MPLS/BGP Layer 3 VPN Multicast Management Information Base
draft-ietf-bess-mvpn-mib-03

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 MVPN, Multicast in MultiProtocol Label Switching/Border Gateway Protocol (MPLS/BGP) IP Virtual Private Networks (VPNs) on a router.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on September 1, 2017.
Multicast in MultiProtocol Label Switching/Border Gateway Protocol (MPLS/BGP) IP Virtual Private Networks (VPNs) is specified in [RFC6513], [RFC6514], and [RFC6625]. The term "Multicast VPN (MVPN)" [RFC6513] refers to a BGP/MPLS Layer 3 (IP) VPN service that supports multicast.

These specifications support either Protocol Independent Multicast (PIM) or BGP as the protocol for exchanging VPN multicast state (referred to as C-multicast states, where ‘C-’ stands for ‘VPN Customer-’) among Provider Edge routers (PEs). In the rest of this document we will use the term "PIM-MVPN" to refer to PIM being used for exchanging C-multicast states, and "BGP-MVPN" to refer to BGP being used for exchanging C-multicast states.
This document defines a Management Information Base (MIB) for MVPN-specific objects that are generic to both PIM-MVPN and BGP-MVPN.

This document borrowed some text from Cisco PIM-MVPN MIB [I-D.svaidya-mcast-vpn-mib]. For PIM-MVPN this document attempts to provide coverage comparable to [I-D.svaidya-mcast-vpn-mib], but in a generic way that applies to both PIM-MVPN and BGP-MVPN.

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].

Comments should be made directly to the BESS WG at bess@ietf.org.

1.1. Terminology

This document adopts the definitions, acronyms and mechanisms described in [RFC6513] and other documents that [RFC6513] refers to. Familiarity with Multicast, MPLS, L3VPN, MVPN 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.

Interchangeably, the term Multicast Virtual Routing and Forwarding table (MVRF) and MVPN are used to refer to a particular Multicast VPN instantiation on a particular PE device.

"Provider Multicast Service Interface (PMSI)" [RFC6513] is a conceptual interface instantiated by a Provider tunnel (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.

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. MVPN MIB

This section gives the overview of the MVPN MIB. The MIB module aims to provide configuring and/or monitoring of MVPNs on PE devices: the whole multicast VPN machinery and the per-MVRFs information, including the configuration, status and operational details, such as different P-Multicast Service Interfaces (PMSIs) and the provider tunnels implementing them.

3.1. Summary of MIB Module

The configuration and states specific to an MVPN include the following:

- C-multicast routing exchange protocol (PIM or BGP)
- I-PMSI, S-PMSI and corresponding provider tunnels
- Mapping of C-multicast states to PMSI/tunnels

To represent them, the following tables are defined. The following figure depicts relationships among tables defined in this document. Each box in the figure represents a table defined in this document. The label in each box corresponds to a table name.
### mvpnGeneralTable

An entry in this table is created for each MVRF in the device, for general configuration/states of the MVRF, including Inclusive PMSI (I-PMSI) configuration.

Existence of the corresponding VRF in [RFC4382] is necessary for a row to exist in this table.

### mvpnBgpGeneralTable

This table augments mvpnGeneralTable and is for BGP-MVPN specific information.

### mvpnSpmsiConfigTable

This table contains objects for Selective PMSI (S-PMSI) configurations in an MVRF.

### mvpnPmsiConfigTable

Both I-PMSI configuration (in mvpnGeneralEntry) and S-PMSI configuration (in mvpnSpmsiConfigEntry) refer to entries in this table.

### mvpnIpmsiTable
This table contains all advertised and received intra-as I-PMSIs. With PIM-MVPN, it is applicable only when BGP-Based Autodiscovery of MVPN Membership is used.

- mvpnInterAsIpmsiTable
  This table contains all advertised and received inter-as I-PMSIs. With PIM-MVPN, it is applicable only when BGP-Based Autodiscovery of MVPN Membership is used.

- mvpnSpmsiTable
  This table contains all advertised or received S-PMSIs.

- 12L3VpnMcastPmsiTunnelAttributeTable
  This table is defined separately in 12L3VpnMcastMIB [I-D.ietf-bess-12l3-vpn-mcast-mib], which is common for both VPLS Multicast and MVPN. It contains sent/received PMSI attribute entries referred to by mvpnIpmsiEntry, mvpnSpmsiEntry, mvpnInterAsIpmsiEntry, and other MIB objects (e.g., VPLS Multicast ones).

- mvpnMrouteTable
  This table augments ipMcastMIB.ipMcast.ipMcastRouteTable [RFC5132], for some MVPN specific information.

