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MPLS-TP Operations, Administration, and Management (OAM) Identifiers Management Information Base (MIB) draft-vkst-mpls-tp-oam-id-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 Operations, Administration, and Management (OAM) identifiers related managed objects for Multiprotocol Label Switching (MPLS) based Transport Profile (TP).

Status of this Memo

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1 Introduction

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 for modeling a Multiprotocol Label Switching (MPLS) [RFC3031] based transport profile.

This MIB module should be used for performing the OAM operations for MPLS LSPs, Pseudowires and Sections.

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 RFC3410 [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, RFC2578, STD 58, RFC2579 and STD58, RFC2580.

3. Overview

3.1 Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC-2119 [RFC2119].

3.2 Terminology

This document uses terminology from the MPLS architecture document [RFC3031], MPLS Traffic Engineering Management information [RFC3812], MPLS Label Switch Router MIB [RFC3813], MPLS-TP OAM Framework document [RFC6371] and MPLS-TP Identifiers document [RFC6370].

3.3 Acronyms

ICC: ITU Carrier Code
IP: Internet Protocol

LSP: Label Switching Path
LSR: Label Switching Router

MIB: Management Information Base
ME: Maintenance Entity
MEG: Maintenance Entity Group
MEP: Maintenance Entity Group End Point
MIP: Maintenance Intermediate Point
MPLS: Multi-Protocol Label Switching
MPLS-TP: MPLS Transport Profile
PW: Pseudowire
TE: Traffic Engineering
TP: Transport Profile

4. Feature List

The MPLS transport profile OAM identifiers MIB module is designed to satisfy the following requirements and constraints:

- The MIB module supports configuration of OAM identifiers for point-to-point, co-routed bi-directional, associated bi-directional MPLS tunnels and MPLS Pseudowires.

5. Brief description of MIB Objects

The objects described in this section support the functionality described in documents [RFC5654] and [RFC6370]. The tables support both IP compatible and ICC based OAM identifiers configurations for MPLS Tunnels and Pseudowires.

5.1. mplsOamIdMegTable

The mplsOamIdMegTable is used to manage one or more Maintenance Entities (MEs) that belongs to the same transport path.

When a new entry is created with mplsOamIdMegOperatorType set to ipCompatible (1), then as per [RFC6370] (MEG_ID for LSP is LSP_ID and MEG_ID for PW is PW_Path_ID), MEP_ID can be automatically formed.

For ICC based transport path, the user is expected to configure the ICC identifier explicitly in this table for MPLS tunnel and pseudowires.

5.2. mplsOamIdMeTable

The mplsOamIdMeTable defines a relationship between two points

(source and sink) of a transport path to which maintenance and monitoring operations apply. The two points that define a maintenance entity are called Maintenance Entity Group End Points (MEPs).

In between MEPs, there are zero or more intermediate points, called Maintenance Entity Group Intermediate Points (MIPs). MEPs and MIPs are associated with the MEG and can be shared by more than one ME in a MEG.

6. Example of MPLS OAM identifier configuration for MPLS tunnel

In this section, we provide an example of the OAM identifier configuration for MPLS co-routed bidirectional tunnel.

This example provides usage of a MEG and ME tables for management and monitoring operations of MPLS tunnel.

This example considers the OAM identifiers configuration on a head-end LSR to manage and monitor a MPLS tunnel.
Only relevant objects which are applicable for IP based OAM identifiers of co-routed MPLS tunnel are illustrated here.

In mplsOamIdMegTable:

```
{
  -- MEG index (Index to the table)
  mplsOamIdMegIndex                = 1,
  mplsOamIdMegName                 = "MEG1",
  mplsOamIdMegOperatorType         = ipCompatible (1),
  mplsOamIdMegServiceType          = lsp (1),
  mplsOamIdMegMpLocation           = perNode(1),
-- Mandatory parameters needed to activate the row go here
  mplsOamIdMegRowStatus            = createAndGo (4)
}
```

This will create an entry in the mplsOamIdMegTable to manage and monitor the MPLS tunnel.

