        Link Management Protocol (LMP) Management Information Base (MIB)

Status of This Memo

Copyright Notice

Abstract

   This memo defines a portion of the Management Information Base (MIB)
   for use with network management protocols in the Internet community.
   In particular, it describes managed objects for modeling the Link
   Management Protocol (LMP).

Table of Contents

1.  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].

2.  Introduction

   Current work is under way in the IETF to specify a suite of protocols
   to be used as a common control plane and a separate common
   measurement plane.  Generalized MPLS (GMPLS) [RFC3471] and the Link
   Management Protocol [RFC4204] are key components of this
   standardization activity.  The primary purpose of LMP is to manage
   traffic engineering (TE) links.  Primary goals of LMP are the
   maintenance of the control channel connectivity, correlation of link
   properties, verification of data-bearing links, and detection and
   isolation of link faults.

   We describe in this document a MIB module that can be used to manage
   LMP implementations.  This MIB module covers both configuration and
   performance monitoring aspects of LMP.

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

3.  Terminology

   This document uses terminology from the document describing the Link
   Management Protocol [RFC4204].  An "LMP adjacency" is formed between
   two nodes that support the same capabilities, and LMP messages are
   exchanged between the node pair over control channels that form this
   adjacency.  Several control channels can be active at the same time.
   With the exception of messages related to control channel management,
   anytime an LMP message needs to be transferred to a neighbor node, it
   can be sent on any of the active control channels.  The control
   channels can also be used to exchange MPLS control plane information
   or routing information.

   LMP is designed to support aggregation of one or more data-bearing
   links into a traffic-engineering (TE) link.  The data-bearing links
   can be either component links or ports depending on their
   multiplexing capability (see [RFC4204] for distinction between port
   and component link).

   Each TE link is associated with an LMP adjacency, and one or more
   control channels are used to exchange LMP messages for a particular
   adjacency.  In turn, control channels are used to manage the TE links
   associated with the LMP adjacency.

4.  Feature Checklist

   The Link Management Protocol MIB module (LMP-MIB) is designed to
   satisfy the following requirements and constraints:

   -  The MIB module supports the enabling and disabling of LMP
      capability on LMP-capable interfaces of a photonic switch, optical
      cross-connect, or router.

   -  The MIB module is used to provide information about LMP
      adjacencies.

   -  Support is provided for configuration of the keep alive and link
      verification parameters.

   -  The MIB module is used to express the mapping between local and
      remote TE links, as well as local and remote interface identifiers
      for port or component link.

   -  Performance counters are provided for measuring LMP performance on
      a per-control channel basis.  Performance counters are also
      provided for measuring LMP performance on the data-bearing links.

Note that the LMP MIB module goes hand-in-hand with the TE Link
(TE-LINK-STD-MIB) MIB module [RFC4220].  The TE link table, which is
used to associate data-bearing links to TE links, is defined in the
TE Link MIB.  The TE link table in the LMP MIB module contains TE
link information specific to LMP.

5.  Outline

Configuring LMP through an optical device involves the following
steps:

-  Enabling LMP on LMP-capable interfaces through control channel
   configuration.

-  Optionally specifying link verification parameters.

-  Configuring the data-bearing links and associating them to the
   appropriate TE link (this association is stored in the
   ifStackTable of the Interfaces Group MIB).

TE links are managed by the control channels that run between the
same pair of nodes (LMP adjacency).

6.  Brief Description of MIB Objects

Sections 6.1-6.8 describe objects pertaining to LMP.  The MIB objects
were derived from the LMP document [RFC4204].

6.1.  lmpNbrTable

The remote node table is used to identify the pair of nodes that
exchange LMP messages over control channels.

6.2.  lmpControlChannelTable

The control channel table is used for enabling the LMP protocol on
LMP-capable interfaces.  A photonic switch, optical cross-connect, or
router creates an entry in this table for every LMP-capable interface
in that device.

6.3.  lmpControlChannelPerfTable

The control channel performance table is used for collecting LMP
performance counts on a per-control channel basis.  Each entry in the
lmpControlChannelTable has a corresponding entry in the
lmpControlChannelPerfTable.

6.4.  lmpTeLinkTable

   The TE link table is used for specifying LMP information associated
   with TE links.

6.5.  lmpLinkVerificationTable

   The link verification table is used for configuring the LMP link
   verification parameters of TE links.  For every TE link entry in the
   lmpTeLinkTable that supports the link verification procedure, there
   is a corresponding entry in the lmpLinkVerificationTable.

