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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   (IETF). It represents the consensus of the IETF community. It has
   received public review and has been approved for publication by the
   Internet Engineering Steering Group (IESG). Further information on
   Internet Standards is available in Section 2 of RFC 7841.

   Information about the current status of this document, any errata,
   and how to provide feedback on it may be obtained at
   http://www.rfc-editor.org/info/rfc8150.

Table of Contents

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:

   o MplsLpsReq: This textual convention describes an object that
      stores the PSC Request field of the PSC control packet.

   o MplsLpsFpathPath: This textual convention describes an object that
      stores the Fault Path (FPath) field and Data Path (Path) field of
      the PSC control packet.

   o MplsLpsCommand: This textual convention describes an object that
      allows a user to perform any action over a protection domain.

   o 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:

   o The notification mplsLpsEventSwitchover informs the management
      station about the switchover of the active path.

   o The notification mplsLpsEventRevertiveMismatch informs the
      management station about a provisioning mismatch in the revertive
      mode across the endpoint of the protection domain.

   o 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.

   o The notification mplsLpsEventCapabilitiesMismatch informs the
      management station about a provisioning mismatch in Capabilities
      TLVs across the endpoint of the protection domain.

   o The notification mplsLpsEventPathConfigMismatch informs the
      management station about a provisioning mismatch in the protection
      path configuration for PSC communication.

   o 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.

   o 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:

   o 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.

   o 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.

   o 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.

   o 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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         Mahadevapura Post
         Bangalore 560048
         India
         Email: kingstonsmiler@gmail.com

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          ETRI
          218 Gajeong-ro
          Yuseong-gu, Daejeon 34129
          South Korea
          Email: ryoo@etri.re.kr
          "
    DESCRIPTION
        "This MIB module supports the configuration and management of
        MPLS-TP linear protection domains.

    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:

   o 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).

   o 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.

   o 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:

   o 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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