The following ME table is used to associate the path information to a MEG.

In mplsOamIdMeTable:

```
{
-- ME index (Index to the table)
 mplsOamIdMeIndex                 = 1,
```

```
      -- MP index (Index to the table)
       mplsOamIdMeMpIndex               = 1,
       mplsOamIdMeName                  = "ME1",
       mplsOamIdMeMpIfIndex             = 0,
       -- Source MEP id is derived from the IP compatible MPLS tunnel
       mplsOamIdMeSourceMepIndex        = 0,
       -- Source MEP id is derived from the IP compatible MPLS tunnel
       mplsOamIdMeSinkMepIndex          = 0,
       mplsOamIdMeMpType                = mep (1),
       mplsOamIdMeMepDirection          = down (2),
       mplsOamIdMeProactiveOamPhbTCValue = 0,
       mplsOamIdMeOnDemandOamPhbTCValue  = 0,
      --  RowPointer MUST point to the first accessible column of an
      --  MPLS tunnel
       mplsOamIdMeServicePointer        = mplsTunnelName.1.1.10.20,
      -- Mandatory parameters needed to activate the row go here
       mplsOamIdMeRowStatus             = createAndGo (4)
      }
```

7. MPLS OAM Identifiers MIB definitions

```
   MPLS-OAM-ID-STD-MIB DEFINITIONS ::= BEGIN

       IMPORTS
          MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
          Unsigned32, zeroDotZero
             FROM SNMPv2-SMI                    -- [RFC2578]
          MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
             FROM SNMPv2-CONF                   -- [RFC2580]
          RowStatus, RowPointer, StorageType
             FROM SNMPv2-TC                     -- [RFC2579]
          SnmpAdminString
             FROM SNMP-FRAMEWORK-MIB            -- [RFC3411]
          mplsStdMIB
             FROM MPLS-TC-STD-MIB               -- [RFC3811]
          InterfaceIndexOrZero, ifGeneralInformationGroup,
          ifCounterDiscontinuityGroup
             FROM IF-MIB;                       -- [RFC2863]

      mplsOamIdStdMIB MODULE-IDENTITY
         LAST-UPDATED
            "201206030000Z" -- June 03, 2012
         ORGANIZATION
            "Multiprotocol Label Switching (MPLS) Working Group"
         CONTACT-INFO
            "
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                   Huawei Technologies, co.
```

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         "
        DESCRIPTION
            "Copyright (c) 2012 IETF Trust and the persons identified
             as the document authors.  All rights reserved.

             This MIB module contains generic object definitions for
             MPLS OAM maintenance identifiers in MPLS based transport
             networks."

        -- Revision history.

        REVISION
           "201206030000Z" -- June 03, 2012
        DESCRIPTION
             "MPLS OAM Identifiers mib objects for LSPs and
              Pseudowires"
```

```
        ::= { mplsStdMIB xxx } -- xxx to be replaced with correct value

    -- Top level components of this MIB module.

    -- notifications
    mplsOamIdNotifications
                OBJECT IDENTIFIER ::= { mplsOamIdStdMIB 0 }
    -- tables, scalars
    mplsOamIdObjects  OBJECT IDENTIFIER ::= { mplsOamIdStdMIB 1 }
    -- conformance
    mplsOamIdConformance
                OBJECT IDENTIFIER ::= { mplsOamIdStdMIB 2 }

     -- Start of MPLS Transport Profile MEG table

     mplsOamIdMegTable OBJECT-TYPE
      SYNTAX        SEQUENCE OF MplsOamIdMegEntry
      MAX-ACCESS    not-accessible
      STATUS        current
      DESCRIPTION
            "This table contains information about the Maintenance
             Entity Groups (MEG).

