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MPLS Transport Profile Linear Protection MIB
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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols. In particular it defines objects for managing MPLS Transport Profile (MPLS-TP) Linear Protection.

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1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols. In particular it defines objects for managing MPLS Transport Profile (MPLS-TP) Linear Protection.

This MIB module should be used for configuring and managing the MPLS TP linear protection for MPLS TP LSPs.

2. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

3. Conventions

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

4. Overview

[RFC6378] defines the protocol to provide a linear protection switching mechanism for MPLS transport profile with protection domain as point-to-point LSP. The detailed protocol specification of MPLS transport profile linear protection is described in [RFC6378]. This document specifies a MIB module for the LER that supports MPLS TP Linear protection (which includes 1:n protection architecture) and a MIB module that defines textual conventions.

5. Structure of the MIB Module

5.1. Textual Conventions

The following new textual conventions are defined in a separate MIB module in this document

MplsLpsReq
MplsLpsFpathPath
MplsLpsCommand

5.2. The MPLS TP Linear Protection Subtree

MPLS-LPS-MIB is the MIB module defined in this document, and it is put under mplsStdMIB.

5.3. The Notifications Subtree

Notifications are defined to inform the management station about switchover and mode mismatch of linear protection switching group. Two notifications are defined for this purpose. The notification, mplsLpsEventSwitchover is to inform the management station about the switchover of the active path and the notification mplsLpsEventModeMismatch is to inform the management station about the mismatch in the revertive mode across the end point of the protection domain.

5.4. The Table Structures

The MPLS TP Linear protection MIB module has four tables. The tables are as follows

o mplsLpsConfigTable

This table is used to configure MPLS TP Linear protection switching Group. The protection switching group is identified by mplsLpsConfigGroupName. The other attributes in this table can be used to configure properties that are specific to the protection switching group.

o mplsLpsStatusTable

This table provides the current status information of mpls linear protection groups that have been configured on the system. When a protection group is configured or deleted in the mplsLpsConfigTable, then the corresponding row of that session in the mplsLpsStatusTable is, respectively, automatically created or deleted.

o mplsLpsMeConfigTable

This table is used to associate the Maintenance Entities (MEs) to the protection switching group. The ME is identified by mplsOamIdMegIndex, mplsOamIdMeIndex and mplsOamIdMeMpIndex.

o mplsLpsMeStatusTable

This table provides the current information about the protection state of MEs that have been configured on the system. When a ME configured or deleted in the mplsLpsMeConfigTable, then the corresponding row of that session in the mplsLpsMeStatusTable is, respectively, automatically created or deleted.

6. Relationship to Other MIB Modules

6.1. Relationship to the MPLS OAM maintenance identifiers MIB module

The mplsLpsMeConfigTable entry is extended by entry in the mplsOamIdMeTable [MPLS-OAM-ID-STD-MIB] defined in draft-ietf-mpls-tp-oam-id-mib. Note that the nature of the 'extends' relationship is a sparse augmentation so that the entry in the mplsLpsMeConfigTable has the same index values as the entry in the mplsOamIdMeTable. Each time that an entry is created in the mplsOamIdMeTable for which the LER supports MPLS TP Linear protection a row is created automatically in the mplsLpsMeConfigTable.

6.2. MIB modules required for IMPORTS

The MPLS-LPS-MIB module requires following MIB modules for IMPORTS:

o SNMPv2-SMI defined in [RFC2578]

o SNMPv2-CONF defined in [RFC2580]

o SNMPv2-TC defined in [RFC2579]

o MPLS-OAM-ID-STD-MIB defined in [draft-ietf-mpls-tp-oam-id-mib]

7. Example of Protection switching groups configuration for MPLS-TP TE tunnel

This example considers the protection group configuration on a head-end LSR to provide protection for a co-routed bidirectional MPLS tunnel.
Only relevant objects which are applicable for protection group 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 protect 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.1.1.1.2,
      -- Mandatory parameters needed to activate the row go here
       mplsOamIdMeRowStatus              = createAndGo (4)
   }
```

The below table associates the MEs with protection switching groups.

