

Network Working Group
INTERNET-DRAFT
Intended Status: Standards Track
Expires: August 06, 2015

Sam Aldrin
Huawei Technologies
M.Venkatesan
Dell Inc.
Kannan KV Sampath
Redeem
Thomas D. Nadeau
Brocade

February 02, 2015

**MPLS-TP Operations, Administration, and Management (OAM) Identifiers
Management Information Base (MIB)
draft-ietf-mpls-tp-oam-id-mib-07**

Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes Operations, Administration, and Management (OAM) identifiers related managed objects for Multiprotocol Label Switching (MPLS) and MPLS based Transport Profile (TP).

Status of this Memo

This Internet-Draft is submitted to IETF in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/1id-abstracts.txt>.

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

This Internet-Draft will expire on August 06, 2015.

Copyright and License Notice

Copyright (c) 2015 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

- [1](#) Introduction [3](#)
- [2](#). The Internet-Standard Management Framework [3](#)
- [3](#). Overview [3](#)
 - [3.1](#) Conventions used in this document [3](#)
 - [3.2](#) Terminology [3](#)
 - [3.3](#) Acronyms [4](#)
- [4](#). Feature List [4](#)
- [5](#). Brief description of MIB Objects [4](#)
 - [5.1](#). mplsOamIdMegTable [4](#)
 - [5.2](#). mplsOamIdMeTable [5](#)
- [6](#). MPLS OAM identifier configuration for MPLS LSP example [5](#)
- [7](#). MPLS OAM Identifiers MIB definitions [6](#)
- [8](#). Security Consideration [24](#)
- [9](#). IANA Considerations [25](#)
- [10](#). References [25](#)
 - [10.1](#) Normative References [25](#)
 - [10.2](#) Informative References [26](#)
- [11](#). Acknowledgments [27](#)
- [12](#). Authors' Addresses [27](#)

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, Administration, and Maintenance) operations for MPLS LSP(Label Switched Path), Pseudowires and Sections.

At the time of 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 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 examples described in [Section 6](#) specify 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, [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 Multiprotocol Label Switching Architecture [[RFC3031](#)], MPLS Traffic Engineering (TE) MIB [[RFC3812](#)], MPLS Label Switching Router (LSR) MIB [[RFC3813](#)], 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

ICC: ITU Carrier Code
IP: Internet Protocol

LSP: Label Switched Path
LSR: Label Switching Router
MIB: Management Information Base
ME: Maintenance Entity
MEG: Maintenance Entity Group
MEP: Maintenance Entity Group End Point
MIP: Maintenance Entity Group 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 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 documents [[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 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 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 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. 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 a 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 a MPLS LSP. Only relevant objects which are applicable for IP based OAM identifiers of MPLS co-routed bidirectional LSP are illustrated here.

In `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 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 LSP
mplsOamIdMeSourceMepIndex    = 0,
-- Source 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
        -- [RFC2578]
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
        FROM SNMPv2-CONF
        -- [RFC2580]
    RowStatus, RowPointer, StorageType
        FROM SNMPv2-TC
        -- [RFC2579]
    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB
        -- [RFC3411]

```

IndexIntegerNextFree
FROM DIFFSERV-MIB -- [[RFC3289](#)]
mplsStdMIB
FROM MPLS-TC-STD-MIB -- [[RFC3811](#)]
InterfaceIndexOrZero, ifGeneralInformationGroup,
ifCounterDiscontinuityGroup
FROM IF-MIB; -- [[RFC2863](#)]

mplsOamIdStdMIB MODULE-IDENTITY

LAST-UPDATED

"201412250000Z" -- December 25, 2014

ORGANIZATION

"Multiprotocol Label Switching (MPLS) Working Group"

CONTACT-INFO

"

Sam Aldrin
Huawei Technologies, co.
2330 Central Express Way,

Santa Clara, CA 95051, USA
Email: aldrin.ietf@gmail.com

Thomas D. Nadeau
Email: tnadeau@lucidvision.com

Venkatesan Mahalingam
Dell Inc.
5450 Great America Parkway,
Santa Clara, CA 95054, USA
Email: venkat.mahalingams@gmail.com

Kannan KV Sampath
Redeem,
India
Email: kannankvs@gmail.com

Ping Pan
Infinera
Email: ppan@infinera.com

Sami Boutros
Cisco Systems, Inc.
3750 Cisco Way
San Jose, California 95134
USA
Email: sboutros@cisco.com

```
"
DESCRIPTION
  "Copyright (c) 2014 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."

-- Revision history.

