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MPLS Transport Profile Linear Protection MIB

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 Multiprotocol Label Switching - Transport Profile (MPLS-TP) linear protection.

Status of This Memo

This is an Internet Standards Track document.

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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 Multiprotocol Label Switching - Transport Profile (MPLS-TP) linear protection.

This MIB module should be used for configuring and managing MPLS-TP linear protection for MPLS-TP Label Switched Paths (LSPs).

At the time of this writing, Simple Network Management Protocol (SNMP) SET is no longer recommended as a way to configure MPLS networks as described in RFC 3812 [RFC3812]. However, since the MIB module specified in this document is intended to work in parallel with the MIB module for MPLS specified in [RFC3812] and the MIB module for MPLS-TP Operations, Administration, and Maintenance (OAM) identifiers in RFC 7697 [RFC7697], certain objects defined here are specified with a MAX-ACCESS clause of read-write or read-create so that specifications of the base tables in [RFC3812] and [RFC7697] and the new MIB module in this document are consistent.

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", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14, RFC 2119 [RFC2119].

4. Overview

RFC 6378 [RFC6378] defines the protocol to provide a linear protection switching mechanism for MPLS-TP for a point-to-point LSP within the protection domain bounded by the endpoints of the LSP. RFC 7271 [RFC7271] describes alternative mechanisms to perform some of the functions defined in [RFC6378] and also defines additional mechanisms to provide operator control and experience that more closely model the behavior of linear protection seen in other transport networks. Two modes are defined for MPLS-TP linear protection switching: the Protection State Coordination (PSC) mode and the Automatic Protection Switching (APS) mode, as specified in [RFC6378] and [RFC7271], respectively. The detailed protocol specification of MPLS-TP linear protection is described in [RFC6378] and [RFC7271].

This document specifies a MIB module for Label Edge Routers (LERs) that support MPLS-TP linear protection as described in [RFC6378] and [RFC7271]. Objects defined in this document are generally applied to both the PSC mode and the APS mode. If an object is valid for a particular mode only, it is noted in the description for the object.

5. Structure of the MIB Module

5.1. Textual Conventions

The following new textual conventions are defined in this document:

- MplsLpsReq: This textual convention describes an object that stores the PSC Request field of the PSC control packet.
- MplsLpsFpathPath: This textual convention describes an object that stores the Fault Path (FPath) field and Data Path (Path) field of the PSC control packet.
- MplsLpsCommand: This textual convention describes an object that allows a user to perform any action over a protection domain.
- MplsLpsState: This textual convention describes an object that stores the current state of the PSC state machine.

5.2. The MPLS-TP Linear Protection Switching Subtree

MPLS-LPS-MIB is the MIB module defined in this document. It is rooted under the mplsStdMIB subtree per [RFC3811]. "LPS" as used in this document means "Linear Protection Switching".

5.3. The Notifications Subtree

Notifications are defined to inform the management station about switchovers, provisioning mismatches, and protocol failures of the linear protection domain. The following notifications are defined for this purpose:

- The notification mplsLpsEventSwitchover informs the management station about the switchover of the active path.
- The notification mplsLpsEventRevertiveMismatch informs the management station about a provisioning mismatch in the revertive mode across the endpoint of the protection domain.
- The notification mplsLpsEventProtecTypeMismatch informs the management station about a provisioning mismatch in the protection type, representing both the bridge type and the switching type, across the endpoint of the protection domain.
- The notification mplsLpsEventCapabilitiesMismatch informs the management station about a provisioning mismatch in Capabilities TLVs across the endpoint of the protection domain.
- The notification mplsLpsEventPathConfigMismatch informs the management station about a provisioning mismatch in the protection path configuration for PSC communication.
- The notification mplsLpsEventFopNoResponse informs the management station that protocol failure has occurred due to a lack of response to a traffic switchover request in 50 ms.
- The notification mplsLpsEventFopTimeout informs the management station that protocol failure has occurred because no protocol message was received during at least 3.5 times the long PSC message interval [RFC7271].

5.4. The Table Structures

The MPLS-TP linear protection MIB module has four tables. The tables are as follows:

- mplsLpsConfigTable

  This table is used to configure MPLS-TP linear protection domains. An MPLS-TP linear protection domain (or a protection domain) is identified by mplsLpsConfigDomainIndex. A protection domain consists of two LERs, as well as the working path and protection path that connect the two LERs. The objects in this table are

used to configure properties that are specific to the protection domain. Two Maintenance Entities (MEs) MUST be defined for each protection domain: one for the working path and the other for the protection path. Therefore, two entries in the mplsLpsMeConfigTable, which is for configuring the MEs used in protection switching, are associated to one entry in this table.

- mplsLpsStatusTable

  This table provides the current status information of MPLS-TP linear protection domains that have been configured on the system. The entries in the mplsLpsStatusTable have an AUGMENTS relationship with the entries in the mplsLpsConfigTable. When a protection domain is configured or deleted in the mplsLpsConfigTable, then the corresponding row of that session in the mplsLpsStatusTable is automatically created or deleted, respectively.

- mplsLpsMeConfigTable

  This table is used to associate MEs to the protection domain. Each protection domain requires two MEs. One entry in the mplsLpsConfigTable is associated with two entries in this table: one for the working path and the other for the protection path of the protection domain. The mplsLpsMeConfigPath object in this table indicates that the path is either the working path or the protection path. The ME is identified by mplsOamIdMegIndex, mplsOamIdMeIndex, and mplsOamIdMeMpIndex, which are the same index values as the entry in the mplsOamIdMeTable defined in [RFC7697]. The relationship to the mplsOamIdMeTable is described in Section 6.1.

- mplsLpsMeStatusTable

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

6. Relationship to Other MIB Modules

6.1. Relationship to the MPLS OAM Identifiers MIB Module

Entries in the mplsOamIdMeTable [RFC7697] are extended by entries in the mplsLpsMeConfigTable. 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.