```
   In mplsLpsConfigTable:
   mplsLpsConfigEntry ::= SEQUENCE {
     -- Group index
     mplsLpsConfigGroupIndex  = 1,
     mplsLpsConfigGroupName   = "PGGroup1",
     mplsLpsConfigMode        = onePlusOne (1),
     -- Mandatory parameters needed to activate the row go here
     mplsLpsConfigRowStatus   = createAndGo (4)
```

```
          }
        In mplsLpsMeConfigTable:
        MplsLpsMeConfigEntry ::= SEQUENCE {
          -- MEG index (Index to the table)
          mplsOamIdMegIndex                = 1,
          -- ME index
          mplsOamIdMeIndex                 = 1,
          -- MP index (Index to the table)
          mplsOamIdMeMpIndex               = 1,
          -- Group index
          mplsLpsMeConfigGroupIndex        = 1,
          -- Configuration state
          mplsLpsMeConfigState             = primary(1)
        }
```

8. Definitions

```
   MPLS-LPS-MIB DEFINITIONS ::= BEGIN

   IMPORTS
           MODULE-IDENTITY, NOTIFICATION-TYPE, OBJECT-TYPE,
           Gauge32, Counter32, Integer32, Unsigned32
                   FROM SNMPv2-SMI
           MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
                   FROM SNMPv2-CONF          -- [RFC2580]
           TEXTUAL-CONVENTION, RowStatus,
           TimeStamp, StorageType
                   FROM SNMPv2-TC
           SnmpAdminString

                FROM SNMP-FRAMEWORK-MIB
        mplsStdMIB
            FROM MPLS-TC-STD-MIB          -- [RFC3811]
        mplsOamIdMegIndex, mplsOamIdMeIndex, mplsOamIdMeMpIndex
            FROM MPLS-OAM-ID-STD-MIB;


mplsLpsMIB MODULE-IDENTITY
    LAST-UPDATED  "201301210000Z"  -- January 21, 2013
    ORGANIZATION  "Multiprotocol Label Switching (MPLS) Working Group"
    CONTACT-INFO


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```
DESCRIPTION
    "This management information module supports the
     configuration and management of MPLS TP linear
     protection groups. "
REVISION
        "201301210000Z" -- January 21, 2013
     DESCRIPTION
          "MPLS Protection Switching Group objects for LSP
           MEPs"

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


      -- Top level components of this MIB module.
      -- Notifications
      mplsLpsNotifications
                  OBJECT IDENTIFIER ::= { mplsLpsMIB 0 }
      -- tables, scalars
      mplsLpsObjects
                  OBJECT IDENTIFIER ::= { mplsLpsMIB 1 }
      -- conformance

      mplsLpsConformance
                  OBJECT IDENTIFIER ::= { mplsLpsMIB 2 }

MplsLpsReq ::= TEXTUAL-CONVENTION
    STATUS current
```

```
    DESCRIPTION
        "This Textual Convention describes an object that stores
         the PSC Request field of the PSC control packet. The values
         are as follows

         1110  Lockout of Protection
         1100  Forced Switch
         1010  Signal Fail (SF)
         0111  Signal Degrade (SD)
         0101  Manual Switch
         0100  Wait-to-Restore
         0001  Do Not Revert
         0000  No Request"
    REFERENCE
        "Section 4.2.2 of RFC6378"
    SYNTAX      OCTET STRING (SIZE (2))

MplsLpsFpathPath ::= TEXTUAL-CONVENTION
    STATUS current
    DESCRIPTION
        "This Textual Convention describes an object that stores
         the Fault Path (FPath) field and Data Path (Path) field of
         the PSC control packet.

         FPath is located in the first octet and Path is
         located in the second octet. Bits are numbered from left to
         right.

