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MPLS Transport Profile (MPLS-TP) Operations, Administration, and
Maintenance (OAM) Identifiers Management Information Base (MIB)

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 the Operations, Administration, and Maintenance (OAM) identifiers for Multiprotocol Label Switching (MPLS) and the 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 Transport Profile (TP) based on Multiprotocol Label Switching (MPLS) [RFC3031].

This MIB module should be used for performing the OAM (Operations, Administration, and Maintenance) operations for MPLS Tunnel LSPs (Label Switched Paths), Pseudowires, and Sections.

At the time of this writing, SNMP SET is no longer recommended as a way to configure MPLS networks as was described in [RFC3812]. However, since the MIB modules specified in this document are intended to work in parallel with the MIB modules for MPLS specified in [RFC3812], certain objects defined here are specified with a MAX-ACCESS of read-write or read-create so that specifications of the base tables in [RFC3812] and the new MIB modules in this document are consistent. Although the example described in Section 6 specifies means to configure OAM identifiers for MPLS-TP Tunnels, this should be seen as indicating how the MIB values would be returned in the specified circumstances having been configured by alternative means.

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, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [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 Multiprotocol Label Switching Architecture [RFC3031], the MPLS Traffic Engineering (TE) MIB [RFC3812], the MPLS Label Switching Router (LSR) MIB [RFC3813], the OAM Framework for MPLS-Based Transport Networks [RFC6371], "MPLS Transport Profile (MPLS-TP) Identifiers" [RFC6370], MPLS-TP Identifiers Following ITU-T Conventions [RFC6923], and OAM in MPLS Transport Networks [RFC5860].

3.3. Acronyms

BFD: Bidirectional Forwarding Detection

ICC: ITU Carrier Code

IP: Internet Protocol

LSP: Label Switched Path

LSR: Label Switching Router

ME: Maintenance Entity

MEG: Maintenance Entity Group

MEP: Maintenance Entity Group End Point

MIB: Management Information Base

MIP: Maintenance Entity Group Intermediate Point

MP: Maintenance Point

MPLS: Multiprotocol 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 MPLS point-to-point Tunnels, point-to-multipoint LSPs, co-routed bidirectional LSPs, associated bidirectional LSPs, and Pseudowires.

5. Brief Description of MIB Objects

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

5.1. mplsOamIdMegTable

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

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

For an ICC-based transport path, the user is expected to configure the ICC identifier explicitly in this table for MPLS Tunnels, LSPs, 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 an ME 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. MPLS OAM Identifier Configuration for MPLS LSP: Example

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

This example provides usage of MEG and ME tables for management and monitoring operations of an MPLS LSP.

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

In the `mplsOamIdMegTable`:

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

  mplsOamIdMegRowStatus       = createAndGo (4),
  mplsOamIdMegPathFlow        = coRoutedBidirectionalPointToPoint (2)
}
```

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 the mplsOamIdMeTable:

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

-- MP index (Index to the table)
  mplsOamIdMeMpIndex        = 1,
  mplsOamIdMeName           = "ME1",
  mplsOamIdMeMpIfIndex      = 0,
-- The source MEP ID is derived from the IP-compatible MPLS LSP
  mplsOamIdMeSourceMepIndex = 0,
-- The sink MEP ID is derived from the IP-compatible MPLS LSP
  mplsOamIdMeSinkMepIndex   = 0,
  mplsOamIdMeMpType         = mep (1),
  mplsOamIdMeMepDirection   = down (2),
-- RowPointer MUST point to the first accessible column of an
-- MPLS LSP
  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
        FROM SNMPv2-SMI -- RFC 2578
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
        FROM SNMPv2-CONF -- RFC 2580
    RowStatus, RowPointer, StorageType
        FROM SNMPv2-TC -- RFC 2579
    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB -- RFC 3411
    IndexIntegerNextFree
        FROM DIFFSERV-MIB -- RFC 3289
    mplsStdMIB
        FROM MPLS-TC-STD-MIB -- RFC 3811
    InterfaceIndexOrZero, ifGeneralInformationGroup,
    ifCounterDiscontinuityGroup
        FROM IF-MIB; -- RFC 2863

mplsOamIdStdMIB MODULE-IDENTITY
    LAST-UPDATED
        "201601070000Z" -- January 07, 2016
    ORGANIZATION
        "Multiprotocol Label Switching (MPLS) Working Group"
    CONTACT-INFO
        "Sam Aldrin
        Google, Inc.
        1600 Amphitheatre Parkway
        Mountain View, CA 94043
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DESCRIPTION

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This MIB module contains generic object definitions for MPLS OAM identifiers."

-- Revision history

REVISION

"201601070000Z" -- January 07, 2016

DESCRIPTION

"MPLS OAM Identifiers MIB objects for Tunnels, LSPs, Pseudowires, and Sections."

::= { mplsStdMIB 21 }

-- 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

mplsOamIdMegIndexNext OBJECT-TYPE
    SYNTAX      IndexIntegerNextFree (0..4294967295)
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION
        "This object contains an unused value for
        mplsOamIdMegIndex, or a zero to indicate
        that none exist. Negative values are not allowed,
        as they do not correspond to valid values of
        mplsOamIdMegIndex."
    ::= { mplsOamIdObjects 1 }

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

        A MEG, as mentioned in the MPLS-TP OAM framework, defines
        a set of one or more Maintenance Entities (MEs).
        MEs define a relationship between any two points of a
        transport path in an OAM domain to which maintenance and
        monitoring operations apply."
    ::= { mplsOamIdObjects 2 }

mplsOamIdMegEntry OBJECT-TYPE
    SYNTAX      MplsOamIdMegEntry
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "An entry in this table represents an 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 RFC 6370 (MEG_ID for an LSP is LSP_ID, and
        MEG_ID for a PW is PW_Path_ID), MEP_ID can be
        automatically formed."
```