When a point-to-point transport path needs to be monitored, one ME is needed for the path and one entry in the mplsOamIdMeTable will be created. But the ME entry in the mplsOamIdMeTable may or may not participate in protection switching. If an ME participates in protection switching, an entry in the mplsLpsMeConfigTable MUST be created, and the objects in the entry indicate which protection domain this ME belongs to and whether this ME is for the working path or the protection path. If the ME does not participate in protection switching, an entry in the mplsLpsMeConfigTable does not need to be created.

7. Example of Protection Switching Configuration

This example considers the protection domain configuration on an LER to provide protection for a co-routed bidirectional MPLS tunnel. For the working path and protection path of the protection domain, two Maintenance Entity Groups (MEGs) need to be configured, and each MEG contains one ME for a point-to-point transport path. For more information on the mplsOamIdMegTable and the mplsOamIdMeTable, see [RFC7697].

Although the example described in this section shows a way to configure linear protection for MPLS-TP tunnels, this also indicates how the MIB values would be returned if they had been configured by alternative means.

The following table configures a protection domain.

```
In the mplsLpsConfigTable:
mplsLpsConfigEntry ::= SEQUENCE
{
   -- Protection domain index (index to the table)
   mplsLpsConfigDomainIndex  = 3,
   -- Protection domain name
   mplsLpsConfigDomainName   = "LPDomain3",
   mplsLpsConfigMode         = psc(1),
   mplsLpsConfigProtectionType = oneColonOneBidirectional(2),
   -- Mandatory parameters needed to activate the row go here
   mplsLpsConfigRowStatus    = createAndGo(4)
}
```

The following table associates the MEs with the protection domain.

```
In the mplsLpsMeConfigTable:
MplsLpsMeConfigEntry ::= SEQUENCE
{
   -- MEG index (index to the table)
   mplsOamIdMegIndex                = 1,
   -- ME index (index to the table)
   mplsOamIdMeIndex                 = 1,
   -- Maintenance Point (MP) index (index to the table)
   mplsOamIdMeMpIndex               = 1,
   -- Protection domain this ME belongs to
   mplsLpsMeConfigDomain            = 3,
   -- Configuration state
   mplsLpsMeConfigPath              = working(1)
}
{
   -- MEG index (index to the table)
   mplsOamIdMegIndex                = 2,
   -- ME index (index to the table)
   mplsOamIdMeIndex                 = 2,
   -- MP index (index to the table)
   mplsOamIdMeMpIndex               = 2,
   -- Protection domain this ME belongs to
   mplsLpsMeConfigDomain            = 3,
   -- Configuration state
   mplsLpsMeConfigPath              = protection(2)
}
```

8. Definitions

This MIB module makes reference to the following documents: [RFC2578], [RFC2579], [RFC2580], [RFC3289], [RFC3411], [RFC3811], [RFC6378], [RFC7271], [RFC7697], [G8121], and [G8151].

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

IMPORTS
   MODULE-IDENTITY, NOTIFICATION-TYPE, OBJECT-TYPE,
   Counter32, Unsigned32
      FROM SNMPv2-SMI             -- RFC 2578

   MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
      FROM SNMPv2-CONF            -- RFC 2580

   TEXTUAL-CONVENTION, RowStatus, TimeStamp, StorageType, TruthValue
      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

   mplsOamIdMegIndex, mplsOamIdMeIndex, mplsOamIdMeMpIndex
       FROM MPLS-OAM-ID-STD-MIB;  -- RFC 7697

mplsLpsMIB MODULE-IDENTITY
   LAST-UPDATED  "201704040000Z"  -- April 4, 2017
   ORGANIZATION  "Multiprotocol Label Switching (MPLS) Working Group"
   CONTACT-INFO
      "
      Kingston Smiler Selvaraj
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         South Korea
         Email: ryoo@etri.re.kr
         "
   DESCRIPTION
      "This MIB module supports the configuration and management of
       MPLS-TP linear protection domains.

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       Relating to IETF Documents
       (http://trustee.ietf.org/license-info)."

   REVISION
      "201704040000Z"  -- April 4, 2017
      DESCRIPTION
         "MPLS-TP protection domain objects for
          LSP MEG End Points (MEPs)."

      ::= { mplsStdMIB 22 }
```

```
      -- 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:

          noRequest
          No Request

          doNotRevert
          Do-not-Revert

          reverseRequest
          Reverse Request

          exercise
          Exercise

          waitToRestore
          Wait-to-Restore

          manualSwitch
          Manual Switch

          signalDegrade
          Signal Degrade (SD)

          signalFail
          Signal Fail (SF)
```

```
          forcedSwitch
          Forced Switch

          lockoutOfProtection
          Lockout of Protection."
      REFERENCE
         "Section 4.2.2 of RFC 6378 and Section 8 of RFC 7271"
      SYNTAX  INTEGER {
                 noRequest(0),
                 doNotRevert(1),
                 reverseRequest(2),
                 exercise(3),
                 waitToRestore(4),
                 manualSwitch(5),
                 signalDegrade(7),
                 signalFail(10),
                 forcedSwitch(12),
                 lockoutOfProtection(14)
                 }

   MplsLpsFpathPath ::= TEXTUAL-CONVENTION
      DISPLAY-HINT "1x:"
      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.

          The value and the interpretation of the FPath field are
          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 the Path field are
          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
          "Sections 4.2.5 and 4.2.6 of RFC 6378"
       SYNTAX      OCTET STRING (SIZE (2))

   MplsLpsCommand ::= TEXTUAL-CONVENTION
       STATUS      current
       DESCRIPTION
          "This command allows a user to perform any action over a
           protection domain.  If the protection command cannot be
           executed because a request of equal or higher priority is
           in effect, an inconsistentValue error is returned.