         The value and the interpretation of FPath field is as follows


         2-255  for future extensions
         1      the anomaly condition is on the working path
         0      the anomaly condition is on the protection path

         The value and the interpretation of Path field is as follows

         2-255  for future extensions
         1      protection path is transporting user data traffic
         0      protection path is not transporting user data traffic
         "
    REFERENCE
        "Section 4.2.5 and 4.2.6 of RFC6378"
    SYNTAX      OCTET STRING (SIZE (2))

MplsLpsCommand ::= TEXTUAL-CONVENTION
    STATUS       current
    DESCRIPTION
```

```
        "This command allows a user to perform any action over ME.
         If the protection command cannot be executed because an
         equal or higher priority request is in effect, an
         inconsistentValue error is returned.

         The command values are:

         noCmd

         This value should be returned by a read request when no command
         has been written to the object in question since
         initialization. This value may not be used in a write
         operation.  If noCmd is used in a write operation a wrongValue
         error is returned.

         clear

         Clears all of the commands listed below for the specified ME.

         lockoutOfProtection

         Prevents any of the working ME from switching to the protection
         ME. The specified ME should be the protection ME, otherwise an
         inconsistentValue error is returned.

         forcedSwitchWorkToProtect

         Switches the specified working ME to the protection path.
         If the protection ME is specified an inconsistentValue
         error is returned.


         manualSwitchWorkToProtect

         Switches the specified working ME to the protection ME.
         If the protection ME is specified an inconsistentValue
         error is returned."

    SYNTAX       INTEGER {
                     noCmd(1),
                     clear(2),
                     lockoutOfProtection(3),
                     forcedSwitchWorkToProtect(4),
                     manualSwitchWorkToProtect(5)
                 }

-- Start of MPLS Transport Profile Protection Switching
-- Table
```

```
-- MPLS TP Protection Switching Configuration Table
-- This table supports the addition, configuration and deletion
-- of MPLS TP Protection Switching groups.

mplsLpsConfigGroups OBJECT-TYPE
    SYNTAX      Gauge32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The object hold the count of MPLS Protection Switching
         groups. This count includes all rows in mplsLpsConfigTable,
         regardless of the value of mplsLpsConfigRowStatus."
    ::= { mplsLpsObjects 1 }

mplsLpsConfigTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLpsConfigEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists the mpls linear protection groups that
         have been configured on the system."
    ::= { mplsLpsObjects 2 }

mplsLpsConfigEntry OBJECT-TYPE
    SYNTAX      MplsLpsConfigEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A conceptual row in the mplsLpsConfigTable."
    INDEX { mplsLpsConfigGroupIndex }
    ::= { mplsLpsConfigTable  1 }

MplsLpsConfigEntry ::= SEQUENCE {
    mplsLpsConfigGroupIndex          Unsigned32,
    mplsLpsConfigGroupName           SnmpAdminString,
    mplsLpsConfigMode                INTEGER,
    mplsLpsConfigRevertive           INTEGER,
    mplsLpsConfigProtectionScheme    INTEGER,
    mplsLpsConfigSdThreshold         Integer32,
    mplsLpsConfigWaitToRestore       Integer32,
    mplsLpsConfigContinualTxInterval Integer32,
    mplsLpsConfigRapidTxInterval     Integer32,
    mplsLpsConfigCreationTime        TimeStamp,
    mplsLpsConfigRowStatus           RowStatus,
    mplsLpsConfigStorageType         StorageType
```

```
}

mplsLpsConfigGroupIndex  OBJECT-TYPE
    SYNTAX        Unsigned32
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "Index for the conceptual row identifying a protection group."
    ::= { mplsLpsConfigEntry 1 }

mplsLpsConfigGroupName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE (1..32))
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "Textual name represents the mpls tp protection group.
         Each Protection Group is identified by a unique
         protection group name. "
    ::= { mplsLpsConfigEntry 2 }

mplsLpsConfigMode OBJECT-TYPE
    SYNTAX INTEGER {
                   onePlusOne(1),
                   oneColonOne(2),
                   oneColonN(3)
                   }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
       "The architectural mode of the Protection group. This can
        either be 1+1, 1:1, 1:n.