             MEG as mentioned in MPLS-TP OAM framework defines a set
             of one or more maintenance entities (ME).
             Maintenance Entities define a relationship between any
             two points of a transport path in an OAM domain to which
             maintenance and monitoring operations apply."
      ::= { mplsOamIdObjects 1 }

     mplsOamIdMegEntry OBJECT-TYPE
      SYNTAX        MplsOamIdMegEntry
      MAX-ACCESS    not-accessible
      STATUS        current
      DESCRIPTION
            "An entry in this table represents MPLS-TP MEG.
             An entry can be created by a network administrator
             or by an SNMP agent as instructed by an MPLS-TP OAM
             Framework.

             When a new entry is created with
             mplsOamIdMegOperatorType set to ipCompatible (1),
             then as per [RFC6370] (MEG_ID for LSP is LSP_ID and
             MEG_ID for PW is PW_Path_ID), MEP_ID can be
             automatically formed.

             For co-routed bidirectional LSP, MEG_ID is
             A1-{Global_ID::Node_ID::Tunnel_Num}::Z9-{Global_ID::
```

```
            Node_ID::Tunnel_Num}::LSP_Num.

            For associated bidirectional LSP, MEG_ID is A1-
            {Global_ID::Node_ID::Tunnel_Num::LSP_Num}:: Z9-
            {Global_ID::Node_ID::Tunnel_Num::LSP_Num}

            For LSP, MEP_ID is formed using,
            Global_ID::Node_ID::Tunnel_Num::LSP_Num

            For PW, MEG_ID is formed using AGI::A1-
            {Global_ID::Node_ID::AC_ID}:: Z9-
            {Global_ID::Node_ID::AC_ID}.

            For PW, MEP_ID is formed using
            AGI::Global_ID::Node_ID::AC_ID

            MEP_ID is retrieved from the mplsOamIdMegServicePointer
            object based on the mplsOamIdMegServiceType value.
            ICC MEG_ID for LSP and PW is formed using the objects
            mplsOamIdMegIdIcc and mplsOamIdMegIdUmc.

            MEP_ID can be formed using MEG_ID::MEP_Index."
        REFERENCE
            "1. RFC 5860, Requirements for OAM in MPLS Transport
                Networks, May 2010.
             2. RFC 6371, Operations, Administration, and Maintenance
                Framework for MPLS-Based Transport Networks,
                September 2011.
             3. RFC 6370, MPLS Transport Profile (MPLS-TP) Identifiers.
             4. MPLS-TP Identifiers Following ITU-T Conventions
                [TP-ITUIDS]."
        INDEX { mplsOamIdMegIndex }
        ::= { mplsOamIdMegTable 1 }

        MplsOamIdMegEntry ::= SEQUENCE {
             mplsOamIdMegIndex            Unsigned32,
             mplsOamIdMegName             SnmpAdminString,
             mplsOamIdMegOperatorType     INTEGER,
             mplsOamIdMegIdIcc            SnmpAdminString,
             mplsOamIdMegIdUmc            SnmpAdminString,
             mplsOamIdMegServiceType      INTEGER,
             mplsOamIdMegMpLocation       INTEGER,
             mplsOamIdMegRowStatus        RowStatus,
             mplsOamIdMegStorageType      StorageType
        }

        mplsOamIdMegIndex  OBJECT-TYPE
           SYNTAX        Unsigned32
```

```
          MAX-ACCESS    not-accessible
          STATUS        current
          DESCRIPTION
              "Index for the conceptual row identifying a MEG within

               this MEG table."
          ::= { mplsOamIdMegEntry 1 }

       mplsOamIdMegName  OBJECT-TYPE
          SYNTAX        SnmpAdminString (SIZE(1..48))
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
              "Each Maintenance Entity Group has unique name amongst
               all those used or available to a service provider or
               operator. It facilitates easy identification of
               administrative responsibility for each MEG."
          ::= { mplsOamIdMegEntry 2 }

       mplsOamIdMegOperatorType OBJECT-TYPE
          SYNTAX        INTEGER {
                            ipCompatible (1),