6.6.  lmpTeLinkPerfTable

   The TE link performance table is used for collecting LMP performance
   counts on a per-TE link basis.  Each entry in the lmpTeLinkTable has
   a corresponding entry in the lmpTeLinkPerfTable.

6.7.  lmpDataLinkTable

   The data-bearing link table is used to specify the data-bearing links
   that are associated with TE links.

6.8.  lmpDataLinkPerfTable

   The data-bearing link performance table is used for collecting LMP
   performance counts on data-bearing links.

7.  Example of LMP Control Channel Setup

   In this section, we provide a brief example of using the MIB
   objects described in section 9 to set up an LMP control channel.
   While this example is not meant to illustrate every nuance of the
   MIB module, it is intended as an aid to understanding some of the
   key concepts.  It is meant to be read after going through the MIB
   itself.

   Suppose that one would like to form an LMP adjacency between two
   nodes using two control channels.  Suppose also that there are
   three data-bearing links.  We also assume that the data-bearing
   links are ports (lambdas).  We also assume that the link
   verification procedure is not enabled.  The following example
   illustrates which rows and corresponding objects might be created
   to accomplish this.

   First, LMP must be enabled between the pair of nodes.

```
In lmpNbrTable:
{
   lmpNbrNodeId                         = 'c0000201'H, -- 192.0.2.1
   lmpNbrAdminStatus                    = up(1),
   lmpNbrRowStatus                      = createAndGo(4),
   lmpNbrStorageType                    = nonVolatile(3)
}
```

Then, the control channels must be set up.  These are created in
the lmpControlChannelTable.

```
In lmpControlChannelTable:
{
   lmpCcId                     = 1,
   lmpCcUnderlyingIfIndex      = 1,
   lmpCcIsIf                   = false(1),
   lmpCcAuthentication         = false(1),
   lmpCcHelloInterval          = 15,
   lmpCcHelloIntervalMin       = 15,
   lmpCcHelloIntervalMax       = 1000,
   lmpCcHelloDeadInterval      = 45,
   lmpCcHelloDeadIntervalMin   = 45,
   lmpCcHelloDeadIntervalMax   = 1000,
   lmpCcAdminStatus            = up(1),
   lmpCcRowStatus              = createAndGo(4),
   lmpCcStorageType            = nonVolatile(3)
}

{
   lmpCcId                     = 2,
   lmpCcUnderlyingIfIndex      = 2,
   lmpCcIsIf                   = false(1),
   lmpCcAuthentication         = false(1),
   lmpCcHelloInterval          = 15,
   lmpCcHelloIntervalMin       = 15,
   lmpCcHelloIntervalMax       = 1000,
   lmpCcHelloDeadInterval      = 45,
   lmpCcHelloDeadIntervalMin   = 45,
   lmpCcHelloDeadIntervalMax   = 1000,
   lmpCcAdminStatus            = up(1),
   lmpCcRowStatus              = createAndGo(4),
   lmpCcStorageType            = nonVolatile(3)
}
```

Next, the three data-bearing links are created.  For each data-
bearing link, an ifEntry with the same ifIndex needs to be created
beforehand.

```
   In lmpDataLinkTable:
   {
      ifIndex                       = 41,
      lmpDataLinkAddressType        = unknown(0),
      lmpDataLinkIpAddr             = ''H,
      lmpDataLinkRemoteIpAddress    = ''H,
      lmpDataLinkRemoteIfId         = 47,
      lmpDataLinkRowStatus          = createAndGo(4),
      lmpDataLinkStorageType        = nonVolatile(3)
   }

   {
      ifIndex                       = 43,
      lmpDataLinkAddressType        = unknown(0),
      lmpDataLinkIpAddr             = ''H,
      lmpDataLinkRemoteIpAddress    = ''H,
      lmpDataLinkRemoteIfId         = 42,
      lmpDataLinkRowStatus          = createAndGo(4),
      lmpDataLinkStorageType        = nonVolatile(3)
   }

   {
      ifIndex                       = 44,
      lmpDataLinkAddressType        = unknown(0),
      lmpDataLinkIpAddr             = ''H,
      lmpDataLinkRemoteIpAddress    = ''H,
      lmpDataLinkRemoteIfId         = 48,
      lmpDataLinkRowStatus          = createAndGo(4),
      lmpDataLinkStorageType        = nonVolatile(3)
   }
```

   Note that the data-bearing link type (lmpDataLinkType) does
   not need to be provisioned as it is automatically populated by the
   node.  The definition of the protection role (primary or
   secondary) for the data-bearing links is stored in the
   componentLinkTable of the TE Link MIB module [RFC4220].