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

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

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

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

MEP_ID is retrieved from the mplsOamIdMegServicePointer
object based on the mplsOamIdMegServicePointerType value.
The ICC MEG_ID for an LSP and a 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 Operations, Administration,
and Maintenance (OAM) in MPLS Transport Networks,
May 2010.
2. RFC 6371: Operations, Administration, and Maintenance
Framework for MPLS-Based Transport Networks,
September 2011, Section 3.
3. RFC 6370: MPLS Transport Profile (MPLS-TP) Identifiers,
September 2011.
4. RFC 6923: MPLS Transport Profile (MPLS-TP) Identifiers
Following ITU-T Conventions, May 2013."

INDEX { mplsOamIdMegIndex }
 ::= { mplsOamIdMegTable 1 }

```

MplsOamIdMegEntry ::= SEQUENCE {
    mplsOamIdMegIndex          Unsigned32,
    mplsOamIdMegName           SnmpAdminString,
    mplsOamIdMegOperatorType   INTEGER,
    mplsOamIdMegIdCc           SnmpAdminString,
    mplsOamIdMegIdIcc          SnmpAdminString,
    mplsOamIdMegIdUmc          SnmpAdminString,
    mplsOamIdMegServicePointerType INTEGER,
    mplsOamIdMegMpLocation     INTEGER,
    mplsOamIdMegPathFlow       INTEGER,
    mplsOamIdMegOperStatus     INTEGER,
    mplsOamIdMegSubOperStatus  BITS,
    mplsOamIdMegRowStatus      RowStatus,
    mplsOamIdMegStorageType    StorageType
}

mplsOamIdMegIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS   not-accessible
    STATUS      current
    DESCRIPTION
        "Index for the conceptual row identifying a MEG within
         this MEG table.  Managers should obtain new values for row
         creation in this table by reading mplsOamIdMegIndexNext."
    ::= { mplsOamIdMegEntry 1 }

mplsOamIdMegName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE(0..48))
    MAX-ACCESS   read-create
    STATUS      current
    DESCRIPTION
        "Each MEG has a 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 the MEG. Conceptual rows
        having 'iccBased' as the operator type MUST have valid
        values for the objects mplsOamIdMegIdIcc and
        mplsOamIdMegIdUmc when the row status is active."
    REFERENCE
        "1. RFC 6370: MPLS Transport Profile (MPLS-TP) Identifiers,
        September 2011.
        2. RFC 6923: MPLS Transport Profile (MPLS-TP) Identifiers
        Following ITU-T Conventions, May 2013, Section 3.1."
    DEFVAL { ipCompatible }
    ::= { mplsOamIdMegEntry 3 }

mplsOamIdMegIdCc OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE(0..2))
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "Global uniqueness is assured by concatenating the ICC
        with a Country Code (CC). The Country Code (alpha-2)
        is a string of two alphabetic characters represented
        with uppercase letters (i.e., A-Z).

        This object MUST contain a non-null value if
        the MplsOamIdMegOperatorType value is iccBased (2);
        otherwise, a null value with octet size 0
        should be assigned."
    REFERENCE
        "RFC 6923: MPLS Transport Profile (MPLS-TP) Identifiers
        Following ITU-T Conventions, May 2013, Section 3."
    DEFVAL { "" }
    ::= { mplsOamIdMegEntry 4 }
```

mplsOamIdMegIdIcc OBJECT-TYPE
SYNTAX SnmpAdminString (SIZE(0..6))
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Unique code assigned to a network operator or service
provider; maintained by the ITU-T. This is the
ITU Carrier Code used to form the MEGID.

