
                                senderOnly     (3)
                        }
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The type of the customer site, connected to
        the MVPN represented by this entry.

        The enumerated types and the corresponding
        descriptions are as follows:

            senderReceiver : Site is both sender and receiver
            receiverOnly   : Site is receiver-only
            senderOnly     : Site is sender-only
        "
    REFERENCE
        "RFC6513, Section 2.3"
    ::= { mvpnGenericEntry 9 }

-- Generic BGP-MVPN table

mvpnBgpTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MvpnBgpEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "A conceptual table that supplements mvpnGenericTable
        with BGP-MVPN specific information for BGP-MVPNs on this PE.
        "
    ::= { mvpnObjects 3 }

mvpnBgpEntry OBJECT-TYPE
    SYNTAX      MvpnBgpEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION

```



```

        "A conceptual row corresponding to a BGP-MVPN on this PE.
        "
        INDEX {
            mplsL3VpnVrfName
        }
 ::= { mvpnBgpTable 1 }

MvpnBgpEntry ::= SEQUENCE {
    mvpnBgpMode                INTEGER,
    mvpnBgpVrfRouteImportExtendedCommunity MplsL3VpnRouteDistinguisher,
    mvpnBgpSrcASEExtendedCommunity Unsigned32,
    mvpnBgpMsgRateLimit        Unsigned32,
    mvpnBgpMaxSpmsiAdRoutes     Unsigned32,
    mvpnBgpMaxSpmsiAdRouteFreq  Unsigned32,
    mvpnBgpMaxSrcActiveAdRoutes Unsigned32,
    mvpnBgpMaxSrcActiveAdRouteFreq Unsigned32
}

mvpnBgpMode OBJECT-TYPE
    SYNTAX      INTEGER {
        other      (0),
        rptSpt     (1),
        sptOnly    (2)
    }
    MAX-ACCESS   read-only
    STATUS        current
    DESCRIPTION
        "The inter-site C-tree mode used by the BGP-MVPN
        represented by this entry.

        other      : none of the following
        rptSpt     : inter-site shared tree mode
                     (Rendezvous Point Tree (RPT) and
                     source-specific shortest-path tree (SPT))
        sptOnly    : inter-site source-only tree mode
        "
    REFERENCE
        "RFC6513, Section 9.3.1"
 ::= { mvpnBgpEntry 1 }

mvpnBgpVrfRouteImportExtendedCommunity OBJECT-TYPE
    SYNTAX      MplsL3VpnRouteDistinguisher
    MAX-ACCESS   read-only
    STATUS        current
    DESCRIPTION
        "The VRF Route Import Extended Community added by this PE
        to unicast VPN routes that it advertises for the BGP-MVPN
        corresponding to this entry.

```



```
"
REFERENCE
  "RFC6514, Section 7"
"
::= { mvpnBgpEntry 2 }

mvpnBgpSrcASExtendedCommunity OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The Source AS Extended Community added by this PE
        to the unicast VPN routes that it advertises for
        the BGP-MVPN represented by this entry."
    "
    REFERENCE
        "RFC6514, Section 6"
    "
    ::= { mvpnBgpEntry 3 }

mvpnBgpMsgRateLimit OBJECT-TYPE
    SYNTAX      Unsigned32 (0..4294967295)
    UNITS        "messages per second"
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The configurable upper bound for the rate of BGP C-multicast
        routing information message exchange between this PE and other
        PEs in the BGP-MVPN corresponding to this entry."
    "
    REFERENCE
        "RFC6514, Section 17"
    ::= { mvpnBgpEntry 4 }

mvpnBgpMaxSpmsiAdRoutes OBJECT-TYPE
    SYNTAX      Unsigned32 (0..4294967295)
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The configurable upper bound for the number of
        S-PMSI A-D routes for the BGP-MVPN corresponding to
        this entry."
    "
    REFERENCE
        "RFC6514, Section 17"
    ::= { mvpnBgpEntry 5 }

mvpnBgpMaxSpmsiAdRouteFreq OBJECT-TYPE
```


SYNTAX Unsigned32 (0..4294967295)
UNITS "routes per second"
MAX-ACCESS read-write
STATUS current
DESCRIPTION
 "The configurable upper bound for the frequency of
 S-PMSI A-D route generation for the BGP-MVPN corresponding
 to this entry."
 "

REFERENCE
 "[RFC6514, Section 17](#)"
::= { mvpnBgpEntry 6 }

mvpnBgpMaxSrcActiveAdRoutes OBJECT-TYPE

SYNTAX Unsigned32 (0..4294967295)
MAX-ACCESS read-write
STATUS current
DESCRIPTION
 "The configurable upper bound for the number of
 Source Active A-D routes for the BGP-MVPN corresponding
 to this entry."
 "

REFERENCE
 "[RFC6514, Section 17](#)"
::= { mvpnBgpEntry 7 }

mvpnBgpMaxSrcActiveAdRouteFreq OBJECT-TYPE

SYNTAX Unsigned32 (0..4294967295)
UNITS "routes per second"
MAX-ACCESS read-write
STATUS current
DESCRIPTION
 "The configurable upper bound for the frequency of Source
 Active A-D route generation for the BGP-MVPN corresponding
 to this entry."
 "

REFERENCE
 "[RFC6514, Section 17](#)"
::= { mvpnBgpEntry 8 }

-- Table of PMSI information

mvpnPmsiTable OBJECT-TYPE

SYNTAX SEQUENCE OF MvpnPmsiEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "A conceptual table containing information related


```
        to PMSIs on this PE.
    "
    ::= { mvpnObjects 4 }

mvpnPmsiEntry OBJECT-TYPE
    SYNTAX      MvpnPmsiEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A conceptual row corresponding to a
        PMSI on this PE.
    "
    INDEX       {
        mvpnPmsiTunnelIfIndex
    }
    ::= { mvpnPmsiTable 1 }

MvpnPmsiEntry ::= SEQUENCE {
    mvpnPmsiTunnelIfIndex      InterfaceIndex,
    mvpnPmsiRD                 MplsL3VpnRouteDistinguisher,
    mvpnPmsiTunnelType         L2L3VpnMcastProviderTunnelType,
    mvpnPmsiTunnelAttribute    RowPointer,
    mvpnPmsiTunnelPimGroupAddrType InetAddressType,
    mvpnPmsiTunnelPimGroupAddr  InetAddress,
    mvpnPmsiEncapsulationType  INTEGER
}

mvpnPmsiTunnelIfIndex OBJECT-TYPE
    SYNTAX      InterfaceIndex
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A unique value for this conceptual row. Its value
        will be the same as that of the ifIndex object instance
        for the corresponding PMSI in ifTable.
    "
    REFERENCE
        "RFC2863 Sec. 3.1.5
    "
    ::= { mvpnPmsiEntry 1 }

mvpnPmsiRD OBJECT-TYPE
    SYNTAX      MplsL3VpnRouteDistinguisher
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The Route Distinguisher for this I-PMSI."
    ::= { mvpnPmsiEntry 3 }
```


mvpnPmsiTunnelType OBJECT-TYPE

SYNTAX L2L3VpnMcastProviderTunnelType

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The type of tunnel used to
instantiate the PMSI corresponding to this entry.
"

REFERENCE

"[RFC6513](#), Sec. 2.6
"

::= { mvpnPmsiEntry 4 }

mvpnPmsiTunnelAttribute OBJECT-TYPE

SYNTAX RowPointer

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A pointer to a conceptual row representing
the P-tunnel used by the PMSI in
l2L3VpnMcastPmsiTunnelAttributeTable.
"

::= { mvpnPmsiEntry 5 }

mvpnPmsiTunnelPimGroupAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The InetAddressType of the mvpnPmsiTunnelPimGroupAddr object
that follows.
When the PMSI corresponding to this entry does not use
the PIM provider tunnel, i.e.,
the value of mvpnPmsiTunnelType is not one of
pimSsm(3), pimAsm(4), or pimBidir(5),
this object should be unknown(0).
"

::= { mvpnPmsiEntry 6 }

mvpnPmsiTunnelPimGroupAddr OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The tunnel address which is used by the PMSI
corresponding to this entry.
When the PMSI corresponding to this entry does not
use PIM provider tunnel, i.e.,