### 3.2. MIB Module Definitions

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

IMPORTS
  MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
  Gauge32, Unsigned32, mib-2 -- [RFC2578]
  FROM SNMPv2-SMI

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

  TruthValue, RowPointer, RowStatus, TimeStamp, TimeInterval
  FROM SNMPv2-TC -- [RFC2579]

  SnmpAdminString
  FROM SNMP-FRAMEWORK-MIB -- [RFC2571]

  InetAddress, InetAddressType

```
FROM INET-ADDRESS-MIB -- [RFC2851]
mplsL3VpnVrfName, MplsL3VpnRouteDistinguisher
FROM MPLS-L3VPN-STD-MIB -- [RFC4382]
ipMcastRouteEntry
FROM IPMCAST-MIB -- [RFC5132]
L2L3VpnMcastProviderTunnelType
FROM L2L3-VPN-MCAST-MIB;

mvpnMIB MODULE-IDENTITY
LAST-UPDATED "201702281200Z" -- 28th February 2017 12:00:00 GMT
ORGANIZATION "IETF BESS Working Group."
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DESCRIPTION  
"This MIB contains managed object definitions for  
multicast in BGP/MPLS IP VPNs defined by [RFC6513].  
Copyright (C) The Internet Society (2016)."

-- Revision history.

REVISION "201702281200Z" -- 28th February, 2017
DESCRIPTION  
"Initial version, published as RFC XXXX."

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

::= { mib2 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.

mvpnNotifications OBJECT IDENTIFIER ::= { mvpnMIB 0 }

--- tables, scalars  
mvpnObjects OBJECT IDENTIFIER ::= { mvpnMIB 1 }

--- conformance information  
mvpnConformance OBJECT IDENTIFIER ::= { mvpnMIB 2 }

--- mvpn Objects  
mvpnScalars OBJECT IDENTIFIER ::= { mvpnObjects 1 }
mvpnGeneral OBJECT IDENTIFIER ::= { mvpnObjects 2 }
mvpnConfig OBJECT IDENTIFIER ::= { mvpnObjects 3 }
mvpnStates OBJECT IDENTIFIER ::= { mvpnObjects 4 }
-- Scalar Objects

mvpnMvrfs OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The total number of MVRFs that are present on this device, whether for IPv4, IPv6, or mLDP C-Multicast."
 ::= { mvpnScalars 1 }

mvpnV4Mvrfs OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of MVRFs for IPv4 C-Multicast that are present in this device."
 ::= { mvpnScalars 2 }

mvpnV6Mvrfs OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of MVRFs for IPv6 C-Multicast that are present in this device."
 ::= { mvpnScalars 3 }

mvpnPimV4Mvrfs OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of PIM-MVPN MVRFs for IPv4 C-Multicast that are present in this device."
 ::= { mvpnScalars 4 }

mvpnPimV6Mvrfs OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of PIM-MVPN MVRFs for IPv6 C-Multicast that are present in this device."
 ::= { mvpnScalars 5 }

mvpnBgpV4Mvrfs OBJECT-TYPE
SYNTAX         Gauge32
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION
"The number of BGP-MVPN MVRFs for IPv4 C-Multicast that are
present in this device."
::= { mvpnScalars 6 }

mvpnBgpV6Mvrfs OBJECT-TYPE
SYNTAX         Gauge32
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION
"The number of BGP-MVPN MVRFs for IPv6 C-Multicast that are
present in this device."
::= { mvpnScalars 7 }

mvpnMldpMvrfs OBJECT-TYPE
SYNTAX         Gauge32
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION
"The number of BGP-MVPN MVRFs for mLDP C-Multicast that are
present in this device."
::= { mvpnScalars 8 }

mvpnNotificationEnable OBJECT-TYPE
SYNTAX         TruthValue
MAX-ACCESS     read-write
STATUS         current
DESCRIPTION
"If this object is TRUE, then the generation of all
notifications defined in this MIB is enabled."
DEFVAL { false }
::= { mvpnScalars 9 }

-- General MVRF Information Table

mvpnGeneralTable  OBJECT-TYPE
SYNTAX        SEQUENCE OF MvpnGeneralEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"This table specifies the general information about the MVRFs
present in this device."
::= { mvpnGeneral 1 }

mvpnGeneralEntry OBJECT-TYPE
SYNTAX MvpnGeneralEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry in this table is created for each MVRF in the device."
INDEX { mplsL3VpnVrfName, mvpnGenAddressFamily }
 ::= { mvpnGeneralTable 1 }

MvpnGeneralEntry ::= SEQUENCE {
  mvpnGenAddressFamily       INTEGER,
  mvpnGenOperStatusChange    INTEGER,
  mvpnGenOperChangeTime      TimeStamp,
  mvpnGenCmcastRouteProtocol INTEGER,
  mvpnGenIpmsiConfig         RowPointer,
  mvpnGenInterAsPmsiConfig   RowPointer,
  mvpnGenUmhSelection        INTEGER,
  mvpnGenSiteType            INTEGER,
  mvpnGenSptnlLimit          Unsigned32,