This object MUST contain a non-null value if
the MplsOamIdMegOperatorType value is iccBased (2);
otherwise, a null value with octet size 0
should be assigned."
REFERENCE
"RFC 6923: MPLS Transport Profile (MPLS-TP) Identifiers
Following ITU-T Conventions, May 2013, Section 3.1."
DEFVAL { "" }
 ::= { mplsOamIdMegEntry 5 }

mplsOamIdMegIdUmc OBJECT-TYPE
SYNTAX SnmpAdminString (SIZE(0..7))
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Unique code assigned by a network operator or service
provider. This code is appended to mplsOamIdMegIdIcc to
form the MEGID.
This object MUST contain a non-null value if
the MplsOamIdMegOperatorType value is iccBased (2);
otherwise, a null value with octet size 0
should be assigned."
REFERENCE
"RFC 6923: MPLS Transport Profile (MPLS-TP) Identifiers
Following ITU-T Conventions, May 2013, Section 7.1."
DEFVAL { "" }
 ::= { mplsOamIdMegEntry 6 }

mplsOamIdMegServicePointerType OBJECT-TYPE

SYNTAX INTEGER {
 tunnel (1),
 lsp (2),
 pseudowire (3),
 section (4)
}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Indicates the service type for the MEG.

If the service type indicates tunnel (1), the service pointer in the mplsOamIdMeTable points to an entry in the point-to-point mplsTunnelTable (RFC 3812).

If the service type indicates lsp (2), the service pointer in the mplsOamIdMeTable points to an entry in the co-routed or associated bidirectional mplsTunnelTable.

If the value is the pseudowire (3) service type, the service pointer in the mplsOamIdMeTable points to an entry in the pwTable (RFC 5601).

If the value is the section (4) service type, the service pointer in the mplsOamIdMeTable points to an entry in the mplsTunnelTable (RFC 3812)."

REFERENCE

- "1. RFC 3812: Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) Management Information Base (MIB), June 2004.
2. RFC 5601: Pseudowire (PW) Management Information Base (MIB), July 2009."

DEFVAL { lsp }

::= { mplsOamIdMegEntry 7 }

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 MEPs/MIPs, 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 8 }

mplsOamIdMegPathFlow OBJECT-TYPE

SYNTAX INTEGER {
 unidirectionalPointToPoint (1),
 coRoutedBidirectionalPointToPoint (2),
 associatedBidirectionalPointToPoint (3),
 unidirectionalPointToMultiPoint (4)
 }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Indicates the transport path flow for this MEG.

In the case of a unidirectional point-to-point transport path, a single unidirectional ME is defined to monitor it.

In the case of associated bidirectional point-to-point transport paths, two independent unidirectional MEs are defined to independently monitor each direction.

In the case of co-routed bidirectional point-to-point transport paths, a single bidirectional ME is defined to monitor both directions congruently.

In the case of unidirectional point-to-multipoint transport paths, a single unidirectional ME for each leaf is defined to monitor the transport path from the root to that leaf."

REFERENCE

"RFC 6371: Operations, Administration, and Maintenance Framework for MPLS-Based Transport Networks, September 2011."

DEFVAL { coRoutedBidirectionalPointToPoint }
::= { mplsOamIdMegEntry 9 }

mplsOamIdMegOperStatus OBJECT-TYPE

SYNTAX INTEGER {
up (1),
down (2)
}

MAX-ACCESS read-only

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.

When the value of mplsOamIdMegOperStatus is up (1), all the bits of mplsOamIdMegSubOperStatus must be cleared. When the value of mplsOamIdMegOperStatus is down (2), at least one bit of mplsOamIdMegSubOperStatus must be set."

::= { mplsOamIdMegEntry 10 }

mplsOamIdMegSubOperStatus OBJECT-TYPE

SYNTAX BITS {
megDown (0),
meDown (1),
oamAppDown (2),
pathDown (3)
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object specifies the reason why the MEG operational status, as indicated 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) indicates that the MEG is down.

The bit 1 (meDown) indicates that the ME table is down.