                            iccBased (2)
                        }
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
              "Indicates the operator type for MEG. Conceptual rows
               having 'iccBased' as operator type, should have valid
               values for the objects mplsOamIdMegIdIcc and
               mplsOamIdMegIdUmc while making the row status active."
          REFERENCE
              "1. RFC 6370, MPLS Transport Profile (MPLS-TP)
                  Identifiers.
               2. MPLS-TP Identifiers Following ITU-T Conventions
                  [TP-ITUIDS]."
          DEFVAL { ipCompatible }
          ::= { mplsOamIdMegEntry 3 }

       mplsOamIdMegIdIcc OBJECT-TYPE
          SYNTAX      SnmpAdminString (SIZE(1..6))
          MAX-ACCESS  read-write
          STATUS      current
          DESCRIPTION
            "Unique code assigned to Network Operator or Service
             Provider maintained by ITU-T. The ITU Carrier Code
             used to form MEGID.
```

```
            This object contains non-null ICC value if
            the MplsOamIdMegOperatorType value is iccBased(2),
            otherwise null ICC value should be assigned."
         REFERENCE

            "MPLS-TP Identifiers Following ITU-T Conventions
             [TP-ITUIDS]."
         DEFVAL {""}
         ::= { mplsOamIdMegEntry 4 }

      mplsOamIdMegIdUmc OBJECT-TYPE
         SYNTAX      SnmpAdminString (SIZE(1..7))
         MAX-ACCESS  read-write
         STATUS      current
         DESCRIPTION
           "Unique code assigned by Network Operator or Service
            Provider and is appended to mplsOamIdMegIdIcc to form
            the MEGID.
            This object contains non-null ICC value if
            the MplsOamIdMegOperatorType value is iccBased(2),
            otherwise null ICC value should be assigned."
         REFERENCE
            "MPLS-TP Identifiers Following ITU-T Conventions
           [TP-ITUIDS]."
         DEFVAL {""}
         ::= { mplsOamIdMegEntry 5 }

      mplsOamIdMegServiceType OBJECT-TYPE

         SYNTAX        INTEGER {
                           lsp (1),
                           pseudowire (2),
                           section (3)
                       }
         MAX-ACCESS    read-create
         STATUS        current
         DESCRIPTION
           "Indicates the service type for which the MEG is created.

            If the service type indicates lsp, the service pointer
            in mplsOamIdMeTable points to the TE tunnel table entry.

            If the value is pseudowire service type, the service
            pointer in mplsOamIdMeTable points to the pseudowire
            table entry.

            If the value is section service type, the service
            pointer in mplsOamIdMeTable points to a section entry."
```

```
          DEFVAL { lsp }
          ::= { mplsOamIdMegEntry 6 }

       mplsOamIdMegMpLocation OBJECT-TYPE
          SYNTAX        INTEGER {

                            perNode (1),
                            perInterface (2)
                        }
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
            "Indicates the MP location type for this MEG.

             If the value is perNode, then the MEG in the LSR supports
             only perNode MEP/MIP, i.e., only one MEP/MIP in an LSR.

             If the value is perInterface, then the MEG in the LSR
             supports perInterface MEPs/MIPs, i.e., two MEPs/MIPs in
             an LSR."
          REFERENCE
            "RFC 6371, Operations, Administration, and Maintenance
             Framework for MPLS-Based Transport Networks,
             September 2011."
          DEFVAL { perNode }
          ::= { mplsOamIdMegEntry 7 }

       mplsOamIdMegRowStatus OBJECT-TYPE
          SYNTAX        RowStatus
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION

             "This variable is used to create, modify, and/or delete
              a row in this table. When a row in this table is in
              active(1) state, no objects in that row can be modified
              by the agent except mplsOamIdMegRowStatus."
          ::= { mplsOamIdMegEntry 8 }

       mplsOamIdMegStorageType OBJECT-TYPE
           SYNTAX        StorageType
           MAX-ACCESS    read-create
           STATUS        current
           DESCRIPTION
             "This variable indicates the storage type for this
              object.
              Conceptual rows having the value 'permanent'
              need not allow write-access to any columnar
```

```
              objects in the row."
            DEFVAL { volatile }
            ::= { mplsOamIdMegEntry 9 }

       -- End of MPLS Transport Profile MEG table


       -- Start of MPLS Transport Profile ME table
       mplsOamIdMeTable OBJECT-TYPE
        SYNTAX        SEQUENCE OF MplsOamIdMeEntry
        MAX-ACCESS    not-accessible
        STATUS        current
        DESCRIPTION
              "This table contains MPLS-TP maintenance entity
               information.