```

    the value of mvpnPmsiTunnelType is not one of
    pimSsm(3), pimAsm(4), or pimBidir(5),
    this object should be a zero-length octet string.
    "
 ::= { mvpnPmsiEntry 7 }

mvpnPmsiEncapsulationType OBJECT-TYPE
    SYNTAX          INTEGER {
                                greIp (1),
                                ipIp  (2),
                                mpls  (3)
                            }
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The encapsulation type used for sending
        packets through the PMSI corresponding to this entry.

        The enumerated encapsulation types and the corresponding
        descriptions are as follows:

            greIp : GRE (Generic Routing Encapsulation)
                    encapsulation [RFC2784]
            ipIp  : IP-in-IP encapsulation [RFC2003]
            mpls  : MPLS encapsulation [RFC3032]
        "
    REFERENCE
        "RFC2003
        RFC2784
        RFC3032
        RFC6513, Sec. 12.1
        "
 ::= { mvpnPmsiEntry 8 }

-- Table of S-PMSI specific information

mvpnSpmsiTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF MvpnSpmsiEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A conceptual table containing information related
        to S-PMSIs on this PE.
        This table stores only S-PMSI specific attribute
        information. Generic PMSI attribute information of
        S-PMSIs is stored in mvpnPmsiTable.
        "
 ::= { mvpnObjects 5 }
```


mvpnSpmsiEntry OBJECT-TYPE

SYNTAX MvpnSpmsiEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual row corresponding to an S-PMSI on this PE. Implementers need to be aware that if the total number of octets in mplsL3VpnVrfName, mvpnSpmsiCmcastGroupAddr and mvpnSpmsiCmcastSourceAddr exceeds 113, the OIDs of column instances in this row will have more than 128 sub-identifiers and cannot be accessed using SNMPv1, SNMPv2c, or SNMPv3.

"

```
INDEX      {
            mplsL3VpnVrfName,
            mvpnSpmsiCmcastGroupAddrType,
            mvpnSpmsiCmcastGroupAddr,
            mvpnSpmsiCmcastGroupPrefixLen,
            mvpnSpmsiCmcastSourceAddrType,
            mvpnSpmsiCmcastSourceAddr,
            mvpnSpmsiCmcastSourcePrefixLen
        }
```

::= { mvpnSpmsiTable 1 }

MvpnSpmsiEntry ::= SEQUENCE {

```
    mvpnSpmsiCmcastGroupAddrType  InetAddressType,
    mvpnSpmsiCmcastGroupAddr      InetAddress,
    mvpnSpmsiCmcastGroupPrefixLen  InetAddressPrefixLength,
    mvpnSpmsiCmcastSourceAddrType  InetAddressType,
    mvpnSpmsiCmcastSourceAddr      InetAddress,
    mvpnSpmsiCmcastSourcePrefixLen InetAddressPrefixLength,
    mvpnSpmsiPmsiPointer           RowPointer
```

}

mvpnSpmsiCmcastGroupAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The InetAddressType of the mvpnSpmsiCmcastGroupAddr object that follows.

"

::= { mvpnSpmsiEntry 1 }

mvpnSpmsiCmcastGroupAddr OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The group address of the C-flow assigned to the S-PMSI corresponding to this entry."

REFERENCE

"[RFC6513](#), Sec. 3.1"

::= { mvpnSpmsiEntry 2 }

mvpnSpmsiCmcastGroupPrefixLen OBJECT-TYPE

SYNTAX InetAddressPrefixLength

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The prefix length of the corresponding mvpnSpmsiCmcastGroupAddr object."

::= { mvpnSpmsiEntry 3 }

mvpnSpmsiCmcastSourceAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The InetAddressType of the mvpnSpmsiCmcastSourceAddr object that follows."

::= { mvpnSpmsiEntry 4 }

mvpnSpmsiCmcastSourceAddr OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The source address of the C-flow assigned to the S-PMSI corresponding to this entry."

::= { mvpnSpmsiEntry 5 }

mvpnSpmsiCmcastSourcePrefixLen OBJECT-TYPE

SYNTAX InetAddressPrefixLength

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The prefix length of the corresponding mvpnSpmsiCmcastSourceAddr object."

::= { mvpnSpmsiEntry 6 }

mvpnSpmsiPmsiPointer OBJECT-TYPE

SYNTAX RowPointer

MAX-ACCESS read-only


```
STATUS          current
DESCRIPTION
    "A pointer to a conceptual row representing
    generic information of this S-PMSI in mvpnPmsiTable.
    "
 ::= { mvpnSpmsiEntry 7 }

-- Table of statistics pertaining to
-- advertisements sent/received

mvpnAdvtStatsTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF MvpnAdvtStatsEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A conceptual table containing statistics pertaining to
        I-PMSI and S-PMSI advertisements sent/received by this PE.
        "
    ::= { mvpnObjects 6 }

mvpnAdvtStatsEntry OBJECT-TYPE
    SYNTAX          MvpnAdvtStatsEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A conceptual row corresponding to statistics
        pertaining to advertisements sent/received
        for a particular MVPN on this PE.