  mvpnGenRowStatus           RowStatus
}

mvpnGenAddressFamily OBJECT-TYPE
SYNTAX      INTEGER { ipv4(1), ipv6(2) }
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION "The Address Family that this entry is for"
 ::= { mvpnGeneralEntry 1 }

mvpnGenOperStatusChange OBJECT-TYPE
SYNTAX      INTEGER { createdMvrf(1), deletedMvrf(2), modifiedMvrfIpmsiConfig(3), modifiedMvrfSpmsiConfig(4) }
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION "This object describes the last operational change that happened for the given MVRF.

createdMvrf - indicates that the MVRF was created in the device."
deletedMvrf - indicates that the MVRF was deleted from the device. A row in this table will never have mvpnGenOperStatusChange equal to deletedMvrf(2), because in that case the row itself will be deleted from the table. This value for mvpnGenOperStatusChange is defined mainly for use in mvpnMvrfChange notification.

modifiedMvrfIpmsiConfig - indicates that the I-PMSI for the MVRF was configured, deleted or changed.

modifiedMvrfSpmsiConfig - indicates that the S-PMSI for the MVRF was configured, deleted or changed.

DEFVAL { createdMvrf }
::= { mvpnGeneralEntry 2 }

mvpnGenOperChangeTime OBJECT-TYPE
SYNTAX        TimeStamp
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"The time at which the last operational change for the MVRF in question took place. The last operational change is specified by mvpnGenOperStatusChange."
::= { mvpnGeneralEntry 3 }

mvpnGenCmcastRouteProtocol OBJECT-TYPE
SYNTAX        INTEGER { pim (1),
  bgp (2)
  }
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
"The protocol used to signal C-multicast states across the provider core.
pim(1): PIM (PIM-MVPN).
bgp(2): BGP (BGP-MVPN)."
::= { mvpnGeneralEntry 4 }

mvpnGenIpmsiConfig OBJECT-TYPE
SYNTAX        RowPointer
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
"This points to a row in mvpnPmsiConfigTable, for I-PMSI configuration."
::= { mvpnGeneralEntry 5 }

mvpnGenInterAsPmsiConfig OBJECT-TYPE
SYNTAX    RowPointer  
MAX-ACCESS read-write  
STATUS    current  
DESCRIPTION
"This points to a row in mvpnPmsiConfigTable,  
for inter-as I-PMSI configuration, in case of segmented  
inter-as provider tunnels."
::= { mvpnGeneralEntry 6 }

mvpnGenUmhSelection OBJECT-TYPE
SYNTAX    INTEGER {
            highestPeAddress  (1),
            cRootGroupHashing (2),
            ucastUmhRoute     (3)
        }
MAX-ACCESS read-write  
STATUS    current  
DESCRIPTION
"The UMH selection method for this mvpn, as specified in  
section 5.1.3 of [RFC6513]:  
highestPeAddress  (1): PE with the highest address
  cRootGroupHashing (2): hashing based on (c-root, c-group)
  ucastUmhRoute     (3): per ucast route towards c-root"
::= { mvpnGeneralEntry 7}

mvpnGenSiteType OBJECT-TYPE
SYNTAX    INTEGER {
            senderReceiver (1),
            receiverOnly  (2),
            senderOnly    (3)
        }
MAX-ACCESS read-write  
STATUS    current  
DESCRIPTION
"Whether this site is a receiver-only site or not.  
senderReceiver (1): both sender and receiver site.
receiverOnly  (2): receiver-only site.
senderOnly    (3): sender-only site."
::= { mvpnGeneralEntry 8}

mvpnGenSptnlLimit OBJECT-TYPE
SYNTAX    Unsigned32  
MAX-ACCESS read-write  
STATUS    current  
DESCRIPTION
"The max number of selective provider tunnels this device  
allows for this mvpn."
::= { mvpnGeneralEntry 9}

mvpnGenRowStatus OBJECT-TYPE
SYNTAX    RowStatus
MAX-ACCESS read-create
STATUS    current
DESCRIPTION
  "This is used to create or delete a row in this table."
::= { mvpnGeneralEntry 10 }

-- General BGP-MVPN table

mvpnBgpGeneralTable OBJECT-TYPE
SYNTAX    SEQUENCE OF MvpnBgpGeneralEntry
MAX-ACCESS not-accessible
STATUS    current
DESCRIPTION
  "This table augments the mvpnGeneralTable and is for BGP-MVPN
  specific information."
::= { mvpnGeneral 2 }

MvpnBgpGeneralEntry OBJECT-TYPE
SYNTAX    MvpnBgpGeneralEntry
MAX-ACCESS not-accessible
STATUS    current
DESCRIPTION
  "The mvpnBgpGeneralEntry matches and augments an
  mvpnGeneralEntry for a BGP-MVPN instance, with BGP-MVPN
  specific information."
AUGMENTS    { mvpnGeneralEntry }
::= { mvpnBgpGeneralTable 1 }

MvpnBgpGeneralEntry ::= SEQUENCE {
  mvpnBgpGenMode           INTEGER,
  mvpnBgpGenVrfRtImport    MplsL3VpnRouteDistinguisher,
  mvpnBgpGenSrcAs          Unsigned32
}