REVISION
  "201412250000Z" -- December 25, 2014
DESCRIPTION
  "MPLS OAM Identifiers MIB objects for Tunnels, LSPs,
  Pseudowires and Sections"

 ::= { mplsStdMIB xxx } -- xxx to be replaced with the correct
                        -- OID value assigned by
                        -- IANA (see section 9).

-- 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 (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 2 }

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 mplsOamIdMegServicePointerType 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. [RFC5860](#), Requirements for OAM in MPLS Transport Networks, May 2010.
2. [RFC6371](#), Operations, Administration, and Maintenance Framework for MPLS-Based Transport Networks, September 2011 [Section 3](#).
3. [RFC6370](#), MPLS Transport Profile (MPLS-TP) Identifiers.
4. [RFC6923](#), MPLS Transport Profile (MPLS-TP) Identifiers Following ITU-T Conventions."

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 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, MUST have valid values for the objects mplsOamIdMegIdIcc and mplsOamIdMegIdUmc when the row status is active."
REFERENCE
 "1. [RFC6370](#), MPLS Transport Profile (MPLS-TP) Identifiers.
 2. [RFC6923](#), MPLS Transport Profile (MPLS-TP) Identifiers Following ITU-T Conventions. [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 upper case letters (i.e., A-Z).

 This object MUST contain a non-null ICC value if the MplsOamIdMegOperatorType value is iccBased(2), otherwise a null ICC value with octet size 0 should be assigned."
REFERENCE
 "[RFC6923](#), MPLS Transport Profile (MPLS-TP) Identifiers Following ITU-T Conventions. [Section 3.](#)"
DEFVAL {""}
 ::= { mplsOamIdMegEntry 4 }

mplsOamIdMegIdIcc OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE(0..6))
 MAX-ACCESS read-create
 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 MUST contain a non-null ICC value if the MplsOamIdMegOperatorType value is iccBased(2), otherwise a null ICC value with octet size 0 should be assigned."

REFERENCE

"[RFC6923](#), MPLS Transport Profile (MPLS-TP) Identifiers Following ITU-T Conventions. [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 Network Operator or Service Provider and is appended to mplsOamIdMegIdIcc to form the MEGID.
 This object MUST contain a non-null ICC value if the MplsOamIdMegOperatorType value is iccBased(2), otherwise a null ICC value with octet size 0 should be assigned."

REFERENCE

"[RFC6923](#), MPLS Transport Profile (MPLS-TP) Identifiers Following ITU-T Conventions. [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, the service pointer in mplsOamIdMeTable points to an entry in the point-to-point mplsTunnelTable [[RFC3812](#)].

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

If the value is pseudowire service type, the service pointer in mplsOamIdMeTable points to an entry in the pwTable [[RFC5601](#)].

If the value is section service type, the service pointer in mplsOamIdMeTable points to an entry in the mplsTunnelTable [[RFC3812](#)]."

REFERENCE

1. Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) Management Information Base (MIB), Srinivasan, et al, [RFC 3812](#), June 2004
2. Pseudowire (PW) Management Information Base (MIB), Nadeau & Zelig, [RFC 5601](#), 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 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 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 case of a unidirectional point-to-point transport path, a single unidirectional Maintenance Entity is defined to monitor it.

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

In case of co-routed bidirectional 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."

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 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) indicates the MEG is down.