        Implementers need to be aware that if the total number of
        octets in mplsL3VpnVrfName and mvpnAdvtPeerAddr exceeds 115,
        then OIDs of column instances in this row will have more than
        128 sub-identifiers and cannot be accessed using SNMPv1,
        SNMPv2c, or SNMPv3.
        "
    INDEX {
        mplsL3VpnVrfName,
        mvpnAdvtType,
        mvpnAdvtPeerAddrType,
        mvpnAdvtPeerAddr
    }
    ::= { mvpnAdvtStatsTable 1 }

MvpnAdvtStatsEntry ::= SEQUENCE {
    mvpnAdvtType                INTEGER,
    mvpnAdvtPeerAddrType        InetAddressType,
    mvpnAdvtPeerAddr            InetAddress,
    mvpnAdvtSent                Counter32,
```



```

    mvpnAdvtReceived          Counter32,
    mvpnAdvtReceivedError     Counter32,
    mvpnAdvtReceivedMalformedTunnelType Counter32,
    mvpnAdvtReceivedMalformedTunnelId Counter32,
    mvpnAdvtLastSentTime      DateAndTime,
    mvpnAdvtLastReceivedTime  DateAndTime,
    mvpnAdvtCounterDiscontinuityTime TimeStamp
}

```

mvpnAdvtType OBJECT-TYPE

```

SYNTAX      INTEGER {
                                intraAsIpmsi (0),
                                interAsIpmsi (1),
                                sPmsi        (2)
                            }

```

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The PMSI type.

The enumerated PMSI types and corresponding descriptions are as follows:

```

    intraAsIpmsi : Intra-AS Inclusive PMSI
    interAsIpmsi : Inter-AS Inclusive PMSI
    sPmsi        : Selective PMSI

```

"

REFERENCE

"[RFC6513](#), Sec. 3.2.1"

::= { mvpnAdvtStatsEntry 1 }

mvpnAdvtPeerAddrType OBJECT-TYPE

```

SYNTAX      InetAddressType

```

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The InetAddressType of the mvpnAdvtPeerAddr object that follows.

"

::= { mvpnAdvtStatsEntry 2 }

mvpnAdvtPeerAddr OBJECT-TYPE

```

SYNTAX      InetAddress

```

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The address of a peer PE that exchanges advertisement with


```
        this PE.
    "
    ::= { mvpnAdvtStatsEntry 3 }

mvpnAdvtSent OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION
        "The number of advertisements successfully
        sent to the peer PE specified by the corresponding
        mvpnAdvtPeerAddr.

        Discontinuities in the value of this counter can
        occur at re-initialization of the management system,
        and at other times as indicated by the corresponding
        mvpnAdvtCounterDiscontinuityTime object.
    "
    ::= { mvpnAdvtStatsEntry 4 }

mvpnAdvtReceived OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION
        "The number of advertisements received from the peer PE
        specified by the corresponding mvpnAdvtPeerAddr object.
        This includes advertisements that were discarded.

        Discontinuities in the value of this counter can
        occur at re-initialization of the management system,
        and at other times as indicated by the corresponding
        mvpnAdvtCounterDiscontinuityTime object.
    "
    ::= { mvpnAdvtStatsEntry 5 }

mvpnAdvtReceivedError OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION
        "The total number of advertisements received from a peer PE,
        specified by the corresponding mvpnAdvtPeerAddr object,
        that were rejected due to error(s) in the advertisement.
        The value of this object includes
        the error cases counted in the corresponding
        mvpnAdvtReceivedMalformedTunnelType and
        mvpnAdvtReceivedMalformedTunnelId objects.
```


Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the corresponding mvpnAdvtCounterDiscontinuityTime object.

"

::= { mvpnAdvtStatsEntry 6 }

mvpnAdvtReceivedMalformedTunnelType OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of advertisements received from the peer PE specified by the corresponding mvpnAdvtPeerAddr object, that were rejected due to malformed Tunnel Type in the PMSI Tunnel attribute.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the corresponding mvpnAdvtCounterDiscontinuityTime object.

"

REFERENCE

"[RFC6514](#) Sec.5"

::= { mvpnAdvtStatsEntry 7 }

mvpnAdvtReceivedMalformedTunnelId OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of advertisements received from the peer PE specified by the corresponding mvpnAdvtPeerAddr object, that were rejected due to malformed Tunnel Identifier in the PMSI Tunnel attribute.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the corresponding mvpnAdvtCounterDiscontinuityTime object.

"

REFERENCE

"[RFC6514](#) Sec.5"

::= { mvpnAdvtStatsEntry 8 }

mvpnAdvtLastSentTime OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The timestamp when the last advertisement was successfully sent by this PE.
If no advertisement has been sent since the last re-initialization of this PE, then this object will have a zero-length string."
"

::= { mvpnAdvtStatsEntry 9 }

mvpnAdvtLastReceivedTime OBJECT-TYPE

SYNTAX DateAndTime

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The timestamp when the last advertisement was successfully received from the peer PE specified by the corresponding mvpnAdvtPeerAddr object and processed by this PE.
If no advertisement has been received since the last re-initialization of this PE, then this object will have a zero-length string."
"

::= { mvpnAdvtStatsEntry 10 }

mvpnAdvtCounterDiscontinuityTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which any one or more of this application's counters, viz., counters with OID prefix 'mvpnAdvtSent' or 'mvpnAdvtReceived' or 'mvpnAdvtReceivedError' or 'mvpnAdvtReceivedMalformedTunnelType' or 'mvpnAdvtReceivedMalformedTunnelId' suffered a discontinuity.
If no such discontinuities have occurred since the last re-initialization of the local management subsystem, then this object will have a zero value."
"

::= { mvpnAdvtStatsEntry 11 }

-- Table of multicast routes in an MVPN

mvpnMrouteTable OBJECT-TYPE

SYNTAX SEQUENCE OF MvpnMrouteEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual table containing multicast routing information corresponding to the MVRFs present on the PE.

"

::= { mvpnObjects 7 }

mvpnMrouteEntry OBJECT-TYPE

SYNTAX MvpnMrouteEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual row corresponding to a route for IP datagrams from a particular source and addressed to a particular IP multicast group address.

Implementers need to be aware that if the total number of octets in mplsL3VpnVrfName, mvpnMrouteCmcastGroupAddr and mvpnMrouteCmcastSourceAddrs exceeds 113, the OIDs of column instances in this row will have more than 128 sub-identifiers and cannot be accessed using SNMPv1, SNMPv2c, or SNMPv3.

"

INDEX {
 mplsL3VpnVrfName,
 mvpnMrouteCmcastGroupAddrType,
 mvpnMrouteCmcastGroupAddr,
 mvpnMrouteCmcastGroupPrefixLength,
 mvpnMrouteCmcastSourceAddrType,
 mvpnMrouteCmcastSourceAddrs,
 mvpnMrouteCmcastSourcePrefixLength
 }

::= { mvpnMrouteTable 1 }

MvpnMrouteEntry ::= SEQUENCE {

mvpnMrouteCmcastGroupAddrType	InetAddressType,
mvpnMrouteCmcastGroupAddr	InetAddress,
mvpnMrouteCmcastGroupPrefixLength	InetAddressPrefixLength,
mvpnMrouteCmcastSourceAddrType	InetAddressType,
mvpnMrouteCmcastSourceAddrs	InetAddress,
mvpnMrouteCmcastSourcePrefixLength	InetAddressPrefixLength,
mvpnMrouteUpstreamNeighborAddrType	InetAddressType,
mvpnMrouteUpstreamNeighborAddr	InetAddress,
mvpnMrouteInIfIndex	InterfaceIndexOrZero,
mvpnMrouteExpiryTime	TimeTicks,
mvpnMrouteProtocol	IANAipMRouteProtocol,
mvpnMrouteRtProtocol	IANAipRouteProtocol,
mvpnMrouteRtAddrType	InetAddressType,


```

    mvpnMrouteRtAddr          InetAddress,
    mvpnMrouteRtPrefixLength  InetAddressPrefixLength,
    mvpnMrouteRtType          INTEGER,
    mvpnMrouteOctets          Counter64,
    mvpnMroutePkts            Counter64,
    mvpnMrouteTtlDroppedOctets Counter64,
    mvpnMrouteTtlDroppedPackets Counter64,
    mvpnMrouteDroppedInOctets Counter64,
    mvpnMrouteDroppedInPackets Counter64,
    mvpnMroutePmsiPointer     RowPointer,
    mvpnMrouteNumberOfLocalReplication Unsigned32,
    mvpnMrouteNumberOfRemoteReplication Unsigned32,
    mvpnMrouteCounterDiscontinuityTime TimeStamp
}

```

mvpnMrouteCmcastGroupAddrType OBJECT-TYPE

```

SYNTAX      InetAddressType
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The InetAddressType of the mvpnMrouteCmcastGroupAddr object
    that follows.
    "
 ::= { mvpnMrouteEntry 1 }

```

mvpnMrouteCmcastGroupAddr OBJECT-TYPE

```

SYNTAX      InetAddress
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The IP multicast group address which, along with
    the corresponding mvpnMrouteCmcastGroupPrefixLength object,
    identifies destinations for which this entry contains
    multicast routing information.