mvpnBgpGenMode OBJECT-TYPE
SYNTAX    INTEGER {
  rptSpt    (1),
  sptOnly   (2)
}
MAX-ACCESS read-write
STATUS    current
DESCRIPTION
  "For two different BGP-MVPN modes:
   rptSpt(1): inter-site shared tree mode
   sptOnly(2): single site shared tree mode"
sptOnly(2): inter-site source-only tree mode.

::= { mvpnBgpGeneralEntry 1}

mvpnBgpGenVrfRtImport  OBJECT-TYPE
SYNTAX             MplsL3VpnRouteDistinguisher
MAX-ACCESS         read-write
STATUS             current
DESCRIPTION
"The VRF Route Import Extended Community that this device
adds to unicast vpn routes that it advertises for this mvpn."
::= { mvpnBgpGeneralEntry 2}

mvpnBgpGenSrcAs      OBJECT-TYPE
SYNTAX            Unsigned32
MAX-ACCESS        read-only
STATUS            current
DESCRIPTION
"The Source AS number in Source AS Extended Community that this
device adds to the unicast vpn routes that it advertises for
this mvpn."
::= { mvpnBgpGeneralEntry 3}

-- PMSI Configuration Table

mvpnPmsiConfigTable OBJECT-TYPE
SYNTAX        SEQUENCE OF MvpnPmsiConfigEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"This table specifies the configured PMSIs."
::= { mvpnConfig 1 }

mvpnPmsiConfigEntry OBJECT-TYPE
SYNTAX        MvpnPmsiConfigEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"An entry in this table is created for each PMSI configured
on this router. It can be referred to by either I-PMSI
configuration (in mvpnGeneralEntry) or S-PMSI configuration
(in mvpnSpmsiConfigEntry)."
INDEX       { mvpnPmsiConfigTunnelType,
                        mvpnPmsiConfigTunnelAuxInfo,
                        mvpnPmsiConfigTunnelPimGroupAddressType,
                        mvpnPmsiConfigTunnelPimGroupAddress,
                        mvpnPmsiConfigTunnelOrTemplateName }
::= { mvpnPmsiConfigTable 1 }
MvpnPmsiConfigEntry ::= SEQUENCE {
mvpnPmsiConfigTunnelType         L2L3VpnMcastProviderTunnelType,
mvpnPmsiConfigTunnelAuxInfo      Unsigned32,
mvpnPmsiConfigTunnelPimGroupAddressType InetAddressType,
mvpnPmsiConfigTunnelPimGroupAddress InetAddress,
mvpnPmsiConfigTunnelOrTemplateName SnmpAdminString,
mvpnPmsiConfigEncapsType         INTEGER,
mvpnPmsiConfigRowStatus          RowStatus
}

mvpnPmsiConfigTunnelType OBJECT-TYPE
SYNTAX        L2L3VpnMcastProviderTunnelType
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION "Type of tunnel used to instantiate the PMSI."
::= { mvpnPmsiConfigEntry 1 }

mvpnPmsiConfigTunnelAuxInfo OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION "Additional tunnel information depending on the type.
pim:         In case of S-PMSI, number of groups starting at
mvpnPmsiConfigTunnelPimGroupAddress.
         This allows a range of PIM provider tunnel
         group addresses to be specified in S-PMSI case.
         In I-PMSI case, it must be 1.
rsvp-p2mp:   1 for statically specified rsvp-p2mp tunnel
             2 for dynamically created rsvp-p2mp tunnel
ingress-replication:
             1 for using any existing p2p/mp2p lsp
             2 for dynamically creating new p2p lsp"
::= { mvpnPmsiConfigEntry 2 }

mvpnPmsiConfigTunnelPimGroupAddressType OBJECT-TYPE
SYNTAX        InetAddressType
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION "In case of PIM provider tunnel, the type of tunnel address."
::= { mvpnPmsiConfigEntry 3 }

mvpnPmsiConfigTunnelPimGroupAddress OBJECT-TYPE
SYNTAX        InetAddress
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"In case of PIM provider tunnel, the provider tunnel address."
::= { mvpnPmsiConfigEntry 4 }

mvpnPmsiConfigTunnelOrTemplateName OBJECT-TYPE
SYNTAX        SnmpAdminString
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"The tunnel name or template name used to create tunnels. Depending on mvpnPmsiConfigTunnelType and mvpnPmsiConfigTunnelAuxInfo:

dynamically created rsvp-p2mp tunnel:     template name
statically specified rsvp-p2mp tunnel:     tunnel name
ingress-replication using
dynamically created lsps:                 template name
other:                                    null"
::= { mvpnPmsiConfigEntry 5 }

mvpnPmsiConfigEncapsType OBJECT-TYPE
SYNTAX        INTEGER { greIp (1),
                           ipIp  (2),
                           mpls  (3) }
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
"The encapsulation type to be used, in case of PIM tunnel or ingress-replication."
::= { mvpnPmsiConfigEntry 6 }