           The command values are as follows:

           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 protection
           domain.

           lockoutOfProtection
           Prevents switching traffic to the protection path.

           forcedSwitch
           Switches traffic from the working path to the protection path.

           manualSwitchToWork
           Switches traffic from the protection path to the working path.

           manualSwitchToProtect
           Switches traffic from the working path to the protection path.
```

```
          exercise
          Used to verify the correct operation of the PSC communication
          and the integrity of the protection path.  This command is not
          applicable to the PSC mode.

          freeze
          This command freezes the protection state and is a local
          command that is not signaled to the remote node.
          This command is not applicable to the PSC mode.

          clearfreeze
          Clears the local freeze.  This command is not applicable to
          the PSC mode."
       REFERENCE
          "Sections 3.1 and 3.2 of RFC 6378 and Sections 4.3 and 6 of
          RFC 7271"
       SYNTAX   INTEGER {
                   noCmd(1),
                   clear(2),
                   lockoutOfProtection(3),
                   forcedSwitch(4),
                   manualSwitchToWork(5),
                   manualSwitchToProtect(6),
                   exercise(7),
                   freeze(8),
                   clearfreeze(9)
                   }

   MplsLpsState ::= TEXTUAL-CONVENTION
       STATUS      current
       DESCRIPTION
          "This textual convention describes an object that stores
          the current state of the PSC state machine.  The values
          are as follows:

          normal
          Normal state.

          unavLOlocal
          Unavailable state due to local LO command.

          unavSFPlocal
          Unavailable state due to local SF-P.

          unavSDPlocal
          Unavailable state due to local SD-P.
```

unavLOremote
Unavailable state due to remote LO message.

unavSFPremote
Unavailable state due to remote SF-P message.

unavSDPremote
Unavailable state due to remote SD-P message.

protfailSFWlocal
Protecting Failure state due to local SF-W.

protfailSDWlocal
Protecting Failure state due to local SD-W.

protfailSFWremote
Protecting Failure state due to remote SF-W message.

protfailSDWremote
Protecting Failure state due to remote SD-W message.

switadmFSlocal
Switching Administrative state due to local FS command.
Same as Protecting Administrative state due to local FS
command in the PSC mode.

switadmMSWlocal
Switching Administrative state due to local MS-W command.

switadmMSPlocal
Switching Administrative state due to local MS-P command.
Same as Protecting Administrative state due to local MS
command in the PSC mode.

switadmFSremote
Switching Administrative state due to remote FS message.
Same as Protecting Administrative state due to remote FS
message in the PSC mode.

switadmMSWremote
Switching Administrative state due to remote MS-W message.

switadmMSPremote
Switching Administrative state due to remote MS-P message.
Same as Protecting Administrative state due to remote MS
message in the PSC mode.

```
          wtr
          Wait-to-Restore state.

          dnr
          Do-not-Revert state.

          exerLocal
          Exercise state due to local EXER command.

          exerRemote
          Exercise state due to remote EXER message."
       REFERENCE
          "Sections 3 and 11 of RFC 7271"

       SYNTAX   INTEGER {
                   normal(1),
                   unavLOlocal(2),
                   unavSFPlocal(3),
                   unavSDPlocal(4),
                   unavLOremote(5),
                   unavSFPremote(6),
                   unavSDPremote(7),
                   protfailSFWlocal(8),
                   protfailSDWlocal(9),
                   protfailSFWremote(10),
                   protfailSDWremote(11),
                   switadmFSlocal(12),
                   switadmMSWlocal(13),
                   switadmMSPlocal(14),
                   switadmFSremote(15),
                   switadmMSWremote(16),
                   switadmMSPremote(17),
                   wtr(18),
                   dnr(19),
                   exerLocal(20),
                   exerRemote(21)
                   }
```

```
   -- Start of
   -- MPLS-TP Linear Protection Switching Configuration Table.
   -- This table supports the addition, configuration, and deletion
   -- of MPLS-TP linear protection domains.

   mplsLpsConfigDomainIndexNext OBJECT-TYPE
      SYNTAX      IndexIntegerNextFree (0..4294967295)
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "This object contains an unused value for
          mplsLpsConfigDomainIndex, or a zero to indicate that
          the number of unassigned entries has been exhausted.
          Negative values are not allowed, as they do not correspond
          to valid values of mplsLpsConfigDomainIndex."
      ::= { mplsLpsObjects 1 }

   mplsLpsConfigTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF MplsLpsConfigEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "This table lists the MPLS-TP linear protection domains that
          have been configured on the system.
          An entry is created by a network operator who wants to run
          the MPLS-TP linear protection protocol for the protection
          domain."
      ::= { mplsLpsObjects 2 }

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

   MplsLpsConfigEntry ::= SEQUENCE {
      mplsLpsConfigDomainIndex         Unsigned32,
      mplsLpsConfigDomainName          SnmpAdminString,
      mplsLpsConfigMode                INTEGER,
      mplsLpsConfigProtectionType      INTEGER,
      mplsLpsConfigRevertive           INTEGER,
      mplsLpsConfigSdThreshold         Unsigned32,
      mplsLpsConfigSdBadSeconds        Unsigned32,
      mplsLpsConfigSdGoodSeconds       Unsigned32,
      mplsLpsConfigWaitToRestore       Unsigned32,
```

```
      mplsLpsConfigHoldOff             Unsigned32,
      mplsLpsConfigContinualTxInterval Unsigned32,
      mplsLpsConfigRapidTxInterval     Unsigned32,
      mplsLpsConfigCommand             MplsLpsCommand,
      mplsLpsConfigCreationTime        TimeStamp,
      mplsLpsConfigRowStatus           RowStatus,
      mplsLpsConfigStorageType         StorageType
   }

   mplsLpsConfigDomainIndex OBJECT-TYPE
      SYNTAX      Unsigned32 (1..4294967295)
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "Index for the conceptual row identifying a protection domain.
          Operators should obtain new values for row creation in this
          table by reading mplsLpsConfigDomainIndexNext.