               ME is some portion of a transport path that requires
               management bounded by two points (called MEPs), and the
               relationship between those points to which maintenance
               and monitoring operations apply.

               This table is generic enough to handle MEPs and MIPs
               information within a MEG."
        ::= { mplsOamIdObjects 2 }

       mplsOamIdMeEntry OBJECT-TYPE
        SYNTAX        MplsOamIdMeEntry
        MAX-ACCESS    not-accessible
        STATUS        current
        DESCRIPTION
             "An entry in this table represents MPLS-TP maintenance
              entity. This entry represents the ME if the source and
              sink MEPs are defined.

              A ME is a p2p entity. One ME has two such MEPs.
              A MEG is a group of one or more MEs. One MEG can have
              two or more MEPs.

              For P2P LSP, one MEG has one ME and this ME is associated
              two MEPs (source and sink MEPs) within a MEG.
              Each mplsOamIdMeIndex value denotes the ME within a MEG.

              In case of unidirectional point-to-point transport paths,
              a single unidirectional Maintenance Entity is defined to
              monitor it.

              In case of associated bi-directional point-to-point
              transport paths, two independent unidirectional
```

```
            Maintenance Entities are defined to independently monitor
            each direction. This has implications for transactions
            that terminate at or query a MIP, as a return path from
            MIP to source MEP does not necessarily exist within
            the MEG.

            In case of co-routed bi-directional point-to-point
            transport paths, a single bidirectional Maintenance Entity
            is defined to monitor both directions congruently.

            In case of unidirectional point-to-multipoint transport
            paths, a single unidirectional Maintenance entity for
            each leaf is defined to monitor the transport path from
            the root to that leaf."
        INDEX { mplsOamIdMegIndex,
                mplsOamIdMeIndex,
                mplsOamIdMeMpIndex
              }
        ::= { mplsOamIdMeTable 1 }

       MplsOamIdMeEntry ::= SEQUENCE {
            mplsOamIdMeIndex                  Unsigned32,
            mplsOamIdMeMpIndex                Unsigned32,
            mplsOamIdMeName                   SnmpAdminString,
            mplsOamIdMeMpIfIndex              InterfaceIndexOrZero,
            mplsOamIdMeSourceMepIndex         Unsigned32,
            mplsOamIdMeSinkMepIndex           Unsigned32,
            mplsOamIdMeMpType                 INTEGER,
            mplsOamIdMeMepDirection           INTEGER,
            mplsOamIdMeProactiveOamSessIndex  Unsigned32,
            mplsOamIdMeProactiveOamPhbTCValue INTEGER,
            mplsOamIdMeOnDemandOamPhbTCValue  INTEGER,
            mplsOamIdMeServicePointer         RowPointer,
            mplsOamIdMeRowStatus              RowStatus,
            mplsOamIdMeStorageType            StorageType
      }

      mplsOamIdMeIndex  OBJECT-TYPE
         SYNTAX        Unsigned32
         MAX-ACCESS    not-accessible
         STATUS        current
         DESCRIPTION
           "Uniquely identifies a maintenance entity index within
            a MEG."
         ::= { mplsOamIdMeEntry 1 }

      mplsOamIdMeMpIndex  OBJECT-TYPE
```

```
          SYNTAX        Unsigned32
          MAX-ACCESS    not-accessible
          STATUS        current
          DESCRIPTION
            "Indicates the maintenance point index, used to create
             multiple MEPs in a node of single ME. The value of this
             object can be MEP index or MIP index."