        1+1

        In the 1+1 protection scheme, a fully dedicated
        protection entity is allocated. Data traffic is copied

        and fed at the source to both the working and the
        protection entities.  The traffic on the working and the
        protection entities is transmitted simultaneously to
        the sink of the protection domain, where selection
        between the working and protection entities is performed

        1:1

        In the 1:1 scheme, a protection path is allocated to
        protect against a defect, failure, or a degradation in a
        working path. In normal conditions, data traffic is
```

```
        transmitted over the working entity, while the
        protection entity functions in the idle state. If there
        is a defect on the working entity or a specific
        administrative request, traffic is switched to the
        protection entity.

        1:n

        In case of 1:n linear protection, one protection entity
        is allocated to protect n working entities. The protection
        entity might not have sufficient resources to protect all the
        working entities that may be affected by fault conditions at a
        specific time. In this case, in order to guaranteed
        protection, the protection entity should support enough
        capacity and bandwidth to protect any of the n working
        entities."

    DEFVAL {onePlusOne}
    ::= { mplsLpsConfigEntry 3 }

mplsLpsConfigRevertive OBJECT-TYPE
    SYNTAX      INTEGER { nonrevertive(1), revertive(2) }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
       "This object represents the reversion mode of the Linear
        Protection Switching group. The reversion mode of



        protection mechanism may be either revertive or
        non-revertive.

        nonrevertive

        In non-revertive mode, after a service has been
        recovered, traffic will be forwarded on the recovery

        path

        revertive

        In revertive mode, after a service has been
        recovered, traffic will be redirected back onto the
        original working path."

    DEFVAL { nonrevertive }
    ::= { mplsLpsConfigEntry 4 }
```

```
mplsLpsConfigProtectionScheme OBJECT-TYPE
    SYNTAX      INTEGER { bidirectional(1), unidirectional(2) }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
       "The object represents the operational scheme of
        protection switching group. The protection scheme may
        either be unidirectional or bidirectional.

        bidirectional

        In bidirectional protection scheme, both the directions
        will be switched simultaneously even if the fault
        applies to only one direction of the path.

        unidirectional

        In unidirectional protection scheme protection switching
        will be performed independently for each direction of a
        bidirectional transport path

        This object may not be modified if the associated
        mplsLpsConfigRowStatus object is equal to active(1). "

    DEFVAL {bidirectional}
    ::= { mplsLpsConfigEntry 5 }

mplsLpsConfigSdThreshold OBJECT-TYPE
    SYNTAX      Integer32 (1..9)
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object holds the threshold value of the Signal
         Degrade.

         When the MPLS DM OAM reaches this threshold value, the

         Signal Degrade event will be given to this
         protection domain.

         This object may be modified if the associated
         mplsLpsConfigRowStatus object is equal to active(1)."
    ::= { mplsLpsConfigEntry 6 }

mplsLpsConfigWaitToRestore OBJECT-TYPE
    SYNTAX      Integer32 (0..720)
    UNITS       "seconds"
    MAX-ACCESS  read-create
```

```
    STATUS      current
    DESCRIPTION
        "This object hold the Wait To Restore timer value in
         seconds.
         The WTR timer is used to delay reversion of PSC state
         to Normal state when recovering from a failure
         condition on the working path when the protection
         domain is configured for revertive behavior

         This object may not be modified if the associated
         mplsLpsConfigRowStatus object is equal to active(1)."
    DEFVAL { 300 }
    ::= { mplsLpsConfigEntry 7 }

    mplsLpsConfigContinualTxInterval OBJECT-TYPE
        SYNTAX      Integer32 (1..20)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The Continual Tx Time in Seconds. Represents the time
             interval to send the continual LPS packet to the other
             end based on the current state."
        DEFVAL { 5 }
        ::= { mplsLpsConfigEntry 8 }

    mplsLpsConfigRapidTxInterval OBJECT-TYPE
        SYNTAX      Integer32 (1000..20000)
        UNITS       "micro-seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The Rapid Tx interval in micro-Seconds. Represents the time
             interval to send the LPS packet to the other end, when
             there is a change in state of Linear Protection domain due
             to local input. The default value is 3.3 milli-seconds
             which is 3300 micro-seconds"