mvpnPmsiConfigRowStatus OBJECT-TYPE
SYNTAX        RowStatus
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"Used to create/modify/delete a row in this table."
::= { mvpnPmsiConfigEntry 7 }

-- S-PMSI configuration table

mvpnSpmsiConfigTable  OBJECT-TYPE
SYNTAX        SEQUENCE OF MvpnSpmsiConfigEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"This table specifies S-PMSI configuration."
::= { mvpnConfig 2 }

mvpnSpmsiConfigEntry OBJECT-TYPE
SYNTAX          MvpnSpmsiConfigEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION     "An entry is created for each S-PMSI configuration."
INDEX           { mplsL3VpnVrfName,
                  mvpnSpmsiConfigCmcastAddressType,
                  mvpnSpmsiConfigCmcastGroupAddress,
                  mvpnSpmsiConfigCmcastGroupPrefixLen,
                  mvpnSpmsiConfigCmcastSourceAddress,
                  mvpnSpmsiConfigCmcastSourcePrefixLen }
::= { mvpnSpmsiConfigTable 1 }

MvpnSpmsiConfigEntry ::= SEQUENCE {
  mvpnSpmsiConfigCmcastAddressType     InetAddressType,
  mvpnSpmsiConfigCmcastGroupAddress    InetAddress,
  mvpnSpmsiConfigCmcastGroupPrefixLen  Unsigned32,
  mvpnSpmsiConfigCmcastSourceAddress   InetAddress,
  mvpnSpmsiConfigCmcastSourcePrefixLen Unsigned32,
  mvpnSpmsiConfigThreshold             Unsigned32,
  mvpnSpmsiConfigPmsiPointer           RowPointer,
  mvpnSpmsiConfigRowStatus             RowStatus
}

mvpnSpmsiConfigCmcastAddressType OBJECT-TYPE
SYNTAX          InetAddressType
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION     "Type of C-multicast address"
::= { mvpnSpmsiConfigEntry 1 }

mvpnSpmsiConfigCmcastGroupAddress OBJECT-TYPE
SYNTAX          InetAddress
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION     "C-multicast group address"
::= { mvpnSpmsiConfigEntry 2 }

mvpnSpmsiConfigCmcastGroupPrefixLen OBJECT-TYPE
SYNTAX          Unsigned32
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION     ""
"C-multicast group address prefix length. A group 0 (or ::0) with prefix length 32 (or 128) indicates wildcard group, while a group 0 (or ::0) with prefix length 0 indicates any group."

::= { mvpnSpmsiConfigEntry 3 }

mvpnSpmsiConfigCmcastSourceAddress OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "C-multicast source address"
::= { mvpnSpmsiConfigEntry 4 }

mvpnSpmsiConfigCmcastSourcePrefixLen OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "C-multicast source address prefix length. A source 0 (or ::0) with prefix length 32 (or 128) indicates a wildcard source, while a source 0 (or ::0) with prefix length 0 indicates any source."
::= { mvpnSpmsiConfigEntry 5 }

mvpnSpmsiConfigThreshold OBJECT-TYPE
SYNTAX Unsigned32 (0..4294967295)
UNITS "kilobits per second"
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The bandwidth threshold value which when exceeded for a multicast routing entry in the given MVRF, triggers usage of S-PMSI."
::= { mvpnSpmsiConfigEntry 6 }

mvpnSpmsiConfigPmsiPointer OBJECT-TYPE
SYNTAX RowPointer
MAX-ACCESS read-write
STATUS current
DESCRIPTION "This points to a row in mvpnPmsiConfigTable, to specify tunnel attributes."
::= { mvpnSpmsiConfigEntry 7 }

mvpnSpmsiConfigRowStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION "Used to create/modify/delete a row in this table."
 ::= { mvpnSpmsiConfigEntry 8 }

-- Table of intra-as I-PMSIs advertised/received
mvpnIpmsiTable OBJECT-TYPE
SYNTAX        SEQUENCE OF MvpnIpmsiEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION "This table is for all advertised/received I-PMSI advertisements."
 ::= { mvpnStates 1 }

mvpnIpmsiEntry OBJECT-TYPE
SYNTAX        MvpnIpmsiEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION "An entry in this table corresponds to an I-PMSI advertisement that is advertised/received on this router. This represents all the sender PEs in the MVPN, with the provider tunnel they use to send traffic."
INDEX  { mplsL3VpnVrfName,
         mvpnIpmsiAfi,
         mvpnIpmsiRD,
         mvpnIpmsiOrigAddrType,
         mvpnIpmsiOrigAddress }
 ::= { mvpnIpmsiTable 1 }

MvpnIpmsiEntry ::= SEQUENCE {
   mvpnIpmsiAfi          Unsigned32,
   mvpnIpmsiRD           MplsL3VpnRouteDistinguisher,
   mvpnIpmsiOrigAddrType InetAddressType,
   mvpnIpmsiOrigAddress  InetAddress,
   mvpnIpmsiUpTime       TimeInterval,
   mvpnIpmsiAttribute    RowPointer
}

mvpnIpmsiAfi OBJECT-TYPE
SYNTAX        Unsigned32 (1|2)