    This address object is only significant up to
    mvpnMrouteCmcastGroupPrefixLength bits. The remaining address
    bits MUST be set to zero.

    For addresses of type 'ipv4z' or 'ipv6z', the appended zone
    index is significant even though it lies beyond the prefix
    length. The use of these address types indicate that this
    forwarding state applies only within the given zone. Zone
    index zero is not valid in this table.
    "
 ::= { mvpnMrouteEntry 2 }

```

mvpnMrouteCmcastGroupPrefixLength OBJECT-TYPE

SYNTAX InetAddressPrefixLength

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The length in bits of the mask which, along with the corresponding mvpnMrouteCmcastGroupAddr object, identifies destinations for which this entry contains multicast routing information.

If the corresponding InetAddressType is 'ipv4' or 'ipv4z', this object must be in the range 4..32.

If the corresponding InetAddressType is 'ipv6' or 'ipv6z', this object must be in the range 8..128.

"

::= { mvpnMrouteEntry 3 }

mvpnMrouteCmcastSourceAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The InetAddressType of the mvpnMrouteCmcastSourceAddrs object that follows.

A value of unknown(0) indicates a non-source-specific entry, corresponding to all sources in the group. Otherwise, the value MUST be the same as the value of mvpnMrouteCmcastGroupAddrType.

"

::= { mvpnMrouteEntry 4 }

mvpnMrouteCmcastSourceAddrs OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The network address which, along with the corresponding mvpnMrouteCmcastSourcePrefixLength object, identifies the sources for which this entry contains multicast routing information.

This address object is only significant up to mvpnMrouteCmcastSourcePrefixLength bits.
The remaining address bits MUST be set to zero.

For addresses of type 'ipv4z' or 'ipv6z', the appended zone index is significant even though it lies beyond the prefix length. The use of these address types indicate that this

source address applies only within the given zone. Zone index zero is not valid in this table.

"

::= { mvpnMrouteEntry 5 }

mvpnMrouteCmcastSourcePrefixLength OBJECT-TYPE

SYNTAX InetAddressPrefixLength

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The length in bits of the mask which, along with the corresponding mvpnMrouteCmcastSourceAddr object, identifies the sources for which this entry contains multicast routing information.

If the corresponding InetAddressType is 'ipv4' or 'ipv4z', this object must be in the range 4..32.

If the corresponding InetAddressType is 'ipv6' or 'ipv6z', this object must be in the range 8..128.

If the corresponding InetAddressType is 'unknown', this object must be zero.

"

::= { mvpnMrouteEntry 6 }

mvpnMrouteUpstreamNeighborAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The InetAddressType of the mvpnMrouteUpstreamNeighborAddr object that follows.

A value of unknown(0) indicates that the upstream neighbor is unknown, for example in BIDIR-PIM."

REFERENCE

"[RFC 5015](#)"

::= { mvpnMrouteEntry 7 }

mvpnMrouteUpstreamNeighborAddr OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The address of the upstream neighbor (for example, Reverse Path Forwarding (RPF) neighbor) from which IP datagrams from these sources represented by this entry to this multicast address are received.

"


```
::= { mvpnMrouteEntry 8 }
```

mvpnMrouteInIfIndex OBJECT-TYPE

SYNTAX InterfaceIndexOrZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of ifIndex for the interface on which IP datagrams sent by these sources represented by this entry to this multicast address are received.

A value 0 indicates that datagrams are not subject to an incoming interface check, but may be accepted on multiple interfaces (for example, in BIDIR-PIM).

"

REFERENCE

["RFC 5015"](#)

```
::= { mvpnMrouteEntry 9 }
```

mvpnMrouteExpiryTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The minimum amount of time remaining before this entry will be aged out. The value 0 indicates that the entry is not subject to aging. If the corresponding mvpnMrouteNextHopState object is pruned(1), this object represents the remaining time for the prune to expire after which the state will return to forwarding(2).

If the corresponding mvpnMrouteNextHopState object is forwarding(2), this object indicates the time after which this entry will be removed from the table.

"

```
::= { mvpnMrouteEntry 10 }
```

mvpnMrouteProtocol OBJECT-TYPE

SYNTAX IANAipMRouteProtocol

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The multicast routing protocol via which this multicast forwarding entry was learned.

"

```
::= { mvpnMrouteEntry 11 }
```

mvpnMrouteRtProtocol OBJECT-TYPE

SYNTAX IANAipRouteProtocol


```
MAX-ACCESS read-only
STATUS      current
DESCRIPTION
    "The routing protocol via which the route used to find the
    upstream or parent interface for this multicast forwarding
    entry was learned.
    "
::= { mvpnMrouteEntry 12 }
```

```
mvpnMrouteRtAddrType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS read-only
    STATUS      current
    DESCRIPTION
        "The InetAddressType of the mvpnMrouteRtAddr object
        that follows.
        "
    ::= { mvpnMrouteEntry 13 }
```

```
mvpnMrouteRtAddr OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS read-only
    STATUS      current
    DESCRIPTION
        "The address portion of the route used to find the upstream
        or parent interface for this multicast forwarding entry.

        This address object is only significant up to
        mvpnMrouteRtPrefixLength bits. The remaining address bits
        MUST be set to zero.

        For addresses of type 'ipv4z' or 'ipv6z', the appended zone
        index is significant even though it lies beyond the prefix
        length. The use of these address types indicate that this
        forwarding state applies only within the given zone. Zone
        index zero is not valid in this table.
        "
    ::= { mvpnMrouteEntry 14 }
```

```
mvpnMrouteRtPrefixLength OBJECT-TYPE
    SYNTAX      InetAddressPrefixLength
    MAX-ACCESS read-only
    STATUS      current
    DESCRIPTION
        "The length in bits of the mask associated with the route
        used to find the upstream or parent interface for this
        multicast forwarding entry.
```


If the corresponding InetAddressType is 'ipv4' or 'ipv4z',
this object must be in the range 4..32.
If the corresponding InetAddressType is 'ipv6' or 'ipv6z',
this object must be in the range 8..128.

"

::= { mvpnMrouteEntry 15 }

mvpnMrouterRtType OBJECT-TYPE

SYNTAX INTEGER {
 unicast (1),
 multicast (2)
 }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The reason for placing the route in the (logical)
multicast Routing Information Base (RIB).

The enumerated reasons and the corresponding
descriptions are as follows:

unicast:

The route would normally be placed only in
the unicast RIB, but was placed in the multicast RIB
by local configuration, such as when running PIM over
RIP.

multicast:

The route was explicitly added to the multicast RIB by
the routing protocol, such as the Distance Vector
Multicast Routing Protocol (DVMRP) or Multiprotocol BGP.

"

::= { mvpnMrouteEntry 16 }

mvpnMrouteOctets OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of octets contained in IP datagrams that were
received from sources represented by this entry and
addressed to this multicast group address, and which were
forwarded by this router.

Discontinuities in the value of this counter can
occur at re-initialization of the management system,
and at other times as indicated by the corresponding
mvpnMrouteCounterDiscontinuityTime object.