   Then, a TE link is created as an ifEntry with ifType teLink in
   the ifTable.

   Once the TE link is created in the ifTable, a TE link entry
   is created in the LMP MIB module to specify TE link information
   specific to LMP.

```
   In lmpTeLinkTable:
   {
      ifIndex                 = 20,
      lmpTeLinkVerification   = true(2),
```

```
      lmpTeLinkFaultManagement      = true(2),
      lmpTeLinkDwdm                 = false(1),
      lmpTeLinkRowStatus            = createAndGo(4),
      lmpTeLinkStorageType          = nonVolatile(3)
   }

   and in lmpLinkVerificationTable:
   {
      ifIndex                        = 20,
      lmpLinkVerifyInterval          = 100,
      lmpLinkVerifyDeadInterval      = 300,
      lmpLinkVerifyTransportMechanism = j0Trace(3),
      lmpLinkVerifyAllLinks          = true(2),
      lmpLinkVerifyTransmissionRate  = 100000,
      lmpLinkVerifyWavelength        = 0,
      lmpLinkVerifyRowStatus         = createAndGo(4),
      lmpLinkVerifyStorageType       = nonVolatile(3)
   }
```

   The association between the data-bearing links and the TE links is
   stored in the ifStackTable [RFC2863].

   In parallel with the entry created in the lmpTeLinkTable, an entry
   may be created in the teLinkTable of TE Link MIB module
   [RFC4220].

8.  Application of the Interfaces Group to LMP

   The Interfaces Group [RFC2863] defines generic managed objects for
   managing interfaces.  This memo contains the media-specific
   extensions to the Interfaces Group for managing LMP control channels
   that are modeled as interfaces.  If the control channel as defined in
   the lmpControlChannelTable is modeled as an ifEntry, then the
   following definition applies.  An lmpControlChannelTable entry is
   designated as being represented as an Interfaces MIB ifEntry if the
   lmpControlChannelEntry object lmpCcIsIf is set to true (2).  In this
   case, the control channel SHOULD be modeled as an ifEntry and
   provide appropriate interface stacking as defined below.

   This memo assumes the interpretation of the Interfaces Group to be
   in accordance with [RFC2863], which states that the interfaces table
   (ifTable) contains information on the managed resource's
   interfaces and that each sub-layer below the internetwork layer of
   a network interface is considered an interface.  Since the LMP
   interface only carries control traffic, it is considered to be below
   the internetwork layer.  Thus, the LMP interface may be represented
   as an entry in the ifTable.  The interrelation of entries in the
   ifTable is defined by Interfaces Stack Group defined in [RFC2863].

When LMP control channels are modeled as interfaces, the interface
stack table must appear as follows for the LMP control channel
interfaces:

```
+--------------------------------------+
| LMP-interface ifType = lmp(227)      +
+--------------------------------------+
| Underlying Layer...                  +
+--------------------------------------+
```

In the above diagram, "Underlying Layer..." refers to the ifIndex
of any interface type over which the LMP interface will transmit
its traffic.  Note that if the underlying layer provides multiple
access to its media (i.e., Ethernet), then it is possible to stack
multiple LMP interfaces on top of this interface in parallel.

Note that it is not a requirement that LMP control channels be
modeled as interfaces.  It is acceptable that control channels
simply exist as logical connections between adjacent LMP-capable
nodes.  In this case, lmpCcIsIf is set to false(2) and no
corresponding entry is made in the ifTable.

8.1.  Support of the LMP Layer by ifTable

Some specific interpretations of ifTable for the LMP layer
follow.

Object        Use for the LMP layer.

ifIndex       Each LMP interface may be represented by an ifEntry.

ifDescr       Description of the LMP interface.

ifType        The value that is allocated for LMP is 227.
              This number has been assigned by the IANA.

ifSpeed       The total bandwidth in bits per second for use by
              the LMP layer.

ifPhysAddress Unused.

ifAdminStatus This variable indicates the administrator's intent
              as to whether LMP should be enabled, disabled, or
              running in some diagnostic testing mode on this
              interface.  Also see [RFC2863].

ifOperStatus  This value reflects the actual or operational
              status of LMP on this interface.

ifLastChange   See [RFC2863].

ifInOctets     The number of received octets over the interface,
               i.e., the number of octets received as LMP
               packets.