The bit 2 (oamAppDown) indicates that the OAM application (LSP or PW) monitored by this MEG is down. Currently, BFD

is the only supported OAM application.
The bit 3 (pathDown) indicates that the underlying
LSP or PW is down."
 ::= { mplsOamIdMegEntry 11 }

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 the
active(1) state, no objects in that row can be modified
by the agent except mplsOamIdMegRowStatus."
 ::= { mplsOamIdMegEntry 12 }

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 13 }

-- End of MPLS Transport Profile MEG table

-- Start of MPLS Transport Profile ME table

mplsOamIdMeIndexNext OBJECT-TYPE
SYNTAX IndexIntegerNextFree (0..4294967295)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains an unused value for
mplsOamIdMeIndex, or a zero to indicate
that none exist. Negative values are not allowed,
as they do not correspond to valid values of
mplsOamIdMeIndex."
 ::= { mplsOamIdObjects 3 }

mplsOamIdMeMpIndexNext OBJECT-TYPE
SYNTAX IndexIntegerNextFree (0..4294967295)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains an unused value for
mplsOamIdMeMpIndex, or a zero to indicate
that none exist. Negative values are not allowed,
as they do not correspond to valid values of
mplsOamIdMeMpIndex."
::= { mplsOamIdObjects 4 }

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

The 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 MEP and MIP
information within a MEG."
::= { mplsOamIdObjects 5 }

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

An ME is a point-to-point 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 a point-to-point LSP, one MEG has one ME, and this ME
is associated with two MEPs (source and sink MEPs) within
a MEG. Each mplsOamIdMeIndex value denotes the ME within
a MEG."

In the case of unidirectional point-to-point transport paths, a single unidirectional ME is defined to monitor it, and `mplsOamIdMeServicePointer` points to a unidirectional point-to-point path.

In the case of associated bidirectional point-to-point transport paths, two independent unidirectional MEs are defined to independently monitor each direction, and each `mplsOamIdMeServicePointer` MIB object points to a unique unidirectional transport path.

This has implications for transactions that terminate at or query a MIP, as a return path from a MIP to a source MEP does not necessarily exist within the MEG.

In the case of co-routed bidirectional point-to-point transport paths, a single bidirectional ME is defined to monitor both directions congruently, and the `mplsOamIdMeServicePointer` MIB object points to a co-routed bidirectional point-to-point transport path.

In the case of unidirectional point-to-multipoint transport paths, a single unidirectional ME for each leaf is defined to monitor the transport path from the root to that leaf, and each leaf has different transport path information in the `mplsOamIdMeServicePointer` MIB object. Note that the `MplsOamIdMeEntry` should be created manually once the MEG is configured for OAM operations."

```
INDEX { mplsOamIdMegIndex,
        mplsOamIdMeIndex,
        mplsOamIdMeMpIndex
      }
 ::= { mplsOamIdMeTable 1 }
```

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

mplsOamIdMeIndex OBJECT-TYPE
SYNTAX Unsigned32 (1..4294967295)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Uniquely identifies an ME index within a MEG. Managers should obtain new values for row creation in this table by reading mplsOamIdMeIndexNext."
::= { mplsOamIdMeEntry 1 }

mplsOamIdMeMpIndex OBJECT-TYPE
SYNTAX Unsigned32 (1..4294967295)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Indicates the Maintenance Point (MP) index that is used to create multiple MEPs in a node of a single ME. The value of this object can be the MEP index or the MIP index. Managers should obtain new values for row creation in this table by reading mplsOamIdMeMpIndexNext."
::= { mplsOamIdMeEntry 2 }

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

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

If the mplsOamIdMegMpLocation object value is perInterface (2), the MP interface index should point to the incoming interface or outgoing interface."

REFERENCE

- "1. RFC 6371: Operations, Administration, and Maintenance Framework for MPLS-Based Transport Networks, September 2011.
2. RFC 2863: The Interfaces Group MIB, June 2000."

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 the mplsOamIdMegOperatorType object in the mplsOamIdMegEntry is configured as iccBased (2). If the MEG is configured for an IP-based operator, the value of this object should be set to 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 the mplsOamIdMegOperatorType object in the mplsOamIdMegEntry is configured as iccBased (2). If the MEG is configured for an IP-based operator, the value of this object should be set to 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 MP 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 egress nodes of the transport path."

DEFVAL { mep }

::= { mplsOamIdMeEntry 7 }

mplsOamIdMeMepDirection OBJECT-TYPE

SYNTAX INTEGER {
 up (1),
 down (2),
 notApplicable (3)
 }

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); otherwise, notApplicable (3) is set."