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION "The address family this I-PMSI is for.
1 - IPv4
2 - IPv6"
::= { mvpnIpmsiEntry 1 }

mvpnIpmsiRD OBJECT-TYPE
SYNTAX        MplsL3VpnRouteDistinguisher
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
   "The Route Distinguisher in this I-PMSI."
::= { mvpnIpmsiEntry 2 }

mvpnIpmsiOrigAddrType OBJECT-TYPE
SYNTAX        InetAddressType
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
   "The Internet address type of mvpnIpmsiOrigAddress."
::= { mvpnIpmsiEntry 3 }

mvpnIpmsiOrigAddress OBJECT-TYPE
SYNTAX        InetAddress
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
   "The BGP address of the device that originated the I-PMSI."
::= { mvpnIpmsiEntry 4 }

mvpnIpmsiUpTime OBJECT-TYPE
SYNTAX        TimeInterval
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
   "The time since this I-PMSI
    was first advertised/received by the device."
::= { mvpnIpmsiEntry 5 }

mvpnIpmsiAttribute OBJECT-TYPE
SYNTAX        RowPointer
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
   "Points to a row in the l2L3VpnMcastPmsiTunnelAttributeTable."
::= { mvpnIpmsiEntry 6 }

-- Table of inter-as I-PMSIs advertised/received

mvpnInterAsIpmsiTable OBJECT-TYPE
SYNTAX        SEQUENCE OF MvpnInterAsIpmsiEntry
This table is for all advertised/received inter-as I-PMSI advertisements."
::= { mvpnStates 2 }

mvpnInterAsIpmsiEntry OBJECT-TYPE
SYNTAX MvpnInterAsIpmsiEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry in this table corresponds to an inter-as I-PMSI advertisement that is advertised/received on this router. This represents all the ASes in the MVPN, with the provider tunnel used to send traffic to."
INDEX { mplsL3VpnVrfName,
    mvpnInterAsIpmsiAfi,
    mvpnInterAsIpmsiRD,
    mvpnInterAsIpmsiSrcAs }
::= { mvpnInterAsIpmsiTable 1 }

MvpnInterAsIpmsiEntry ::= SEQUENCE {
    mvpnInterAsIpmsiAfi          Unsigned32,
    mvpnInterAsIpmsiRD           MplsL3VpnRouteDistinguisher,
    mvpnInterAsIpmsiSrcAs        Unsigned32,
    mvpnInterAsIpmsiAttribute    RowPointer
}

mvpnInterAsIpmsiAfi OBJECT-TYPE
SYNTAX Unsigned32 {1,2}
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The address family this I-PMSI is for. 1 - IPv4 2 - IPv6"
::= { mvpnInterAsIpmsiEntry 1 }

mvpnInterAsIpmsiRD OBJECT-TYPE
SYNTAX MplsL3VpnRouteDistinguisher
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The Route Distinguisher in this inter-as I-PMSI."
::= { mvpnInterAsIpmsiEntry 2 }

mvpnInterAsIpmsiSrcAs OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION    "The source-as in this inter-as I-PMSI."
::= { mvpnInterAsIpmsiEntry 3 }

mvpnInterAsIpmsiAttribute OBJECT-TYPE
SYNTAX        RowPointer
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION    "Points to a row in the l2L3VpnMcastPmsiTunnelAttributeTable."
::= { mvpnInterAsIpmsiEntry 4 }

-- Table of S-PMSIs advertised/received

mvpnSpmsiTable OBJECT-TYPE
SYNTAX        SEQUENCE OF MvpnSpmsiEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION    "This table has information about the S-PMSIs sent/received by a device."
::= { mvpnStates 3 }

mvpnSpmsiEntry OBJECT-TYPE
SYNTAX        MvpnSpmsiEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION    "An entry in this table is created or updated for each S-PMSI advertised/received in a particular MVRF."
INDEX  { mplsL3VpnVrfName,
                  mvpnSpmsiCmcastAddrType,
                  mvpnSpmsiCmcastGroup,
                  mvpnSpmsiCmcastGroupPrefixLen,
                  mvpnSpmsiCmcastSource,
                  mvpnSpmsiCmcastSourcePrefixLen,
                  mvpnSpmsiOrigAddrType,
                  mvpnSpmsiOrigAddress}
::= { mvpnSpmsiTable 1 }

MvpnSpmsiEntry ::= SEQUENCE {
  mvpnSpmsiCmcastAddrType             InetAddressType,
  mvpnSpmsiCmcastGroup               InetAddress,
  mvpnSpmsiCmcastGroupPrefixLen      Unsigned32,
  mvpnSpmsiCmcastSource              InetAddress,
  mvpnSpmsiOrigAddrType              InetAddress,
mvpnSpmsiCmcastSourcePrefixLen Unsigned32,
mvpnSpmsiOrigAddrType InetAddressType,
mvpnSpmsiOrigAddress InetAddress,
mvpnSpmsiTunnelAttribute RowPointer,
mvpnSpmsiUpTime TimeInterval,
mvpnSpmsiExpTime TimeInterval,
mvpnSpmsiRefCnt Unsigned32
}

mvpnSpmsiCmcastAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The Internet address type of mvpnSpmsiCmcastGroup/Source."