          When the value of this object is the same as the value of
          mplsLpsMeConfigDomain, the mplsLpsMeConfigDomain is defined
          as either the working path or the protection path for this
          protection domain."
      ::= { mplsLpsConfigEntry 1 }

   mplsLpsConfigDomainName OBJECT-TYPE
      SYNTAX      SnmpAdminString (SIZE (0..32))
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
         "Textual name that represents the MPLS-TP linear protection
          domain.  It facilitates easy administrative identification of
          each protection domain."
      DEFVAL {""}
      ::= { mplsLpsConfigEntry 2 }
```

```
   mplsLpsConfigMode OBJECT-TYPE
      SYNTAX INTEGER {
                psc(1),
                aps(2)
                }
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
         "The mode of the MPLS-TP linear protection mechanism.  This can
          be either PSC or APS, as follows:

          PSC
          The Protection State Coordination mode as described in
          RFC 6378.

          APS
          The Automatic Protection Switching mode as described in
          RFC 7271.

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

          The value of this object is not supposed to be changed
          during operation.  When the value should be changed,
          the protection processes in both LERs MUST be
          restarted with the same new value.

          If this value is changed at one LER during operation,
          the LER will generate PSC packets with a new
          Capabilities TLV value.  This will result in
          mplsLpsEventCapabilitiesMismatch notifications at both LERs."
      REFERENCE
         "Sections 9.2 and 10 of RFC 7271"
      DEFVAL {psc}
      ::= { mplsLpsConfigEntry 3 }
```

```
   mplsLpsConfigProtectionType OBJECT-TYPE
      SYNTAX INTEGER {
                onePlusOneUnidirectional(1),
                oneColonOneBidirectional(2),
                onePlusOneBidirectional(3)
                }
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
         "The protection architecture type of the protection domain.
          This object represents both the bridge type, which can be
          either a permanent bridge (1+1) or a selector bridge (1:1);
          and the switching scheme, which can be either unidirectional
          or bidirectional.

          1+1
          In the 1+1 protection scheme, a fully dedicated protection
          path is allocated.  Data traffic is copied and fed at the
          source to both the working path and the protection path.
          The traffic on the working path and protection path is
          transmitted simultaneously to the sink of the protection
          domain, where selection between the working path and the
          protection path is performed.

          1:1
          In the 1:1 protection scheme, a protection path is allocated
          to protect against a defect, failure, or degradation on the
          working path.  In normal conditions, data traffic is
          transmitted over the working path, while the protection path
          functions in the idle state.  If there is a defect on the
          working path or a specific administrative request,
          traffic is switched to the protection path.

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

          unidirectional
          In the 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)."
```

```
      REFERENCE
         "Section 4.2.3 of RFC 6378"
      DEFVAL {oneColonOneBidirectional}
      ::= { mplsLpsConfigEntry 4 }

   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 domain.  The reversion mode of the protection
          mechanism may be either revertive or non-revertive.

          nonrevertive
          In the non-revertive mode, after a service has been recovered,
          traffic will be forwarded on the protection path.

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

          This object may not be modified if the associated
          mplsLpsConfigRowStatus object is equal to active(1)."
      REFERENCE
         "Section 4.2.4 of RFC 6378"
      DEFVAL { revertive }
      ::= { mplsLpsConfigEntry 5 }

   mplsLpsConfigSdThreshold OBJECT-TYPE
      SYNTAX      Unsigned32 (0..100)
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
         "This object holds the threshold value of the Signal Degrade
          (SD) defect in percent.  In order to detect the SD defect,
          the MPLS-TP packet loss measurement (LM) is performed
          every second.

          If either the packet loss is negative (i.e., there are more
          packets received than transmitted) or the packet loss ratio
          (lost packets/transmitted packets) in percent is greater than
          this threshold value, a Bad Second is declared.
          Otherwise, a Good Second is declared.
```

```
            The SD defect is detected if there are
            mplsLpsConfigSdBadSeconds consecutive Bad Seconds
            and cleared if there are
            mplsLpsConfigSdGoodSeconds consecutive Good Seconds.

            This object may be modified if the associated
            mplsLpsConfigRowStatus object is equal to active(1)."
        REFERENCE
           "Clause 6.1.3.3 of ITU-T Recommendation G.8121/Y.1381 and
            Table 8-1 of ITU-T Recommendation G.8151/Y.1374"
        DEFVAL { 30 }
        ::= { mplsLpsConfigEntry 6 }

    mplsLpsConfigSdBadSeconds OBJECT-TYPE
        SYNTAX      Unsigned32 (2..10)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
           "This object holds the number of Bad Seconds to detect the SD.

            If the number of consecutive Bad Seconds reaches this value,
            the SD defect is detected and used as an input to
            the protection switching process.

            This object may be modified if the associated
            mplsLpsConfigRowStatus object is equal to active(1)."
        REFERENCE
           "Clause 6.1.3.3 of ITU-T Recommendation G.8121/Y.1381 and
            Table 8-1 of ITU-T Recommendation G.8151/Y.1374"
        DEFVAL { 10 }
        ::= { mplsLpsConfigEntry 7 }

    mplsLpsConfigSdGoodSeconds OBJECT-TYPE
        SYNTAX      Unsigned32 (2..10)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
           "This object holds the number of Good Seconds to declare
            the clearance of an SD defect.