        DEFVAL { 3300 }
        ::= { mplsLpsConfigEntry 9 }

    mplsLpsConfigCreationTime OBJECT-TYPE
        SYNTAX      TimeStamp
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The value of sysUpTime at the time the row was
             created"
```

```
        ::= { mplsLpsConfigEntry 10 }


    mplsLpsConfigRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "This represents the status of the MPLS TP Linear
             Protection group Entry. This variable is used to
             create, modify, and/or delete a row in this table.
             An entry may not exist in the active state unless all
             objects in the entry have an appropriate value."
        ::= { mplsLpsConfigEntry 11 }

    mplsLpsConfigStorageType OBJECT-TYPE
        SYNTAX      StorageType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The storage type for this conceptual row.
             Conceptual rows having the value 'permanent' need not
             allow write-access to any columnar objects in the row."
        DEFVAL      { nonVolatile }
        ::= { mplsLpsConfigEntry 12 }

--
-- MPLS TP Linear Protection Switching Status Table
--
-- This table provides Protection Switching group statistics.
--

mplsLpsStatusTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLpsStatusEntry

    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table provides status information about mpls
         linear protection groups that have been configured
         on the system."
    ::= { mplsLpsObjects 3 }

mplsLpsStatusEntry OBJECT-TYPE
    SYNTAX      MplsLpsStatusEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
```

```
        "A conceptual row in the mplsLpsStatusTable."
    AUGMENTS { mplsLpsConfigEntry }
    ::= { mplsLpsStatusTable  1 }

MplsLpsStatusEntry ::= SEQUENCE {
    mplsLpsStatusReqRcv                MplsLpsReq,
    mplsLpsStatusReqSent               MplsLpsReq,
    mplsLpsStatusFpathPathRcv          MplsLpsFpathPath,
    mplsLpsStatusFpathPathSent         MplsLpsFpathPath,
    mplsLpsStatusModeMismatches        Counter32
}

mplsLpsStatusReqRcv OBJECT-TYPE
    SYNTAX      MplsLpsReq
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The current value of the PSC Request field received on
         more recent PSC packet"
    ::= { mplsLpsStatusEntry 1 }

mplsLpsStatusReqSent OBJECT-TYPE
    SYNTAX      MplsLpsReq
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The current value of the PSC Request field sent on the
         more recent PSC packet"
    ::= { mplsLpsStatusEntry 2 }

mplsLpsStatusFpathPathRcv OBJECT-TYPE
    SYNTAX      MplsLpsFpathPath
    MAX-ACCESS  read-only

    STATUS      current

    DESCRIPTION
        "The current value of the FPath and Path fields received
         on more recent PSC packet"
    ::= { mplsLpsStatusEntry 3 }

mplsLpsStatusFpathPathSent OBJECT-TYPE
    SYNTAX      MplsLpsFpathPath
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The current value of the FPath and Path fields sent
         on more recent PSC packet"
```

```
    ::= { mplsLpsStatusEntry 4 }


mplsLpsStatusModeMismatches OBJECT-TYPE
    SYNTAX     Counter32
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
        "This object holds number of occurrences of mismatch in
         revertive mode across the protection domain end points."
    ::= { mplsLpsStatusEntry 5 }

-- MPLS Linear Protection ME Association Configuration Table
-- This table supports the addition, configuration and deletion
-- of MPLS Linear Protection Maintenance Entities in Protection
-- Switching groups.

mplsLpsMeConfigTable OBJECT-TYPE

    SYNTAX      SEQUENCE OF MplsLpsMeConfigEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists Maintenance Association that have been
         configured in Protection groups."
    ::= { mplsLpsObjects 4 }


mplsLpsMeConfigEntry OBJECT-TYPE
    SYNTAX      MplsLpsMeConfigEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION

        "A conceptual row in the mplsLpsMeConfigTable."
    INDEX {mplsOamIdMegIndex, mplsOamIdMeIndex, mplsOamIdMeMpIndex}
    ::= { mplsLpsMeConfigTable  1 }