```
"
 ::= { mvpnMrouteEntry 17 }

mvpnMroutePkts OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of packets routed using this multicast route
        entry.

        Discontinuities in the value of this counter can
        occur at re-initialization of the management system,
        and at other times as indicated by the corresponding
        mvpnMrouteCounterDiscontinuityTime object.
        "
 ::= { mvpnMrouteEntry 18 }

mvpnMrouteTtlDroppedOctets OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of octets contained in IP datagrams that this
        router has received from sources represented by
        this entry and addressed to this multicast group address,
        which were dropped due to Time To Live (TTL) issues.
        TTL issues occur when the TTL (IPv4) or Hop Limit (IPv6)
        of the incoming packet was decremented to zero, or to a
        value less than ipMcastInterfaceTtl of the corresponding
        interface.

        The ipMcastInterfaceTtl object is defined in IPMCAST-MIB
        [RFC5132] and represents the datagram TTL
        threshold for the interface. Any IP multicast datagrams
        with a TTL (IPv4) or Hop Limit (IPv6) less than this
        threshold will not be forwarded out of the interface.
        The default value of 0 means all multicast packets are
        forwarded out of the interface. A value of 256 means that
        no multicast packets are forwarded out of the interface.

        Discontinuities in the value of this counter can
        occur at re-initialization of the management system,
        and at other times as indicated by the corresponding
        mvpnMrouteCounterDiscontinuityTime object.
        "

REFERENCE
    "RFC5132, Sec. 6
```



```
"
 ::= { mvpnMrouteEntry 19 }

mvpnMrouteTtlDroppedPackets OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of packets that this router has received from
          the sources represented by this entry and addressed to this
          multicast group address, which were dropped due to
          Time To Live (TTL) issues. TTL issues occur when the
          TTL (IPv4) or Hop Limit (IPv6) of the incoming packet was
          decremented to zero, or to a value less than
          ipMcastInterfaceTtl of the corresponding interface.

          The ipMcastInterfaceTtl object is defined in IPMCAST-MIB
          [RFC5132] and represents the datagram TTL
          threshold for the interface. Any IP multicast datagrams
          with a TTL (IPv4) or Hop Limit (IPv6) less than this
          threshold will not be forwarded out of the interface.
          The default value of 0 means all multicast packets are
          forwarded out of the interface. A value of 256 means that
          no multicast packets are forwarded out of the interface.

          Discontinuities in the value of this counter can
          occur at re-initialization of the management system,
          and at other times as indicated by the corresponding
          mvpnMrouteCounterDiscontinuityTime object.
        "
    REFERENCE
        "RFC5132, Sec. 6
        "
 ::= { mvpnMrouteEntry 20 }

mvpnMrouteDroppedInOctets OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of octets contained in IP datagrams that this
          router has received from sources represented by
          this entry and addressed to this multicast group address,
          which were dropped due to error(s).
          The value of this object includes the octets counted
          in the corresponding mvpnMrouteTtlDroppedOctets object.

          Discontinuities in the value of this counter can
```


occur at re-initialization of the management system,
and at other times as indicated by the corresponding
mvpnMrouteCounterDiscontinuityTime object.

"

::= { mvpnMrouteEntry 21 }

mvpnMrouteDroppedInPackets OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of packets which this router has received from
sources represented by this entry and addressed to this
multicast group address, which were dropped due to error(s).
The value of this object includes the number of octets
counted in the corresponding mvpnMrouteTtlDroppedPackets
object.

Discontinuities in the value of this counter can
occur at re-initialization of the management system,
and at other times as indicated by the corresponding
mvpnMrouteCounterDiscontinuityTime object.

"

::= { mvpnMrouteEntry 22 }

mvpnMroutePmsiPointer OBJECT-TYPE

SYNTAX RowPointer

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A pointer to a conceptual row representing
the corresponding I-PMSI in mvpnPmsiTable or S-PMSI
in mvpnSpmsiTable, that this C-multicast route is using.

"

::= { mvpnMrouteEntry 23 }

mvpnMrouteNumberOfLocalReplication OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Number of replications for local receivers.
For example, if an ingress PE needs to send traffic out of
N PE-CE interfaces, then mvpnMrouteNumberOfLocalReplication
is N.

"

::= { mvpnMrouteEntry 24 }

mvpnMrouteNumberOfRemoteReplication OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Number of local replications for remote PEs. For example, if the number of remote PEs that need to receive traffic is N, then mvpnMrouteNumberOfRemoteReplication is N in case of Ingress Replication, but may be less than N in case of RSVP-TE or mLDP P2MP tunnels, depending on the actual number of replications the PE needs to do.

"

::= { mvpnMrouteEntry 25 }

mvpnMrouteCounterDiscontinuityTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which any one or more of this application's counters, viz., counters with OID prefix 'mvpnMrouteOctets' or 'mvpnMroutePkts' or 'mvpnMrouteTtlDroppedOctets' or 'mvpnMrouteTtlDroppedPackets' or 'mvpnMrouteDroppedInOctets' or 'mvpnMrouteDroppedInPackets' suffered a discontinuity.

If no such discontinuities have occurred since the last re-initialization of the local management subsystem, then this object will have a zero value.

"

::= { mvpnMrouteEntry 26 }

-- Table of next hops for multicast routes in an MVPN

mvpnMrouteNextHopTable OBJECT-TYPE

SYNTAX SEQUENCE OF MvpnMrouteNextHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual table containing information on the next-hops for routing IP multicast datagrams. Each entry is one of a list of next-hops for a set of sources sending to a multicast group address.

"

::= { mvpnObjects 8 }

mvpnMrouteNextHopEntry OBJECT-TYPE

SYNTAX MvpnMrouteNextHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual row corresponding to a next-hop to which IP multicast datagrams from a set of sources to an IP multicast group address are routed.

Implementers need to be aware that if the total number of octets in mplsL3VpnVrfName, mvpnMrouteNextHopGroupAddr, mvpnMrouteNextHopSourceAddrs, and mvpnMrouteNextHopAddr exceeds 111, the OIDs of column instances in this row will have more than 128 sub-identifiers and cannot be accessed using SNMPv1, SNMPv2c, or SNMPv3.

"