            After an SD defect occurs on a path, if the number of
            consecutive Good Seconds reaches this value for the
            degraded path, the clearance of the SD defect is declared
            and used as an input to the protection switching process.
```

```
          This object may be modified if the associated
          mplsLpsConfigRowStatus object is equal to active(1)."
       REFERENCE
          "Clause 6.1.3.3 of ITU-T Recommendation G.8121/Y.1381 and
           Table 8-1 of ITU-T Recommendation G.8151/Y.1374"
       DEFVAL { 10 }
       ::= { mplsLpsConfigEntry 8 }

   mplsLpsConfigWaitToRestore OBJECT-TYPE
       SYNTAX      Unsigned32 (5..12)
       UNITS       "minutes"
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
          "This object holds the Wait-to-Restore timer value in minutes
           and can be configured in 1-minute intervals between 5 and
           12 minutes.

           The WTR timer is used to delay the reversion of the PSC state
           to the 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)."
       REFERENCE
          "Section 3.5 of RFC 6378"
       DEFVAL { 5 }
       ::= { mplsLpsConfigEntry 9 }

   mplsLpsConfigHoldOff OBJECT-TYPE
       SYNTAX      Unsigned32 (0..100)
       UNITS       "deciseconds"
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
          "The hold-off time in deciseconds.  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 intervals of 100 milliseconds.

           When a new defect or a more severe defect occurs on
           the active path (the path from which the selector selects
           the user data traffic) and this value is non-zero,
           the hold-off timer will be started.  A defect on the standby
```

```
          path (the path from which the selector does not select the
          user data traffic) does not trigger the start of the hold-off
          timer, as there is no need for a traffic switchover.

          This object may not be modified if the associated
          mplsLpsConfigRowStatus object is equal to active(1)."
       REFERENCE
          "Section 3.1 of RFC 6378"
       DEFVAL { 0 }
       ::= { mplsLpsConfigEntry 10 }

   mplsLpsConfigContinualTxInterval OBJECT-TYPE
       SYNTAX      Unsigned32 (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 PSC packet to the other
           end, based on the current state.

           This object may not be modified if the associated
           mplsLpsConfigRowStatus object is equal to active(1)."
       REFERENCE
          "Section 4.1 of RFC 6378"
       DEFVAL { 5 }
       ::= { mplsLpsConfigEntry 11 }

   mplsLpsConfigRapidTxInterval OBJECT-TYPE
       SYNTAX      Unsigned32 (1000..20000)
       UNITS       "microseconds"
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
          "The Rapid Tx interval in microseconds.  Represents the time
           interval to send the PSC packet to the other end, when
           there is a change in the state of the linear protection domain
           due to local input.  The default value is 3.3 milliseconds
           (3300 microseconds).

           This object may not be modified if the associated
           mplsLpsConfigRowStatus object is equal to active(1)."
       REFERENCE
          "Section 4.1 of RFC 6378"
       DEFVAL { 3300 }
       ::= { mplsLpsConfigEntry 12 }
```

```
   mplsLpsConfigCommand OBJECT-TYPE
      SYNTAX      MplsLpsCommand
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
         "Allows the initiation of an operator command on
          the protection domain.

          When read, this object returns the last command written
          or noCmd if no command has been written 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.

          This object may be modified if the associated
          mplsLpsConfigRowStatus object is equal to active(1)."
      REFERENCE
         "Sections 3.1 and 3.2 of RFC 6378 and Sections 4.3 and 6 of
          RFC 7271"
      DEFVAL { noCmd }
      ::= { mplsLpsConfigEntry 13 }

   mplsLpsConfigCreationTime OBJECT-TYPE
      SYNTAX      TimeStamp
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The value of sysUpTime at the time the row was created."
      ::= { mplsLpsConfigEntry 14 }

   mplsLpsConfigRowStatus OBJECT-TYPE
      SYNTAX      RowStatus
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
         "This object represents the status of the MPLS-TP linear
          protection domain entry.  This variable is used to
          create, modify, and/or delete a row in this table."
      ::= { mplsLpsConfigEntry 15 }
```

```
   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 16 }

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

   mplsLpsStatusTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF MplsLpsStatusEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "This table provides status information about MPLS-TP
          linear protection domains 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 {
      mplsLpsStatusState                MplsLpsState,
      mplsLpsStatusReqRcv               MplsLpsReq,
      mplsLpsStatusReqSent              MplsLpsReq,
      mplsLpsStatusFpathPathRcv         MplsLpsFpathPath,
      mplsLpsStatusFpathPathSent        MplsLpsFpathPath,
      mplsLpsStatusRevertiveMismatch    TruthValue,
      mplsLpsStatusProtecTypeMismatch   TruthValue,
      mplsLpsStatusCapabilitiesMismatch TruthValue,
      mplsLpsStatusPathConfigMismatch   TruthValue,
      mplsLpsStatusFopNoResponses       Counter32,
      mplsLpsStatusFopTimeouts          Counter32
   }
```

```
   mplsLpsStatusState OBJECT-TYPE
      SYNTAX      MplsLpsState
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The current state of the PSC state machine."
      REFERENCE
         "Section 11 of RFC 7271"
      ::= { mplsLpsStatusEntry 1 }

   mplsLpsStatusReqRcv OBJECT-TYPE
      SYNTAX      MplsLpsReq
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The current value of the PSC Request field received on
          the most recent PSC packet."
      REFERENCE
         "Section 4.2 of RFC 6378"
      ::= { mplsLpsStatusEntry 2 }

   mplsLpsStatusReqSent OBJECT-TYPE
      SYNTAX      MplsLpsReq
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The current value of the PSC Request field sent on the
          most recent PSC packet."
      REFERENCE
         "Section 4.2 of RFC 6378"
      ::= { mplsLpsStatusEntry 3 }

   mplsLpsStatusFpathPathRcv OBJECT-TYPE
      SYNTAX      MplsLpsFpathPath
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The current value of the FPath and Path fields received
          on the most recent PSC packet."
      REFERENCE
         "Section 4.2 of RFC 6378"
      ::= { mplsLpsStatusEntry 4 }
```