MplsLpsMeConfigEntry ::= SEQUENCE {
    mplsLpsMeConfigGroupIndex            Unsigned32,
    mplsLpsMeConfigState                 INTEGER,
    mplsLpsMeConfigCommand               MplsLpsCommand,
    mplsLpsMeConfigHoldOff               Integer32
}

mplsLpsMeConfigGroupIndex  OBJECT-TYPE
    SYNTAX        Unsigned32
    MAX-ACCESS    not-accessible
```

```
    STATUS        current
    DESCRIPTION
        "This object holds the Protection group index wherein
         this ME included in. If this ME is not part of any protection
         group then this object contains value 0. "
    DEFVAL { 0 }
    ::= { mplsLpsMeConfigEntry 1 }

mplsLpsMeConfigState OBJECT-TYPE
    SYNTAX      INTEGER { primary(1), backup(2) }

    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
       "This object represents the operational state of the ME
        as either primary or backup"
    ::= { mplsLpsMeConfigEntry 2 }

mplsLpsMeConfigCommand OBJECT-TYPE
    SYNTAX      MplsLpsCommand
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION

        "Allows the initiation of an MPLS Linear protection command on
         the protection group and the ME specified by the index values.
         When read this object returns the last command written
         or noCmd if no command has been written to this ME
         since initialization. The return of the last command
         written does not imply that this command is currently in
         effect.  This request may have been preempted by a higher
         priority local or remote request.

         The value lockoutOfProtection should only be applied to the
         protection path / ME since that switch command prevents any
         of the working path / ME from switching to the protection path.
         Following the same logic, forcedSwitchWorkToProtect and
         manualSwitchWorkToProtect should only be applied to a working
         ME."
         ::= { mplsLpsMeConfigEntry 3 }

mplsLpsMeConfigHoldOff   OBJECT-TYPE
    SYNTAX     Integer32 (0..10000)
    UNITS       "milli-seconds"
    MAX-ACCESS read-create
    STATUS     current
    DESCRIPTION
        "The hold-off time in milliseconds. Represents the time
```

```
         between SF/SD condition detection and declaration of
         an SF/SD request to the protection switching logic.
         It is intended to avoid unnecessary switching when a lower-
         layer protection mechanism is in place.
         Can be configured in steps of 100"
    DEFVAL { 0 }
    ::= { mplsLpsMeConfigEntry 4 }

-- MPLS Linear Protection ME Status Table
-- This table provides Protection Switching ME statistics.

mplsLpsMeStatusTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLpsMeStatusEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains status information of all the ME
         that are included in MPLS Protection groups."
    ::= { mplsLpsObjects 5 }

mplsLpsMeStatusEntry OBJECT-TYPE
    SYNTAX      MplsLpsMeStatusEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A conceptual row in the mplsLpsMeStatusTable."
    AUGMENTS { mplsLpsMeConfigEntry }
    ::= { mplsLpsMeStatusTable  1 }

MplsLpsMeStatusEntry ::= SEQUENCE {
    mplsLpsMeStatusCurrent               BITS,
    mplsLpsMeStatusSignalDegrades        Counter32,
    mplsLpsMeStatusSignalFailures        Counter32,
    mplsLpsMeStatusSwitchovers           Counter32,
    mplsLpsMeStatusLastSwitchover        TimeStamp,
    mplsLpsMeStatusSwitchoverSeconds     Counter32
}

mplsLpsMeStatusCurrent OBJECT-TYPE
    SYNTAX     BITS {
               localLockedOut(0),
               localSd(1),
               localSf(2),
               localSwitched(3),
               localWtr(4),
               remoteLockedout(5)
               remoteSd(6),
               remoteSf(7),
```

```
               remoteSwitched(8),
               remoteWtr(9)
            }
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
        "Indicates the current state of the MA.

         localLockedOut

         This bit, when it is set on a working ME or working path
         indicates that the working path is prevented from
         switching to the protection path because of local request.
         When it is set on protection / backup path, this bit
         indicates that none of the working path (in case of
         1:n) can switch to the protection path.

         localSd

         This bit implies that local signal degrade condition is
         in effect on this ME / path.