```
INDEX      {
            mplsL3VpnVrfName,
            mvpnMrouteNextHopGroupAddrType,
            mvpnMrouteNextHopGroupAddr,
            mvpnMrouteNextHopGroupPrefixLength,
            mvpnMrouteNextHopSourceAddrType,
            mvpnMrouteNextHopSourceAddrs,
            mvpnMrouteNextHopSourcePrefixLength,
            mvpnMrouteNextHopIfIndex,
            mvpnMrouteNextHopAddrType,
            mvpnMrouteNextHopAddr
          }
```

```
::= { mvpnMrouteNextHopTable 1 }
```

MvpnMrouteNextHopEntry ::= SEQUENCE {

mvpnMrouteNextHopGroupAddrType	InetAddressType,
mvpnMrouteNextHopGroupAddr	InetAddress,
mvpnMrouteNextHopGroupPrefixLength	InetAddressPrefixLength,
mvpnMrouteNextHopSourceAddrType	InetAddressType,
mvpnMrouteNextHopSourceAddrs	InetAddress,
mvpnMrouteNextHopSourcePrefixLength	InetAddressPrefixLength,
mvpnMrouteNextHopIfIndex	InterfaceIndex,
mvpnMrouteNextHopAddrType	InetAddressType,
mvpnMrouteNextHopAddr	InetAddress,
mvpnMrouteNextHopState	INTEGER,
mvpnMrouteNextHopExpiryTime	TimeTicks,
mvpnMrouteNextHopClosestMemberHops	Unsigned32,
mvpnMrouteNextHopProtocol	IANAipMRouteProtocol,
mvpnMrouteNextHopOctets	Counter64,
mvpnMrouteNextHopPkts	Counter64,
mvpnMrouteNextHopCounterDiscontinuityTime	TimeStamp

}

mvpnMrouteNextHopGroupAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The InetAddressType of the mvpnMrouteNextHopGroupAddr object that follows.

"

::= { mvpnMrouteNextHopEntry 1 }

mvpnMrouteNextHopGroupAddr OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The IP multicast group address which, along with the corresponding mvpnMrouteNextHopGroupPrefixLength object, identifies destinations for which this entry contains multicast forwarding information.

This address object is only significant up to mvpnMrouteNextHopGroupPrefixLength bits. The remaining address bits MUST be set to zero.

For addresses of type 'ipv4z' or 'ipv6z', the appended zone index is significant even though it lies beyond the prefix length. The use of these address types indicate that this forwarding state applies only within the given zone. Zone index zero is not valid in this table.

"

::= { mvpnMrouteNextHopEntry 2 }

mvpnMrouteNextHopGroupPrefixLength OBJECT-TYPE

SYNTAX InetAddressPrefixLength

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The length in bits of the mask which, along with the corresponding mvpnMrouteGroupAddr object, identifies destinations for which this entry contains multicast routing information.

If the corresponding InetAddressType is 'ipv4' or 'ipv4z', this object must be in the range 4..32.

If the corresponding InetAddressType is 'ipv6' or 'ipv6z', this object must be in the range 8..128.

"

::= { mvpnMrouteNextHopEntry 3 }

mvpnMrouteNextHopSourceAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The InetAddressType of mvpnMrouteNextHopSourceAddrs object that follows.

A value of unknown(0) indicates a non-source-specific entry, corresponding to all sources in the group. Otherwise, the value MUST be the same as the value of mvpnMrouteNextHopGroupAddrType."

::= { mvpnMrouteNextHopEntry 4 }

mvpnMrouteNextHopSourceAddrs OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The network address which, along with the corresponding mvpnMrouteNextHopSourcePrefixLength object, identifies the sources for which this entry specifies a next-hop.

This address object is only significant up to mvpnMrouteNextHopSourcePrefixLength bits. The remaining address bits MUST be set to zero.

For addresses of type 'ipv4z' or 'ipv6z', the appended zone index is significant even though it lies beyond the prefix length. The use of these address types indicate that this source address applies only within the given zone. Zone index zero is not valid in this table.

"

::= { mvpnMrouteNextHopEntry 5 }

mvpnMrouteNextHopSourcePrefixLength OBJECT-TYPE

SYNTAX InetAddressPrefixLength

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The length in bits of the mask which, along with the corresponding mvpnMrouteNextHopSourceAddrs object, identifies the sources for which this entry specifies a next-hop.

If the corresponding InetAddressType is 'ipv4' or 'ipv4z', this object must be in the range 4..32.

If the corresponding InetAddressType is 'ipv6' or 'ipv6z',
this object must be in the range 8..128.
If the corresponding InetAddressType is 'unknown',
this object must be zero.

"

::= { mvpnMrouteNextHopEntry 6 }

mvpnMrouteNextHopIfIndex OBJECT-TYPE

SYNTAX InterfaceIndex

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The ifIndex value of the outgoing interface
for this next-hop.

"

::= { mvpnMrouteNextHopEntry 7 }

mvpnMrouteNextHopAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The InetAddressType of the mvpnMrouteNextHopAddr object
that follows.

"

::= { mvpnMrouteNextHopEntry 8 }

mvpnMrouteNextHopAddr OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The address of the next-hop specific to this entry. For
most interfaces, this is identical to
mvpnMrouteNextHopGroupAddr. Non-Broadcast Multi-Access
(NBMA) interfaces, however, may have multiple next-hop
addresses out of a single outgoing interface.

"

::= { mvpnMrouteNextHopEntry 9 }

mvpnMrouteNextHopState OBJECT-TYPE

SYNTAX INTEGER {
pruned(1),
forwarding(2)
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An indication of whether the outgoing interface and next-hop represented by this entry is currently being used to forward IP datagrams.

The enumerated states and the corresponding descriptions are as follows:

pruned : this entry is not currently being used.
forwarding : this entry is currently being used.

"

::= { mvpnMrouteNextHopEntry 10 }

mvpnMrouteNextHopExpiryTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The minimum amount of time remaining before this entry will be aged out. If mvpnMrouteNextHopState is pruned(1), this object represents the remaining time for the prune to expire after which the state will return to forwarding(2). If mvpnMrouteNextHopState is forwarding(2), this object indicates the time after which this entry will be removed from the table.

The value of 0 indicates that the entry is not subject to aging.

"

::= { mvpnMrouteNextHopEntry 11 }

mvpnMrouteNextHopClosestMemberHops OBJECT-TYPE

SYNTAX Unsigned32 (0..256)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The minimum number of hops between this router and any member of this IP multicast group reached via this next-hop on the corresponding outgoing interface. Any IP multicast datagram for the group that has a TTL (IPv4) or Hop Count (IPv6) less than mvpnMrouteNextHopClosestMemberHops will not be forwarded through this interface.

A value of 0 means all multicast datagrams are forwarded out of the interface. A value of 256 means that no multicast datagrams are forwarded out of the interface.

This is an optimization applied by multicast routing protocols that explicitly track hop counts to downstream


```
    listeners. Multicast protocols that are not aware of hop
    counts to downstream listeners set this object to 0.
    "
 ::= { mvpnMrouteNextHopEntry 12 }

mvpnMrouteNextHopProtocol OBJECT-TYPE
    SYNTAX      IANAipMrouteProtocol
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The routing protocol via which this next-hop was learned."
 ::= { mvpnMrouteNextHopEntry 13 }

mvpnMrouteNextHopOctets OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of octets of multicast packets that have been
        forwarded using this route.