```
   mplsLpsStatusFpathPathSent OBJECT-TYPE
      SYNTAX      MplsLpsFpathPath
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The current value of the FPath and Path fields sent
          on the most recent PSC packet."
      REFERENCE
         "Section 4.2 of RFC 6378"
      ::= { mplsLpsStatusEntry 5 }

   mplsLpsStatusRevertiveMismatch OBJECT-TYPE
      SYNTAX      TruthValue
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "This object indicates a provisioning mismatch in the
          revertive mode across the protection domain endpoints.
          The value of this object becomes true when a PSC message with
          an incompatible Revertive field is received or false when a
          PSC message with a compatible Revertive field is received."
      REFERENCE
         "Section 12 of RFC 7271"
      ::= { mplsLpsStatusEntry 6 }

   mplsLpsStatusProtecTypeMismatch OBJECT-TYPE
      SYNTAX      TruthValue
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "This object indicates a provisioning mismatch in the
          protection type, representing both the bridge type and the
          switching type, across the protection domain endpoints.
          The value of this object becomes true when a PSC message with
          an incompatible Protection Type (PT) field is received or
          false when a PSC message with a compatible PT field is
          received."
      REFERENCE
         "Section 12 of RFC 7271"
      ::= { mplsLpsStatusEntry 7 }
```

```
   mplsLpsStatusCapabilitiesMismatch OBJECT-TYPE
      SYNTAX      TruthValue
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "This object indicates a provisioning mismatch in
          Capabilities TLVs across the protection domain endpoints.
          The value of this object becomes true when a PSC message with
          an incompatible Capabilities TLV field is received or false
          when a PSC message with a compatible Capabilities TLV field is
          received.

          The Capabilities TLV with 0xF8000000 indicates that the APS
          mode is used for the MPLS-TP linear protection mechanism,
          whereas the PSC mode either (1) uses the Capabilities TLV
          with a value of 0x0 or (2) does not use the Capabilities TLV
          because the TLV does not exist."
      REFERENCE
         "Section 12 of RFC 7271"
      ::= { mplsLpsStatusEntry 8 }

   mplsLpsStatusPathConfigMismatch OBJECT-TYPE
      SYNTAX      TruthValue
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "This object indicates a provisioning mismatch in the
          protection path configuration for PSC communication across
          the protection domain endpoints.

          The value of this object becomes true when a PSC message is
          received from the working path or false when a PSC message
          is received from the protection path."
      REFERENCE
         "Section 12 of RFC 7271"
      ::= { mplsLpsStatusEntry 9 }
```

```
   mplsLpsStatusFopNoResponses OBJECT-TYPE
      SYNTAX      Counter32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "This object holds the number of occurrences of protocol
          failure due to a lack of response to a traffic
          switchover request within 50 ms.

          When there is a traffic switchover due to a local request,
          a 50 ms timer is started to detect protocol failure due to
          no response.  If there is no PSC message received with the
          same Path value as the Path value in the transmitted
          PSC message until the 50 ms timer expires, protocol failure
          due to no response occurs."
      REFERENCE
         "Section 12 of RFC 7271"
      ::= { mplsLpsStatusEntry 10 }

   mplsLpsStatusFopTimeouts OBJECT-TYPE
      SYNTAX      Counter32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "This object holds the number of occurrences of protocol
          failure due to no PSC message being received during
          at least 3.5 times the long PSC message interval.

          When no PSC message is received on the protection path during
          at least 3.5 times the long PSC message interval and there
          is no defect on the protection path, protocol failure due to
          no PSC message occurs."
      REFERENCE
         "Section 12 of RFC 7271"
      ::= { mplsLpsStatusEntry 11 }

   -- MPLS-TP Linear Protection ME Association Configuration Table.
   -- This table supports the addition, configuration, and deletion
   -- of MPLS-TP linear protection MEs in protection domains.

   mplsLpsMeConfigTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF MplsLpsMeConfigEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "This table lists ME associations that have been configured
          in protection domains."
      ::= { mplsLpsObjects 4 }
```

```
   mplsLpsMeConfigEntry OBJECT-TYPE
      SYNTAX      MplsLpsMeConfigEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "A conceptual row in the mplsLpsMeConfigTable.  There is
          a sparse relationship between the conceptual rows of
          this table and 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.

          An entry in this table is related to a single entry in
          the mplsOamIdMeTable.  When a point-to-point transport path
          needs to be monitored, one ME is needed for the path,
          and one entry in the mplsOamIdMeTable will be created.
          But the ME entry in the mplsOamIdMeTable may or may not
          participate in protection switching.

          If an ME participates in protection switching, an entry in
          the mplsLpsMeConfigTable MUST be created, and the objects
          in the entry indicate which protection domain this ME
          belongs to and whether this ME is for the working path or
          the protection path.

          If the ME does not participate in protection switching,
          an entry in the mplsLpsMeConfigTable does not need
          to be created."
      INDEX {mplsOamIdMegIndex, mplsOamIdMeIndex, mplsOamIdMeMpIndex}
      ::= { mplsLpsMeConfigTable 1 }

   MplsLpsMeConfigEntry ::= SEQUENCE {
      mplsLpsMeConfigDomain                Unsigned32,
      mplsLpsMeConfigPath                  INTEGER
   }
```

```
   mplsLpsMeConfigDomain OBJECT-TYPE
      SYNTAX      Unsigned32 (0..4294967295)
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
         "This object holds the mplsLpsConfigDomainIndex value for
          the protection domain in which this ME is included.
          If this ME is not part of any protection domain, then
          this object contains the value 0.