         localSf

         This bit implies that local signal failure condition is
         in effect on this ME / path.

         localSwitched

         This bit is only applicable to the working ME / path.
         It implies that the working path is currently switched
         to the protection path because of local request.

         local wtr

         This bit implies that local Wait-to-Restore state is
         in effect."

         remoteLockedOut

         This bit, when it is set on a working ME or working path
         indicates that the working path is prevented from
         switching to the protection path because of remote request.
         When it is set on protection / backup path, this bit
         indicates that none of the working path (in case of
         1:n) can switch to the protection path.

         remoteSd
```

```
         This bit implies that remote signal degrade condition is
         in effect on this ME / path.

         remoteSf

         This bit implies that remote signal failure condition is
         in effect on this ME / path.

         remoteSwitched

         This bit is only applicable to the working ME / path.
         It implies that the working path is currently switched
         to the protection path because of remote request.

         remoteWtr

         This bit implies that remote Wait-to-Restore state is
         in effect."
    ::= { mplsLpsMeStatusEntry 1 }

mplsLpsMeStatusSignalDegrades OBJECT-TYPE
    SYNTAX     Counter32
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
        "Represents the count of Signal Degrade conditions.
         This condition occurs when the DM exceeds the
         currently configured value of the relevant instance of
         mplsLpsConfigSdThreshold."
    ::= { mplsLpsMeStatusEntry 2 }

mplsLpsMeStatusSignalFailures OBJECT-TYPE

    SYNTAX     Counter32
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
        "Represents the count of Signal failure conditions.
         This condition occurs when the OAM running on this MA
         detects the Signal Fail event."
    ::= { mplsLpsMeStatusEntry 3 }

mplsLpsMeStatusSwitchovers OBJECT-TYPE
    SYNTAX     Counter32
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
        "Represents the count of SwitchOvers happened in this
```

```
         MA.

         When the mplsLpsMeConfigState is primary, this
         object will return the number of times this path
         has switched to the protection path.



         When the mplsLpsMeConfigState is backup, this object
         will return the number of times that any working paths
         has been switched back to the working path from this
         protection path."
    ::= { mplsLpsMeStatusEntry 4 }

mplsLpsMeStatusLastSwitchover OBJECT-TYPE
    SYNTAX     TimeStamp
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
        "This object holds the value of sysUpTime wherein the
         last switchover happened.

         When the mplsLpsMeConfigState is primary, this object
         will return the value of sysUpTime when this path last
         completed a switchover. If this path has never switched
         to the protection line, the value 0 will be returned.

         When the mplsLpsMeConfigState is backup, this object
         will return the value of sysUpTime the last time that
         a working path was switched back to the working path
         from this protection path. If no working path has ever
         switched back to the working path from this protection
         path, the value 0 will be returned."

    ::= { mplsLpsMeStatusEntry 5 }

mplsLpsMeStatusSwitchoverSeconds OBJECT-TYPE
    SYNTAX     Counter32
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
        "The cumulative Protection Switching Duration (PSD) time
         in seconds.

         ForM a working path, this is the cumulative number of
         seconds that traffic was carried on the protection
         path.
```

```
         For the protection path, this is the cumulative number
         of seconds that the protection path has been used to
         carry any working path traffic."

    ::= { mplsLpsMeStatusEntry 6 }


mplsLpsNotificationEnable OBJECT-TYPE
    SYNTAX     BITS {
               switchover(0),
               modeMismatch(1)
            }
    MAX-ACCESS read-write
    STATUS     current

    DESCRIPTION
        "Provides the ability to enable and disable notifications
         defined in this MIB.

         switchover

         Indicates mplsLpsEventSwitchover notifications
         should be generated.

         modeMismatch

         Indicates mplsLpsEventModeMismatch notifications
         should be generated."