        Discontinuities in the value of this counter can
        occur at re-initialization of the management system,
        and at other times as indicated by the corresponding
        mvpnMrouteNextHopCounterDiscontinuityTime object.
        "
 ::= { mvpnMrouteNextHopEntry 14 }

mvpnMrouteNextHopPkts OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of packets which have been forwarded using this
        route.

        Discontinuities in the value of this counter can
        occur at re-initialization of the management system,
        and at other times as indicated by the corresponding
        mvpnMrouteNextHopCounterDiscontinuityTime object.
        "
 ::= { mvpnMrouteNextHopEntry 15 }

mvpnMrouteNextHopCounterDiscontinuityTime OBJECT-TYPE
    SYNTAX      TimeStamp
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
```



```
"The value of sysUpTime on the most recent occasion
at which any one or more of this application's
counters, viz., counters with OID prefix
'mvpnMrouteNextHopOctets' or 'mvpnMrouteNextHopPackets'
suffered a discontinuity.
If no such discontinuities have occurred since the
last re-initialization of the local management
subsystem, then this object will have a zero value.
"

::= { mvpnMrouteNextHopEntry 16 }

-- MVPN Notifications

mvpnMvrfActionTaken NOTIFICATION-TYPE
OBJECTS      {
    mvpnGenMvrfCreationTime,
    mvpnGenMvrfLastAction,
    mvpnGenMvrfLastActionTime,
    mvpnGenMvrfCreationTime,
    mvpnGenCmcastRouteProtocol,
    mvpnGenUmhSelection,
    mvpnGenCustomerSiteType
}
STATUS      current
DESCRIPTION
    "mvpnMvrfActionTaken notifies about a change
    in a MVRF on the PE. The change itself will be given by
    mvpnGenMvrfLastAction.
    "

::= { mvpnNotifications 1 }

-- MVPN MIB Conformance Information

mvpnGroups      OBJECT IDENTIFIER ::= { mvpnConformance 1 }
mvpnCompliances OBJECT IDENTIFIER ::= { mvpnConformance 2 }

-- Compliance Statements

mvpnModuleFullCompliance MODULE-COMPLIANCE
STATUS      current
DESCRIPTION
    "Compliance statement for agents that provide full support
    for the MCAST-VPN-MIB
    "

MODULE -- this module
MANDATORY-GROUPS {
    mvpnScalarGroup,
    mvpnGenericGroup,
```



```
        mvpnPmsiGroup,
        mvpnAdvtStatsGroup,
        mvpnMrouteGroup,
        mvpnMrouteNextHopGroup,
        mvpnNotificationGroup
    }

GROUP mvpnBgpGroup
    DESCRIPTION
        "This group is mandatory for systems that support
        BGP-MVPN.
        "

::= { mvpnCompliances 1 }

mvpnModuleReadOnlyCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION "Compliance requirement for implementations that
        only provide read-only support for MCAST-VPN-MIB.
        Such devices can then be monitored but cannot be
        configured using this MIB module.
        "
    MODULE -- this module
    MANDATORY-GROUPS {
        mvpnScalarGroup,
        mvpnGenericGroup,
        mvpnPmsiGroup,
        mvpnAdvtStatsGroup,
        mvpnMrouteGroup,
        mvpnMrouteNextHopGroup,
        mvpnNotificationGroup
    }

GROUP mvpnBgpGroup
    DESCRIPTION
        "This group is mandatory for systems that support
        BGP-MVPN.
        "

OBJECT      mvpnSPTunnelLimit
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT      mvpnBgpCmcastRouteWithdrawalTimer
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT      mvpnBgpSrcSharedTreeJoinTimer
```



```
MIN-ACCESS    read-only
DESCRIPTION   "Write access is not required."

OBJECT        mvpnBgpMsgRateLimit
MIN-ACCESS    read-only
DESCRIPTION   "Write access is not required."

OBJECT        mvpnBgpMaxSpmsiAdRoutes
MIN-ACCESS    read-only
DESCRIPTION   "Write access is not required."

OBJECT        mvpnBgpMaxSpmsiAdRouteFreq
MIN-ACCESS    read-only
DESCRIPTION   "Write access is not required."

OBJECT        mvpnBgpMaxSrcActiveAdRoutes
MIN-ACCESS    read-only
DESCRIPTION   "Write access is not required."

OBJECT        mvpnBgpMaxSrcActiveAdRouteFreq
MIN-ACCESS    read-only
DESCRIPTION   "Write access is not required."

::= { mvpnCompliances 2 }

mvpnModuleAdvtStatsCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "Compliance statement for agents that support
        monitoring of the statistics pertaining to
        advertisements sent/received by a PE.
        "
    MODULE -- this module
    MANDATORY-GROUPS {
        mvpnAdvtStatsGroup
    }

    ::= { mvpnCompliances 3 }

-- units of conformance

mvpnScalarGroup OBJECT-GROUP
    OBJECTS {
        mvpnMvrfs,
        mvpnV4Mvrfs,
        mvpnV6Mvrfs,
        mvpnMldpMvrfs,
        mvpnPimV4Mvrfs,
```



```
        mvpnPimV6Mvrf,
        mvpnBgpV4Mvrf,
        mvpnBgpV6Mvrf,
        mvpnSPTunnelLimit
    }
STATUS      current
DESCRIPTION
    "These objects are used to monitor/manage
    global MVPN parameters.
    "
 ::= { mvpnGroups 1 }

mvpnGenericGroup    OBJECT-GROUP
OBJECTS {
    mvpnGenMvrfLastAction,
    mvpnGenMvrfLastActionTime,
    mvpnGenMvrfCreationTime,
    mvpnGenCmcastRouteProtocol,
    mvpnGenIpmsiInfo,
    mvpnGenInterAsPmsiInfo,
    mvpnGenUmhSelection,
    mvpnGenCustomerSiteType
}
STATUS      current
DESCRIPTION
    "These objects are used to monitor MVPNs on a PE.
    "
 ::= { mvpnGroups 2 }

mvpnBgpGroup        OBJECT-GROUP
OBJECTS {
    mvpnBgpMode,
    mvpnBgpVrfRouteImportExtendedCommunity,
    mvpnBgpSrcASEExtendedCommunity,
    mvpnBgpCmcastRouteWithdrawalTimer,
    mvpnBgpSrcSharedTreeJoinTimer,
    mvpnBgpMsgRateLimit,
    mvpnBgpMaxSpmsiAdRoutes,
    mvpnBgpMaxSpmsiAdRouteFreq,
    mvpnBgpMaxSrcActiveAdRoutes,
    mvpnBgpMaxSrcActiveAdRouteFreq
}
STATUS      current
DESCRIPTION
    "These objects are used to monitor BGP-MVPNs on
    a PE and to monitor timers and thresholds related
    to the BPG-MVPNs.
    "
```