DEFVAL { down }

::= { mplsOamIdMeEntry 8 }

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 MUST point at an entry in the mplsTunnelEntry if mplsOamIdMegServicePointerType is configured as tunnel (1), lsp (2), or section (4), or at an entry in the pwEntry if mplsOamIdMegServicePointerType is configured as pseudowire (3).

Note: This service pointer object is placed in the ME table instead of the MEG table, since it will be useful in the point-to-multipoint case, where each ME will point to different branches of a point-to-multipoint tree."

::= { mplsOamIdMeEntry 9 }

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 the active(1) state, no objects in that row can be modified by the agent except mplsOamIdMeRowStatus."

::= { mplsOamIdMeEntry 10 }

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 11 }

-- End of MPLS Transport Profile ME table

-- End of MPLS-TP OAM tables


```
-- Notification definitions of MPLS-TP identifiers

mplsOamIdDefectCondition NOTIFICATION-TYPE
    OBJECTS      {
        mplsOamIdMegName,
        mplsOamIdMeName,
        mplsOamIdMegOperStatus,
        mplsOamIdMegSubOperStatus
    }
    STATUS        current
    DESCRIPTION   "This notification is sent whenever the operational
        status of the MEG is changed."
    ::= { mplsOamIdNotifications 1 }

-- End of notifications

-- Module compliance

mplsOamIdCompliances
    OBJECT IDENTIFIER ::= { mplsOamIdConformance 1 }

mplsOamIdGroups
    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 the 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 that can efficiently implement
                the notifications contained in this group."

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

::= { mplsOamIdCompliances 1 }

-- Compliance requirement for read-only implementations

mplsOamIdModuleReadOnlyCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "Compliance statement for agents that only provide
        read-only support for the MPLS-TP-OAM-STD-MIB module."

    MODULE -- this module

    MANDATORY-GROUPS {
        mplsOamIdMegGroup,
        mplsOamIdMeGroup
    }

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

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

```
-- mplsOamIdMegTable

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

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

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

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

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

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

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

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

OBJECT      mplsOamIdMegRowStatus
SYNTAX      RowStatus { active(1) }
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."
```

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

-- mplsOamIdMeTable

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

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

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

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

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

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

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

OBJECT      mplsOamIdMeRowStatus
SYNTAX      RowStatus { active(1) }
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."
```

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

```
::= { mplsOamIdCompliances 2 }
```

```
-- Units of conformance
```

```
mplsOamIdMegGroup OBJECT-GROUP
```

```
OBJECTS {
    mplsOamIdMegIndexNext,
    mplsOamIdMegName,
    mplsOamIdMegOperatorType,
    mplsOamIdMegIdCc,
    mplsOamIdMegIdIcc,
    mplsOamIdMegIdUmc,
    mplsOamIdMegServicePointerType,
    mplsOamIdMegMpLocation,
    mplsOamIdMegOperStatus,
    mplsOamIdMegSubOperStatus,
    mplsOamIdMegPathFlow,
    mplsOamIdMegRowStatus,
    mplsOamIdMegStorageType
}
```

```
STATUS current
```

```
DESCRIPTION
```

```
    "Collection of objects needed for MPLS MEG information."
```

```
::= { mplsOamIdGroups 1 }
```

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

This MIB relates to a system that will provide network connectivity and packet forwarding services. As such, improper manipulation of the objects represented by this MIB may result in denial of service to a large number of end-users.

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.

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:

- The `mplsOamIdMegTable` and the `mplsOamIdMeTable` collectively show the MPLS OAM characteristics. If an administrator does not want to reveal this information, then these tables should be considered sensitive/vulnerable.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

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

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

9. IANA Considerations

As described in [RFC4221] and [RFC6639], and as requested in the MPLS-TC-STD-MIB [RFC3811], MPLS-related Standards Track MIB modules should be rooted under the mplsStdMIB subtree. The following subsection lists a new assignment that has been made by IANA under the mplsStdMIB subtree for the MPLS-OAM-ID-STD-MIB module defined in this document. New assignments can only be made via a Standards Action as specified in [RFC5226].

9.1. IANA Considerations for MPLS-OAM-ID-STD-MIB

IANA has to assign the OID { mplsStdMIB 21 } to the MPLS-OAM-ID-STD-MIB module specified in this document.

10. References

10.1. Normative References

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The coauthors of this document, the working group chairs, the document shepherd, the responsible AD, and the MPLS Working Group wish to dedicate this RFC to the memory of our friend and colleague Ping Pan, in recognition for his devotion and hard work at the IETF.

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