    DEFVAL { { } }
    ::= { mplsLpsObjects 6 }

    -- MPLS Linear Protection EVENTS

mplsLpsEventSwitchover NOTIFICATION-TYPE
    OBJECTS { mplsLpsMeStatusSwitchovers, mplsLpsMeStatusCurrent }
    STATUS  current
    DESCRIPTION
        "An mplsLpsEventSwitchover notification is sent when the
        value of an instance of mplsLpsMeStatusSwitchovers increments."
    ::= { mplsLpsNotifications 1 }

mplsLpsEventModeMismatch NOTIFICATION-TYPE
    OBJECTS { mplsLpsStatusModeMismatches }
    STATUS  current
    DESCRIPTION
        "An mplsLpsEventModeMismatch notification is sent when the
        value of an instance of mplsLpsStatusModeMismatches increments."
```

```
    ::= { mplsLpsNotifications 2 }

-- End of Notifications.

-- Module Compliance.

mplsLpsCompliances
   OBJECT IDENTIFIER ::= { mplsLpsConformance 1 }

mplsLpsGroups
   OBJECT IDENTIFIER ::= { mplsLpsConformance 2 }

-- Compliance requirement for fully compliant implementations.

mplsLpsModuleFullCompliance MODULE-COMPLIANCE

   STATUS       current
   DESCRIPTION "Compliance statement for agents that provide full
                support for MPLS-LPS-MIB. Such devices can
                provide linear protection and also be configured using
                this MIB module."

   MODULE -- This module.
   MANDATORY-GROUPS {
         mplsLpsScalarGroup,
         mplsLpsConfigTableGroup,
         mplsLpsMeTableGroup
   }

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


   ::= { mplsLpsCompliances 1 }

   -- Units of conformance.

mplsLpsScalarGroup OBJECT-GROUP
   OBJECTS {
      mplsLpsConfigGroups,
      mplsLpsNotificationEnable
   }
   STATUS  current
   DESCRIPTION
          "Collection of objects needed for MPLS Linear Protection."
   ::= { mplsLpsGroups 1 }
```

```
mplsLpsConfigTableGroup OBJECT-GROUP
   OBJECTS {
    mplsLpsConfigGroupName,
    mplsLpsConfigRowStatus,
    mplsLpsConfigMode,
    mplsLpsConfigRevertive,
    mplsLpsConfigProtectionScheme,
    mplsLpsConfigSdThreshold,
    mplsLpsConfigWaitToRestore,
    mplsLpsConfigHoldOff,
    mplsLpsConfigContinualTxInterval,
    mplsLpsConfigRapidTxInterval,
    mplsLpsConfigCreationTime,
    mplsLpsConfigStorageType,
    mplsLpsStatusReqRcv,
    mplsLpsStatusReqSent,

    mplsLpsStatusFpathPathRcv,
    mplsLpsStatusFpathPathSent,
    mplsLpsStatusModeMismatches
   }
   STATUS  current
   DESCRIPTION
          "Collection of objects needed for MPLS Linear Protection
           configuration and statistics."
   ::= { mplsLpsGroups 2 }

mplsLpsMeTableGroup OBJECT-GROUP
   OBJECTS {
    mplsLpsMeConfigState,
    mplsLpsMeConfigCommand,
    mplsLpsMeStatusCurrent,

    mplsLpsMeStatusSignalDegrades,
    mplsLpsMeStatusSignalFailures,
    mplsLpsMeStatusSwitchovers,
    mplsLpsMeStatusLastSwitchover,
    mplsLpsMeStatusSwitchoverSeconds
   }
   STATUS  current
   DESCRIPTION
          "Collection of objects needed for MPLS Linear Protection
           ME configuration and statistics."
   ::= { mplsLpsGroups 3 }

mplsLpsNotificationGroup NOTIFICATION-GROUP
   NOTIFICATIONS {
      mplsLpsEventSwitchover,
```

```
      mplsLpsEventModeMismatch
   }
   STATUS  current
   DESCRIPTION
          "Collection of objects needed to implement notifications."
   ::= { mplsLpsGroups 4 }

-- MPLS-LPS-MIB module ends
END
```

9. Security Considerations

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 networks in a non-secure environment without proper protection can have a negative effect on network operations. These are the tables and objects and their sensitivity/vulnerability:

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

10. 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 Linear Protection MIB module specified in this document.

11. References

11.1. Normative References

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