::= { mvpnSpmsiEntry 1 }

mvpnSpmsiCmcastGroup OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"S-PMSI C-multicast group address.
If it is 0 (or ::0), this is a wildcard group,
and mvpnSpmsiCmcastGroupPrefixLen must be 32 (or 128)."
::= { mvpnSpmsiEntry 2 }

mvpnSpmsiCmcastGroupPrefixLen OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"S-PMSI C-multicast group address prefix length."
::= { mvpnSpmsiEntry 3 }

mvpnSpmsiCmcastSource OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"S-PMSI C-multicast source address
If it is 0 (or ::0), this is a wildcard source,
and mvpnSpmsiCmcastSourcePrefixLen must be 32 (or 128)."
::= { mvpnSpmsiEntry 4 }

mvpnSpmsiCmcastSourcePrefixLen OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS not-accessible
mvpnSpmsiOrigAddrType OBJECT-TYPE
SYNTAX      InetAddressType
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"The Internet address type of mvpnSpmsiOrigAddress."
::= { mvpnSpmsiEntry 6 }

mvpnSpmsiOrigAddress OBJECT-TYPE
SYNTAX      InetAddress
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"The BGP address of the device that originated the S-PMSI."
::= { mvpnSpmsiEntry 7 }

mvpnSpmsiTunnelAttribute OBJECT-TYPE
SYNTAX      RowPointer
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"A row pointer to the 12L3VpnMcastPmsiTunnelAttributeTable"
::= { mvpnSpmsiEntry 8 }

mvpnSpmsiUpTime OBJECT-TYPE
SYNTAX      TimeInterval
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The time since this S-PMSI was first advertised/received by the device."
::= { mvpnSpmsiEntry 9 }

mvpnSpmsiExpTime OBJECT-TYPE
SYNTAX      TimeInterval
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"For UDP-based S-PMSI signaling for PIM-MVPN, the amount of time remaining before this received S-PMSI Join Message expires, or the next S-PMSI Join Message refresh is to be advertised again from the device."
Otherwise, it is 0.
 ::= { mvpnSpmsiEntry 10 }

mvpnSpmsiRefCnt OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION    
"The number of c-multicast routes that are mapped to
this S-PMSI."
 ::= { mvpnSpmsiEntry 11 }

-- Table of multicast routes in an MVPN

mvpnMrouteTable OBJECT-TYPE
SYNTAX        SEQUENCE OF MvpnMrouteEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION    
"This table augments ipMcastRouteTable, to provide some MVPN
specific information."
 ::= { mvpnStates 4 }

mvpnMrouteEntry OBJECT-TYPE
SYNTAX        MvpnMrouteEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION    
"The mvpnMrouteEntry matches and augments an ipMcastRouteEntry,
with MVPN specific information, such as PMSI used."
AUGMENTS      { ipMcastRouteEntry }
 ::= { mvpnMrouteTable 1 }

MvpnMrouteEntry ::= SEQUENCE {
 mvpnMroutePmsiPointer               RowPointer,
 mvpnMrouteNumberOfLocalReplication  Unsigned32,
 mvpnMrouteNumberOfRemoteReplication Unsigned32
}
 ::= { mvnpMrouteEntry 1 }

mvnpMrouteNumberOfLocalReplication 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 mvnpMrouteNumberOfLocalReplication is N."
 ::= { mvnpMrouteEntry 2 }

mvnpMrouteNumberOfRemoteReplication 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 mvnpMrouteNumberOfRemoteReplication 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 do."
 ::= { mvnpMrouteEntry 3 }

-- MVPN Notifications

mvnpMvrfChange NOTIFICATION-TYPE
OBJECTS {
    mvnpGenOperStatusChange
}
STATUS current
DESCRIPTION
"A mvnpMvrfChange notification signifies a change about a MVRF in the device. The change event can be creation of the MVRF, deletion of the MVRF or an update on the I-PMSI or S-PMSI configuration of the MVRF. The change event is indicated by mvnpGenOperStatusChange embedded in the notification. The user can then query mvnpGeneralTable, and/or mvnpSpmsiConfigTable to get the details of the change as necessary.

Note: Since the creation of a MVRF is often followed by configuration of I-PMSI and/or S-PMSIs for the MVRF, more than one (three at most) notifications for a MVRF may be generated serially, and it is really not necessary to generate all three of them. An agent may choose to generate a
notification for the last event only, that is for S-PMSI configuration.

Similarly, deletion of I-PMSI and S-PMSI configuration on a MVRF happens before a MVRF is deleted and it is recommended that the agent send the notification for MVRF deletion event only.