```
::= { mvpnGroups 3 }
```

```
mvpnPmsiGroup      OBJECT-GROUP
  OBJECTS {
    mvpnPmsiRD,
    mvpnPmsiTunnelType,
    mvpnPmsiTunnelAttribute,
    mvpnPmsiTunnelPimGroupAddrType,
    mvpnPmsiTunnelPimGroupAddr,
    mvpnPmsiEncapsulationType,
    mvpnSpmsiPmsiPointer
  }
  STATUS      current
  DESCRIPTION
    "These objects are used to monitor
    I-PMSIs and S-PMSIs tunnel on a PE.
    "
```

```
::= { mvpnGroups 4 }
```

```
mvpnAdvtStatsGroup  OBJECT-GROUP
  OBJECTS {
    mvpnAdvtSent,
    mvpnAdvtReceived,
    mvpnAdvtReceivedError,
    mvpnAdvtReceivedMalformedTunnelType,
    mvpnAdvtReceivedMalformedTunnelId,
    mvpnAdvtLastSentTime,
    mvpnAdvtLastReceivedTime,
    mvpnAdvtCounterDiscontinuityTime
  }
  STATUS      current
  DESCRIPTION
    "These objects are used to monitor
    the statistics pertaining to I-PMSI and S-PMSI
    advertisements sent/received by a PE.
    "
```

```
::= { mvpnGroups 5 }
```

```
mvpnMrouteGroup     OBJECT-GROUP
  OBJECTS {
    mvpnMrouteUpstreamNeighborAddrType,
    mvpnMrouteUpstreamNeighborAddr,
    mvpnMrouteInIfIndex,
    mvpnMrouteExpiryTime,
    mvpnMrouteProtocol,
    mvpnMrouteRtProtocol,
    mvpnMrouteRtAddrType,
    mvpnMrouteRtAddr,
  }
```



```
        mvpnMrouteRtPrefixLength,
        mvpnMrouteRtType,
        mvpnMrouteOctets,
        mvpnMroutePkts,
        mvpnMrouteTtlDroppedOctets,
        mvpnMrouteTtlDroppedPackets,
        mvpnMrouteDroppedInOctets,
        mvpnMrouteDroppedInPackets,
        mvpnMroutePmsiPointer,
        mvpnMrouteNumberOfLocalReplication,
        mvpnMrouteNumberOfRemoteReplication,
        mvpnMrouteCounterDiscontinuityTime
    }
STATUS      current
DESCRIPTION
    "These objects are used to monitor multicast routing
    information corresponding to the MVRFs on a PE.
    "
 ::= { mvpnGroups 6 }

mvpnMrouteNextHopGroup OBJECT-GROUP
OBJECTS {
    mvpnMrouteNextHopState,
    mvpnMrouteNextHopExpiryTime,
    mvpnMrouteNextHopClosestMemberHops,
    mvpnMrouteNextHopProtocol,
    mvpnMrouteNextHopOctets,
    mvpnMrouteNextHopPkts,
    mvpnMrouteNextHopCounterDiscontinuityTime
}
STATUS      current
DESCRIPTION
    "These objects are used to monitor the information on
    next-hops for routing datagrams to MVPNs on a PE.
    "
 ::= { mvpnGroups 7 }

mvpnNotificationGroup NOTIFICATION-GROUP
NOTIFICATIONS {
    mvpnMvrfActionTaken
}
STATUS      current
DESCRIPTION
    "Objects required for MVPN notifications."
 ::= { mvpnGroups 8 }
```

END

4. Security Considerations

This MIB module contains some read-only objects that may be deemed sensitive. It also contains some read-write objects, whose setting will change the device's MVPN related behavior. Appropriate security procedures related to SNMP in general but not specific to this MIB module need to be implemented by concerned operators.

There are a number of management objects defined in this MIB module with a MAX-ACCESS clause of read-write. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection opens devices to attack. These are the tables and objects and their sensitivity/vulnerability:

- o mvpnSPTunnelLimit

The value of this object is used to control the maximum number of selective provider tunnels that a PE allows for a particular MVPN. Access to this object may be abused to impact the performance of the PE or prevent the PE from having new selective provider tunnels.

- o mvpnBgpCmcastRouteWithdrawalTimer

The value of this object is used to control the delay for the advertisement of withdrawals of C-multicast routes. Access to this object may be abused to impact the performance of a PE.

- o mvpnBgpSrcSharedTreeJoinTimer

The value of this object is used to control the delay for the advertisement of Source/Shared Tree Join C-multicast routes. Access to this object may be abused to impact the propagation of C-multicast routing information.

- o mvpnBgpMsgRateLimit

The value of this object is used to control the upper bound for the rate of BGP C-multicast routing information message exchange among PEs. Access to this object may be abused to impact the performance of the PE or disrupt the C-multicast routing information message exchange using BGP.

- o mvpnBgpMaxSpmsiAdRoutes

The value of this object is used to control the upper bound for the number of S-PMSI A-D routes. Access to this object may be

abused to impact the performance of the PE or prevent the PE from receiving S-PMSI A-D routes.

- o mvpnBgpMaxSpmsiAdRouteFreq

The value of this object is used to control the upper bound for the frequency of S-PMSI A-D route generation. Access to this object may be abused to impact the performance of the PE or prevent the PE from generating new S-PMSI A-D routes.

- o mvpnBgpMaxSrcActiveAdRoutes

The value of this object is used to control the upper bound for the number of Source Active A-D routes. Access to this object may be abused to impact the performance of the PE or prevent the PE from receiving Source Active A-D routes.

- o mvpnBgpMaxSrcActiveAdRouteFreq

The value of this object is used to control the upper bound for the frequency of Source Active A-D route generation. Access to this object may be abused to impact the performance of the PE or prevent the PE from generating new Source Active A-D routes.

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:

- o The address-related objects in this MIB module may have impact on privacy and security. These objects may reveal the locations of senders and recipients.

- * mvpnPmsiTunnelPimGroupAddr

- * mvpnSpmsiCmcastGroupAddr

- * mvpnSpmsiCmcastSourceAddr

- * mvpnAdvtPeerAddr

- * mvpnMrouteCmcastGroupAddr

- * mvpnMrouteCmcastSourceAddrs

- * mvpnMrouteUpstreamNeighborAddr
- * mvpnMrouteNextHopGroupAddr
- * mvpnMrouteNextHopSourceAddrs
- * mvpnMrouteNextHopAddr

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.

5. IANA Considerations

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

Descriptor	OBJECT IDENTIFIER value
-----	-----
mvpnMIB	{ mib-2 YYYY }

Editor's Note (to be removed prior to publication): the IANA is requested to assign a value for "YYYY" under the 'mib-2' subtree and to record the assignment in the SMI Numbers registry. When the assignment has been made, the RFC Editor is asked to replace "YYYY" (here and in the MIB module) with the assigned value and to remove this note.

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

6. Acknowledgement

An earlier draft version of this document was coauthored by Zhaohui (Jeffrey) Zhang, Saud Asif, Andy Green, Sameer Gulrajani, and Pradeep G. Jain, based on an earlier draft written by Susheela Vaidya, Thomas D. Nadeau, and Harmen Van der Linde.

This document also borrowed the design and descriptions of ipMcastRouteTable and ipMcastRouteNextHopTable from IPMCAST-MIB[RFC5132].

Glenn Mansfield Keeni did the MIB Doctor review and provided valuable comments.

7. References

7.1. Normative References

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