          ::= { mplsOamIdMeEntry 2 }

       mplsOamIdMeName  OBJECT-TYPE
          SYNTAX        SnmpAdminString (SIZE(1..48))
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
              "This object denotes the ME name, each
               Maintenance Entity has unique name within MEG."
          ::= { mplsOamIdMeEntry 3 }

       mplsOamIdMeMpIfIndex OBJECT-TYPE
          SYNTAX        InterfaceIndexOrZero
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
            "Indicates the maintenance point interface.
             If the mplsOamIdMegMpLocation object value
             is perNode (1), the MP interface index should point
             to incoming interface or outgoing interface or
             zero (indicates the MP OAM packets are initiated
             from forwarding engine).

             If the mplsOamIdMegMpLocation object value is
             perInterface (2), the MP interface index should point to
             incoming interface or outgoing interface."
          REFERENCE
            "RFC 6371, Operations, Administration, and Maintenance
             Framework for MPLS-Based Transport Networks,
             September 2011."
          DEFVAL { 0 }
          ::= { mplsOamIdMeEntry 4 }

       mplsOamIdMeSourceMepIndex  OBJECT-TYPE
          SYNTAX        Unsigned32
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
            "Indicates the source MEP Index of the ME. This object
             should be configured if mplsOamIdMegOperatorType object
```

```
            in the mplsOamIdMegEntry is configured as iccBased (2).
            If the MEG is configured for IP based operator,
            the value of this object should be set zero and the MEP
            ID will be automatically derived from the service
            Identifiers(MPLS-TP LSP/PW Identifier)."
         DEFVAL { 0 }
         ::= { mplsOamIdMeEntry 5 }


      mplsOamIdMeSinkMepIndex  OBJECT-TYPE
         SYNTAX        Unsigned32
         MAX-ACCESS    read-create
         STATUS        current
         DESCRIPTION
           "Indicates the sink MEP Index of the ME. This object
            should be configured if mplsOamIdMegOperatorType object
            in the mplsOamIdMegEntry is configured as iccBased (2).
            If the MEG is configured for IP based operator,
            the value of this object should be set zero and the MEP
            ID will be automatically derived from the service
            Identifiers(MPLS-TP LSP/PW Identifier)."
         DEFVAL { 0 }
         ::= { mplsOamIdMeEntry 6 }

      mplsOamIdMeMpType OBJECT-TYPE
         SYNTAX        INTEGER {
                           mep (1),
                           mip (2)
                       }
         MAX-ACCESS    read-create
         STATUS        current
         DESCRIPTION
             "Indicates the maintenance point type within the MEG.

              The object should have the value mep (1),  only in the
              Ingress or Egress nodes of the transport path.

              The object can have the value mip (2),
              in the intermediate nodes and possibly in the end nodes
              of the transport path."
         DEFVAL { mep }
         ::= { mplsOamIdMeEntry 7 }

      mplsOamIdMeMepDirection OBJECT-TYPE
         SYNTAX        INTEGER {
                           up (1),
                           down (2)
                       }
```

```
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
            "Indicates the direction of the MEP. This object
             should be configured if mplsOamIdMeMpType is

             configured as mep (1)."
          DEFVAL { down }
          ::= { mplsOamIdMeEntry 8 }

       mplsOamIdMeProactiveOamSessIndex  OBJECT-TYPE
          SYNTAX        Unsigned32
          MAX-ACCESS    read-only
          STATUS        current
          DESCRIPTION
            "Indicates the proactive OAM session index for this MP.
             When a proactive OAM session for this MP is established,
             the underlying proactive initiator has to update this
             object with the proactive OAM session index."
          DEFVAL { 0 }
          ::= { mplsOamIdMeEntry 9 }

       mplsOamIdMeProactiveOamPhbTCValue  OBJECT-TYPE
          SYNTAX        INTEGER {
                          ef1 (1),
                          ef2 (2),
                          af1 (3),
                          af2 (4),
                          af3 (5),
                          be (6)
                        }
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
            "Indicates the Per-hop Behavior (PHB) value for this source
             MEP generated proactive traffic."
          DEFVAL { ef1 }
          ::= { mplsOamIdMeEntry 10 }

      mplsOamIdMeOnDemandOamPhbTCValue  OBJECT-TYPE
          SYNTAX        INTEGER {
                          ef1 (1),
                          ef2 (2),
                          af1 (3),
                          af2 (4),
                          af3 (5),
                          be (6)
                        }
```