::= { mvpnNotifications 1 }

-- MVPN MIB Conformance Information

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

-- Compliance Statements

mvpnCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION "The compliance statement"
  MODULE -- this module
  MANDATORY-GROUPS {
    mvpnScalarGroup,
    mvpnGeneralGroup,
    mvpnSpmsiConfigGroup,
    mvpnSpmsiGroup,
    mvpnMrouteGroup
  }

GROUP mvpnIpmsiGroup
  DESCRIPTION "This group is mandatory for systems that support BGP signaling for I-PMSI."

GROUP mvpnInterAsIpmsiGroup
  DESCRIPTION "This group is mandatory for systems that support Inter-AS Segmented I-PMSI."

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

::= { mvpnCompliances 1 }

-- units of conformance
mvpnScalarGroup  OBJECT-GROUP
  OBJECTS {
    mvpnMvrfs,
    mvpnV4Mvrfs,
    mvpnV6Mvrfs,
    mvpnPimV4Mvrfs,
    mvpnPimV6Mvrfs,
    mvpnBgpV4Mvrfs,
    mvpnBgpV6Mvrfs,
    mvpnMldpMvrfs,
    mvpnNotificationEnable
  }
  STATUS    current
  DESCRIPTION
  "These objects are used to monitor/manage
global MVPN parameters."
  ::= { mvpnGroups 1 }

mvpnGeneralGroup  OBJECT-GROUP
  OBJECTS {
    mvpnGenOperStatusChange,
    mvpnGenOperChangeTime,
    mvpnGenCmcastRouteProtocol,
    mvpnGenIpmsiConfig,
    mvpnGenInterAsPmsiConfig,
    mvpnGenUmhSelection,
    mvpnGenSiteType,
    mvpnGenSptnlLimit,
    mvpnGenRowStatus
  }
  STATUS    current
  DESCRIPTION
  "These objects are used to monitor/manage
  per-VRF MVPN parameters."
  ::= { mvpnGroups 2 }

mvpnPmsiConfigGroup  OBJECT-GROUP
  OBJECTS {
    mvpnPmsiConfigEncapsType,
    mvpnPmsiConfigRowStatus
  }
  STATUS    current
  DESCRIPTION
  "These objects are used to monitor/manage
  PMSI tunnel configurations."
  ::= { mvpnGroups 3 }

mvpnSpmsiConfigGroup  OBJECT-GROUP
OBJECTS {
  mvnpnSpmsiConfigThreshold,
  mvnpnSpmsiConfigPmsiPointer,
  mvnpnSpmsiConfigRowStatus
}
STATUS current
DESCRIPTION
"These objects are used to monitor/manage
S-PMSI configurations."
::= { mvpnGroups 4 }

mvnpnIpmsiGroup OBJECT-GROUP
OBJECTS {
  mvnpnIpmsiUpTime,
  mvnpnIpmsiAttribute
}
STATUS current
DESCRIPTION
"These objects are used to monitor/manage
Intra-AS I-PMSI attributes."
::= { mvpnGroups 5 }

mvnpnInterAsIpmsiGroup OBJECT-GROUP
OBJECTS {
  mvnpnInterAsIpmsiAttribute
}
STATUS current
DESCRIPTION
"These objects are used to monitor/manage
Inter-AS I-PMSI attributes."
::= { mvpnGroups 6 }

mvnpnSpmsiGroup OBJECT-GROUP
OBJECTS {
  mvnpnSpmsiTunnelAttribute,
  mvnpnSpmsiUpTime,
  mvnpnSpmsiExpTime,
  mvnpnSpmsiRefCnt
}
STATUS current
DESCRIPTION
"These objects are used to monitor/manage
S-PMSI attributes."
::= { mvpnGroups 7 }

mvnpnMrouteGroup OBJECT-GROUP
OBJECTS {
  mvnpnMrouteNumberOfLocalReplication,
mvpnMrouteNumberOfRemoteReplication
}
STATUS  current
DESCRIPTION
"These objects are used to monitor/manage
VPN multicast forwarding states."
::= { mvpnGroups 8 }

mvpnBgpGeneralGroup OBJECT-GROUP
OBJECTS {
  mvpnBgpGenMode,
  mvpnBgpGenVrfRtImport,
  mvpnBgpGenSrcAs
}
STATUS  current
DESCRIPTION
"These objects are used to monitor/manage BGP-MVPN"
::= { mvpnGroups 9 }

mvpnOptionalGroup OBJECT-GROUP
OBJECTS {
  mvpnMroutePmsiPointer
}
STATUS  current
DESCRIPTION
"Support of these object is not required."
::= { mvpnGroups 10 }

END

4. Security Considerations

This MIB contains some read-only objects that may be deemed sensitive
by some though perhaps not all operators. It also contains some
read-write objects, whose setting will change the device’s behavior
related to MVPN. Appropriate security procedures related to SNMP in
general but not specific to this MIB 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 and/or read-create. 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  mvpnNotificationEnable, mvpnGenCmcastRouteProtocol,
     mvpnGenIpmsiConfig, mvpnGenInterAsPmsiConfig, mvpnGenUmhSelection,
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:

- 

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

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

Some of the text has been taken almost verbatim from [I-D.svaidya-mcast-vpn-mib]. We would like to thank Yakov Rekhter, Jeffrey Haas, Huajin Jeng, Durga Prasad Velamuri for their helpful comments.

7. References

7.1. Normative References

[I-D.ietf-bess-l2l3-vpn-mcast-mib]


7.2. Informative References

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