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

The bit 2 (oamAppDown) 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) 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 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 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 5 }
```

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 and mplsOamIdMeServicePointer points to unidirectional point-to-point path.

In case of associated bidirectional point-to-point transport paths, two independent unidirectional Maintenance Entities are defined to independently monitor each direction and each mplsOamIdMeServicePointer MIB object points to unique unidirectional transport path. 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 bidirectional point-to-point transport paths, a single bidirectional Maintenance Entity is defined to monitor both directions congruently and mplsOamIdMeServicePointer MIB object points to co-routed bidirectional point-to-point transport path.

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 and each leaf has different transport path information in 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 a maintenance entity 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 index, used to create
         multiple MEPs in a node of single ME. The value of this
         object can be MEP index or 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
  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.
RFC 2863 - The Interfaces Group MIB, McCloghrie, K.,
and F. Kastenholz, 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 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),
                  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) else 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) or 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 ME table instead of MEG table, since it will be useful in case of point-to-multipoint, where each ME will point to different branches of a P2MP 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 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 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 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 {
    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 Consideration

There is a number of management objects defined in this MIB module that has a MAX-ACCESS clause of 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 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:

- mplsOamIdMegTable and 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

IANA is requested to assign an OID for the MIB module from the "MIB Transmission Group - MPLS STD" sub-registry of the "Internet-standard MIB - Transmission Group" registry for the MPLS-TP OAM ID MIB module specified in this document.

10. References

10.1 Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC2578] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Structure of Management Information Version 2 (SMIv2)", STD 58, [RFC 2578](#), April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Textual Conventions for SMIv2", STD 58, [RFC 2579](#), April 1999.

- [RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIV2", STD 58, [RFC 2580](#), April 1999.
- [RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB ", [RFC 2863](#), June 2000
- [RFC3031] Rosen, E., Viswanathan, A., and R. Callon, "Multiprotocol Label Switching Architecture", [RFC 3031](#), January 2001.
- [RFC3289] Baker, F., Chan, K., and A. Smith, "Management Information Base for the Differentiated Services Architecture", [RFC 3289](#), May 2002.
- [RFC3411] Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks", STD 62, [RFC 3411](#), December 2002.
- [RFC5601] Zelig, D., Ed., and T. Nadeau, Ed., "Pseudowire (PW) Management Information Base (MIB)", [RFC 5601](#), July 2009.

10.2 Informative References

- [RFC3410] J. Case, R. Mundy, D. pertain, B.Stewart, "Introduction and Applicability Statement for Internet Standard Management Framework", [RFC 3410](#), December 2002.
- [RFC3414] Blumenthal, U. and B. Wijnen, "User-based Security Model(USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", STD 62, [RFC 3414](#), December 2002.
- [RFC3811] Nadeau, T., Ed., and J. Cucchiara, Ed., "Definitions of Textual Conventions (TCs) for Multiprotocol Label Switching (MPLS) Management", [RFC 3811](#), June 2004.
- [RFC3812] Srinivasan, C., Viswanathan, A., and T. Nadeau, "Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) Management Information Base (MIB)", [RFC 3812](#), June 2004.
- [RFC3813] Srinivasan, C., Viswanathan, A., and T. Nadeau, "Multiprotocol Label Switching (MPLS) Label Switching (LSR) Router Management Information Base (MIB)", [RFC 3813](#), June 2004.

- [RFC3826] Blumenthal, U., F. Maino and K. McCloghrie, "The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model", [RFC 3826](#), June 2004.
- [RFC5591] Harrington, D. and W. Hardaker, "Transport Security Model for the Simple Network Management Protocol (SNMP)", [RFC 5591](#), June 2009.
- [RFC5592] Harrington, D., Salowey, J., and W. Hardaker, "Secure Shell Transport Model for the Simple Network Management Protocol (SNMP)", [RFC 5592](#), June 2009.
- [RFC5654] Niven-Jenkins, B., Ed., Brungard, D., Ed., Betts, M., Ed., Sprecher, N., and S. Ueno, "Requirements of an MPLS Transport Profile", [RFC 5654](#), September 2009.
- [RFC6353] Hardaker, W., "Transport Layer Security (TLS) Transport Model for the Simple Network Management Protocol (SNMP)", STD 78, [RFC 6353](#), July 2011.
- [RFC6370] Bocci, M., Swallow, G., and E. Gray, "MPLS-TP Identifiers", [RFC 6370](#), September 2011.
- [RFC6371] Busi, I., Niven-Jenkins, B., and D. Allan, "MPLS-TP OAM Framework and Overview", [RFC 6371](#), September 2011.
- [RFC6923] R. Winter, Ed, E. Gray, Ed., H. van Helvoort, and M. Betts, "MPLS-TP Identifiers Following ITU-T Conventions", [RFC 6923](#), May 2013.
- [RFC5860] M. Vigoureux, Ed, D. Ward, Ed, M. Betts, Ed, "OAM in MPLS Transport Networks", [RFC 5860](#), May 2010.

11. Acknowledgments

We wish to thank Muly Ilan, Adrian Farrel, Joan Cucchiara, Weiyang Cheng and Mach Chen for their valuable comments on this document.

12. Authors' Addresses

Venkatesan Mahalingam
Dell Inc.
5450 Great America Parkway,
Santa Clara, CA 95054, USA
Email: venkat.mahalingams@gmail.com

Sam Aldrin
Huawei Technologies, co.
2330 Central Express Way,
Santa Clara, CA 95051, USA
Email: aldrin.ietf@gmail.com

Thomas D. Nadeau
Brocade
Email: tnadeau@lucidvision.com

Kannan KV Sampath
Redeem,
India
Email: kannankvs@gmail.com

Ping Pan
Infinera
Email: ppan@infinera.com

Sami Boutros
Cisco Systems, Inc.
3750 Cisco Way
San Jose, California 95134
USA
Email: sboutros@cisco.com