```
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
            "Indicates the Per-hop Behavior (PHB) value for this
             source MEP generated on-demand traffic."
          DEFVAL { ef1 }

          ::= { mplsOamIdMeEntry 11 }

       mplsOamIdMeServicePointer OBJECT-TYPE

          SYNTAX        RowPointer
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
            "This variable represents a pointer to the MPLS-TP
             transport path. This value may point at an entry in the
             mplsTunnelEntry if mplsOamIdMegServiceType is configured
             as lsp (1) or at an entry in the pwEntry if
             mplsOamIdMegServiceType is configured as pseudowire (2).

             Note: This service pointer object, is placed in ME table
             instead of MEG table, since it will be useful in case of
             poinit-to-multipoint, where each ME will point to different
             branches of a P2MP tree."
          DEFVAL { zeroDotZero }
          ::= { mplsOamIdMeEntry 12 }

       mplsOamIdMeRowStatus OBJECT-TYPE
          SYNTAX        RowStatus
          MAX-ACCESS    read-create
          STATUS        current
          DESCRIPTION
             "This variable is used to create, modify, and/or
              delete a row in this table.  When a row in this
              table is in active(1) state, no objects in that row
              can be modified by the agent except
              mplsOamIdMeRowStatus."
          ::= { mplsOamIdMeEntry 13 }

       mplsOamIdMeStorageType OBJECT-TYPE
           SYNTAX        StorageType
           MAX-ACCESS    read-create
           STATUS        current
           DESCRIPTION
             "This variable indicates the storage type for this
              object.
              Conceptual rows having the value 'permanent'
```

```
              need not allow write-access to any columnar
              objects in the row."
            DEFVAL { volatile }
            ::= { mplsOamIdMeEntry 14 }

       -- End of MPLS Transport Profile ME table

       -- End of MPLS-TP OAM Tables

   -- Notification Definitions of MPLS-TP identifiers


       mplsOamIdMegOperStatus OBJECT-TYPE
          SYNTAX       INTEGER {
                        up (1),
                        down (2)
                       }
          MAX-ACCESS   accessible-for-notify
          STATUS       current
          DESCRIPTION
              "This object specifies the operational status of the
               Maintenance Entity Group (MEG). This object is used to
               send the notification to the SNMP manager about the MEG.

               The value up (1) indicates that the MEG and its monitored
               path are operationally up. The value down (2) indicates
               that the MEG is operationally down."
        ::= {  mplsOamIdObjects 3 }

       mplsOamIdMegSubOperStatus OBJECT-TYPE
          SYNTAX       BITS {
                        megDown (0),
                        meDown (1),
                        oamAppDown (2),
                        pathDown (3)
                       }
          MAX-ACCESS   accessible-for-notify
          STATUS       current
          DESCRIPTION
              "This object specifies the reason why the MEG operational
               status as mentioned by the object mplsOamIdMegOperStatus
               is down. This object is used to send the notification to
               the SNMP manager about the MEG.

               The bit 0 (megDown) when set indicates the MEG is down.
               MEG table can be made down administratively.
               The bit 1 (meDown) when set indicates the ME table is
               down. ME can be made down administratively.
```

```
               The bit 2 (oamAppDown) when set indicates that the
               OAM application has notified that the entity (LSP or PW)
               monitored by this MEG is down. Currently, BFD is the
               only supported OAM application.
               The bit 3 (pathDown) when set indicates that the
               underlying LSP or PW is down."
         ::= {  mplsOamIdObjects 4 }

      mplsOamIdDefectCondition NOTIFICATION-TYPE
       OBJECTS      {
                      mplsOamIdMegName,
                      mplsOamIdMeName,

                      mplsOamIdMegOperStatus,
                      mplsOamIdMegSubOperStatus
                    }
       STATUS       current
       DESCRIPTION
           "This notification signifies the operational status of MEG.