          When the value of this object is the same as the value of
          mplsLpsConfigDomainIndex, the object is defined as either
          the working path or the protection path of the
          protection domain corresponding to mplsLpsConfigDomainIndex."
      DEFVAL { 0 }
      ::= { mplsLpsMeConfigEntry 1 }

   mplsLpsMeConfigPath OBJECT-TYPE
      SYNTAX      INTEGER { working(1), protection(2) }
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
         "This object represents whether the ME is configured
          as the working path or the protection path."
      REFERENCE
         "Section 4.3 of RFC 6378"
      ::= { mplsLpsMeConfigEntry 2 }

   --
   -- 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 MEs
          that are included in MPLS-TP linear protection domains."
      ::= { 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 {
                  localSelectTraffic(0),
                  localSD(1),
                  localSF(2)
                  }
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "Indicates the current state of the ME.

          localSelectTraffic
          This bit indicates that traffic is being selected from
          this ME.

          localSD
          This bit implies that a local Signal Degrade condition is
          in effect on this ME/path.

          localSF
          This bit implies that a local Signal Fail condition is
          in effect on this ME/path."
      REFERENCE
         "Section 4.3 of RFC 6378 and Section 7 of RFC 7271"
      ::= { mplsLpsMeStatusEntry 1 }
```

```
   mplsLpsMeStatusSignalDegrades OBJECT-TYPE
      SYNTAX      Counter32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "Represents the count of Signal Degrade conditions.
          For the detection and clearance of Signal Degrade,
          see the description of mplsLpsConfigSdThreshold."
      REFERENCE
         "Section 7 of RFC 7271"
      ::= { mplsLpsMeStatusEntry 2 }

   mplsLpsMeStatusSignalFailures OBJECT-TYPE
      SYNTAX      Counter32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "Represents the count of Signal Fail conditions.
          This condition occurs when the OAM running on this ME
          detects the Signal Fail event."
      REFERENCE
         "Section 4.3 of RFC 6378"
      ::= { mplsLpsMeStatusEntry 3 }

   mplsLpsMeStatusSwitchovers OBJECT-TYPE
      SYNTAX      Counter32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "Represents the count of switchovers that happened in this ME.

          When the mplsLpsMeConfigPath value is 'working', this object
          will return the number of times that traffic has been
          switched from this working path to the protection path.

          When the mplsLpsMeConfigPath value is 'protection', this
          object will return the number of times that traffic has been
          switched back to the working path from this protection path."
      REFERENCE
         "Section 4.3 of RFC 6378"
      ::= { mplsLpsMeStatusEntry 4 }
```

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

          When the mplsLpsMeConfigPath value is 'working', this object
          will return the value of sysUpTime when traffic was switched
          from this path to the protection path.

          If traffic has never switched to the protection path, the
          value 0 will be returned.

          When the mplsLpsMeConfigPath value is 'protection', this
          object will return the value of sysUpTime the last time that
          traffic was switched back to the working path from this path.
          If no traffic has ever switched back to the working path from
          this protection path, the value 0 will be returned."
      REFERENCE
         "Section 4.3 of RFC 6378"
      ::= { mplsLpsMeStatusEntry 5 }

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

          For the working path, this is the cumulative number of
          seconds that traffic was selected from the protection path.

          For the protection path, this is the cumulative number
          of seconds that the working path has been used to
          select traffic."
      REFERENCE
         "Section 4.3 of RFC 6378"
      ::= { mplsLpsMeStatusEntry 6 }
```

```
   mplsLpsNotificationEnable OBJECT-TYPE
      SYNTAX      BITS {
                  switchover(0),
                  revertiveMismatch(1),
                  protecTypeMismatch(2),
                  capabilitiesMismatch(3),
                  pathConfigMismatch(4),
                  fopNoResponse(5),
                  fopTimeout(6)
                  }
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
         "Provides the ability to enable and disable notifications
          defined in this MIB module.

          switchover
          Indicates that mplsLpsEventSwitchover notifications should be
          generated.

          revertiveMismatch
          Indicates that mplsLpsEventRevertiveMismatch notifications
          should be generated.

          protecTypeMismatch
          Indicates that mplsLpsEventProtecTypeMismatch notifications
          should be generated.

          capabilitiesMismatch
          Indicates that mplsLpsEventCapabilitiesMismatch notifications
          should be generated.

          pathConfigMismatch
          Indicates that mplsLpsEventPathConfigMismatch notifications
          should be generated.

          fopNoResponse
          Indicates that mplsLpsEventFopNoResponse notifications should
          be generated.

          fopTimeout
          Indicates that mplsLpsEventFopTimeout notifications should be
          generated."
      REFERENCE
         "Section 12 of RFC 7271"
      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 }

   mplsLpsEventRevertiveMismatch NOTIFICATION-TYPE
      OBJECTS { mplsLpsStatusRevertiveMismatch }
      STATUS  current
      DESCRIPTION
         "An mplsLpsEventRevertiveMismatch notification is sent when
          the value of mplsLpsStatusRevertiveMismatch changes."
      ::= { mplsLpsNotifications 2 }

   mplsLpsEventProtecTypeMismatch NOTIFICATION-TYPE
      OBJECTS { mplsLpsStatusProtecTypeMismatch }
      STATUS  current
      DESCRIPTION
         "An mplsLpsEventProtecTypeMismatch notification is sent
          when the value of mplsLpsStatusProtecTypeMismatch changes."
      ::= { mplsLpsNotifications 3 }

   mplsLpsEventCapabilitiesMismatch NOTIFICATION-TYPE
      OBJECTS { mplsLpsStatusCapabilitiesMismatch }
      STATUS  current
      DESCRIPTION
         "An mplsLpsEventCapabilitiesMismatch notification is sent
          when the value of mplsLpsStatusCapabilitiesMismatch changes."
      ::= { mplsLpsNotifications 4 }

   mplsLpsEventPathConfigMismatch NOTIFICATION-TYPE
      OBJECTS { mplsLpsStatusPathConfigMismatch }
      STATUS  current
      DESCRIPTION
         "An mplsLpsEventPathConfigMismatch notification is sent
          when the value of mplsLpsStatusPathConfigMismatch changes."
      ::= { mplsLpsNotifications 5 }
```

```
   mplsLpsEventFopNoResponse NOTIFICATION-TYPE
      OBJECTS { mplsLpsStatusFopNoResponses }
      STATUS  current
      DESCRIPTION
         "An mplsLpsEventFopNoResponse notification is sent when the
          value of mplsLpsStatusFopNoResponses increments."
      ::= { mplsLpsNotifications 6 }

   mplsLpsEventFopTimeout NOTIFICATION-TYPE
      OBJECTS { mplsLpsStatusFopTimeouts }
      STATUS  current
      DESCRIPTION
         "An mplsLpsEventFopTimeout notification is sent when the
          value of mplsLpsStatusFopTimeouts increments."
      ::= { mplsLpsNotifications 7 }

   -- 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
          the MPLS-LPS-MIB module.  Such devices can provide linear
          protection and also be configured using this MIB module."
      MODULE -- this module
      MANDATORY-GROUPS {
         mplsLpsScalarGroup,
         mplsLpsTableGroup,
         mplsLpsMeTableGroup
      }
      GROUP        mplsLpsNotificationGroup
      DESCRIPTION
         "This group is only mandatory for those
          implementations that can efficiently implement
          the notifications contained in this group."
      ::= { mplsLpsCompliances 1 }
```

```
   -- Compliance requirement for read-only implementations.

   mplsLpsModuleReadOnlyCompliance MODULE-COMPLIANCE
      STATUS      current
      DESCRIPTION
         "Compliance statement for agents that only provide
          read-only support for the MPLS-LPS-MIB module."
      MODULE -- this module
      MANDATORY-GROUPS {
         mplsLpsScalarGroup,
         mplsLpsTableGroup,
         mplsLpsMeTableGroup
      }
      GROUP        mplsLpsNotificationGroup
      DESCRIPTION
         "This group is only mandatory for those
          implementations that can efficiently implement
          the notifications contained in this group."

      -- mplsLpsConfigTable

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

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

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

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

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

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

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

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

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

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

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

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