            The information that are carried in this notification are
            Meg Name, Me Name, MegOperStatus and
            MegSubOperStatus.
           "
       ::= { mplsOamIdNotifications 1 }

   -- End of Notifications.

   -- Module Compliance.

   mplsOamIdGroups
      OBJECT IDENTIFIER ::= { mplsOamIdConformance 1 }

   mplsOamIdCompliances
      OBJECT IDENTIFIER ::= { mplsOamIdConformance 2 }

   -- Compliance requirement for fully compliant implementations.

   mplsOamIdModuleFullCompliance MODULE-COMPLIANCE
      STATUS       current
      DESCRIPTION "Compliance statement for agents that provide full
                   support for MPLS-TP-OAM-STD-MIB. Such devices can
                   then be monitored and also be configured using
                   this MIB module."

      MODULE IF-MIB -- The Interfaces Group MIB, RFC 2863.
      MANDATORY-GROUPS {
         ifGeneralInformationGroup,
```

```
         ifCounterDiscontinuityGroup
      }

      MODULE -- This module.
      MANDATORY-GROUPS {
            mplsOamIdMegGroup,
            mplsOamIdMeGroup
      }

      GROUP        mplsOamIdNotificationObjectsGroup
      DESCRIPTION "This group is only mandatory for those
                   implementations which can efficiently implement
                   the notifications contained in this group."

      GROUP        mplsOamIdNotificationGroup
      DESCRIPTION "This group is only mandatory for those
                   implementations which can efficiently implement
                   the notifications contained in this group."

      ::= { mplsOamIdCompliances 1 }

   -- Units of conformance.

   mplsOamIdMegGroup OBJECT-GROUP
      OBJECTS {
         mplsOamIdMegName,
         mplsOamIdMegOperatorType,
         mplsOamIdMegIdIcc,
         mplsOamIdMegIdUmc,
         mplsOamIdMegServiceType,
         mplsOamIdMegMpLocation,
         mplsOamIdMegRowStatus,
         mplsOamIdMegStorageType
      }

      STATUS  current
      DESCRIPTION
             "Collection of objects needed for MPLS MEG information."
      ::= { mplsOamIdGroups 1 }

   mplsOamIdMeGroup  OBJECT-GROUP
      OBJECTS {
         mplsOamIdMeName,
         mplsOamIdMeMpIfIndex,
         mplsOamIdMeSourceMepIndex,
         mplsOamIdMeSinkMepIndex,
         mplsOamIdMeMpType,
         mplsOamIdMeMepDirection,
```

```
        mplsOamIdMeProactiveOamSessIndex,
        mplsOamIdMeProactiveOamPhbTCValue,
        mplsOamIdMeOnDemandOamPhbTCValue,
        mplsOamIdMeServicePointer,
        mplsOamIdMeRowStatus,
        mplsOamIdMeStorageType
    }
    STATUS  current
    DESCRIPTION
           "Collection of objects needed for MPLS ME information."
    ::= { mplsOamIdGroups 2 }

mplsOamIdNotificationObjectsGroup  OBJECT-GROUP
    OBJECTS {

        mplsOamIdMegOperStatus,

        mplsOamIdMegSubOperStatus
    }
    STATUS  current
    DESCRIPTION
           "Collection of objects needed to implement notifications."
    ::= { mplsOamIdGroups 3 }

mplsOamIdNotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
        mplsOamIdDefectCondition
    }
    STATUS  current
    DESCRIPTION
           "Set of notifications implemented in this module."
    ::= { mplsOamIdGroups 4 }

END
```

8. Security Consideration

There is a number of management objects defined in this MIB module that has 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 can have a negative effect on network operations.

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access

to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), even then, 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.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full supports for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

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 principles (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

9. IANA Considerations

To be added in a later version of this document.

10. References

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