```
      -- mplsLpsMeConfigTable

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

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

      ::= { mplsLpsCompliances 2 }

   -- Units of conformance.

   mplsLpsScalarGroup OBJECT-GROUP
      OBJECTS {
              mplsLpsConfigDomainIndexNext,
              mplsLpsNotificationEnable
              }
      STATUS  current
      DESCRIPTION
         "Collection of objects needed for MPLS linear protection."
      ::= { mplsLpsGroups 1 }

   mplsLpsTableGroup OBJECT-GROUP
      OBJECTS {
         mplsLpsConfigDomainName,
         mplsLpsConfigRowStatus,
         mplsLpsConfigMode,
         mplsLpsConfigProtectionType,
         mplsLpsConfigRevertive,
         mplsLpsConfigSdThreshold,
         mplsLpsConfigSdBadSeconds,
         mplsLpsConfigSdGoodSeconds,
         mplsLpsConfigWaitToRestore,
         mplsLpsConfigHoldOff,
         mplsLpsConfigContinualTxInterval,
         mplsLpsConfigRapidTxInterval,
         mplsLpsConfigCommand,
         mplsLpsConfigCreationTime,
         mplsLpsConfigStorageType,
         mplsLpsStatusState,
         mplsLpsStatusReqRcv,
         mplsLpsStatusReqSent,
         mplsLpsStatusFpathPathRcv,
         mplsLpsStatusFpathPathSent,
```

```
         mplsLpsStatusRevertiveMismatch,
         mplsLpsStatusProtecTypeMismatch,
         mplsLpsStatusCapabilitiesMismatch,
         mplsLpsStatusPathConfigMismatch,
         mplsLpsStatusFopNoResponses,
         mplsLpsStatusFopTimeouts
         }
      STATUS  current
      DESCRIPTION
         "Collection of objects needed for MPLS linear protection
          configuration and statistics."
      ::= { mplsLpsGroups 2 }

   mplsLpsMeTableGroup OBJECT-GROUP
      OBJECTS {
         mplsLpsMeConfigDomain,
         mplsLpsMeConfigPath,
         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,
         mplsLpsEventRevertiveMismatch,
         mplsLpsEventProtecTypeMismatch,
         mplsLpsEventCapabilitiesMismatch,
         mplsLpsEventPathConfigMismatch,
         mplsLpsEventFopNoResponse,
         mplsLpsEventFopTimeout
         }
      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 network environments. The support for SET operations in a non-secure environment without proper protection opens devices to attack. These are the tables and objects and their sensitivity/vulnerability:

- The mplsLpsConfigTable is used to configure MPLS-TP linear protection domains. Improper manipulation of the objects in this table may result in different behaviors than what network operators originally intended, such as delaying traffic switching or causing a race condition with server-layer protection after network failure (mplsLpsConfigHoldOff), delaying or speeding up reversion after recovering from network failure (mplsLpsConfigWaitToRestore), unexpected traffic switching (mplsLpsConfigCommand), or the discontinuance of the operation of a protection switching control process (mplsLpsConfigMode, mplsLpsConfigProtectionType).

- The mplsLpsMeConfigTable is used to assign each ME to either the working path or the protection path. Improper manipulation of this object may result in the discontinuance of the operation of a protection switching control process.

- The notification is controlled by the mplsLpsNotificationEnable object. In the case of the discontinuance of a protection switching control process, network operators may not be notified if the mplsLpsNotificationEnable object is compromised.

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 mplsLpsStatusTable and the mplsLpsMeStatusTable collectively show the history and current status of the MPLS-TP linear protection domains. They can be used to estimate the performance and qualities of networks configured to use MPLS-TP linear protection. 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.

10. IANA Considerations

IANA has assigned an OID of decimal 22 for the MPLS Linear Protection MIB module (MPLS-LPS-MIB) specified in this document in the "MIB Transmission Group - MPLS STD MIB" subregistry of the "Internet-standard MIB - Transmission Group" registry.

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