ifOutOctets    The number of transmitted octets over the
               interface, i.e., the number of octets transmitted
               as LMP packets.

ifInErrors     The number of LMP packets dropped due to
               uncorrectable errors.

ifInUnknownProtos
               The number of received packets discarded during
               packet header validation, including packets with
               unrecognized label values.

ifOutErrors    See [RFC2863].

ifName         Textual name (unique on this system) of the
               interface or an octet string of zero length.

ifLinkUpDownTrapEnable
               Default is disabled (2).

ifConnectorPresent
               Set to false (2).

ifHighSpeed    See [RFC2863].

ifHCInOctets   The 64-bit version of ifInOctets; supported if
               required by the compliance statements in [RFC2863].

ifHCOutOctets  The 64-bit version of ifOutOctets; supported if
               required by the compliance statements in [RFC2863].

ifAlias        The nonvolatile 'alias' name for the interface as
               specified by a network manager.

ifCounterDiscontinuityTime
               See [RFC2863].

9.  LMP MIB Module Definitions

    This MIB module IMPORTs objects from [RFC2578], [RFC2579], [RFC2580],
    [RFC2863], [RFC4001], and [RFC4220], and it has REFERENCE clauses to
    [RFC4204], [RFC4207], [RFC4209], [RFC3471], and [RFC2914].

LMP-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
    transmission, Unsigned32, Counter32, TimeTicks
        FROM SNMPv2-SMI             -- [RFC2578]

    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
        FROM SNMPv2-CONF            -- [RFC2580]

    TEXTUAL-CONVENTION, TruthValue, RowStatus, StorageType,
    TimeStamp
        FROM SNMPv2-TC              -- [RFC2579]

    InterfaceIndexOrZero, ifIndex
        FROM IF-MIB                 -- [RFC2863]

    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB       -- [RFC4001]

    teLinkRemoteIpAddr, teLinkIncomingIfId, TeLinkEncodingType
        FROM TE-LINK-STD-MIB;       -- [RFC4220]

lmpMIB MODULE-IDENTITY
    LAST-UPDATED "200601110000Z"  -- 11 January 2006
    ORGANIZATION "Common Control and Measurement Protocols (CCAMP)
                  Working Group"
    CONTACT-INFO
        "      Martin Dubuc
         Email:  dubuc.consulting@sympatico.ca

               Thomas D. Nadeau
         Email:  tnadeau@cisco.com

               Jonathan P. Lang
         Email:  jplang@ieee.org

               Evan McGinnis
         Email:  emcginnis@hammerheadsystems.com"


    DESCRIPTION

```
        "Copyright (C) 2006 The Internet Society.  This version of
         the MIB module is part of RFC 4327; see the RFC itself
         for full legal notices.

         This MIB module contains managed object definitions for
         the Link Management Protocol (LMP) as
         defined in 'Link Management Protocol'."

    -- Revision history.
    REVISION
        "200601110000Z"  -- 11 January 2006
    DESCRIPTION
        "Initial version published as RFC 4327"
    ::= { transmission 227 }

-- Textual Conventions

LmpInterval ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS        current
    DESCRIPTION
        "The interval delay in milliseconds."
    SYNTAX        Unsigned32 (1..65535)

LmpRetransmitInterval ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS        current
    DESCRIPTION
        "The retransmission interval delay in milliseconds."
    SYNTAX        Unsigned32 (1..4294967295)

LmpNodeId ::= TEXTUAL-CONVENTION
    DISPLAY-HINT  "1d.1d.1d.1d"
    STATUS        current
    DESCRIPTION
        "Represents a Node ID in network byte order.  Node ID is an
         address of type IPv4."
    REFERENCE
        "Section 1.1 of Link Management Protocol, RFC 4204"
    SYNTAX        OCTET STRING(SIZE(4))


-- Top level components of this MIB

-- Notifications
lmpNotifications OBJECT IDENTIFIER ::= { lmpMIB 0 }
-- Tables, Scalars
lmpObjects      OBJECT IDENTIFIER ::= { lmpMIB 1 }
```

```
-- Conformance
lmpConformance    OBJECT IDENTIFIER ::= { lmpMIB 2 }


lmpAdminStatus OBJECT-TYPE
   SYNTAX         INTEGER { up(1), down(2) }
   MAX-ACCESS     read-write
   STATUS         current
   DESCRIPTION
       "The desired operational status of LMP on the node.
        Implementations should save the value of this object in
        persistent memory so that it survives restarts or reboot."
   DEFVAL        { up }
   ::= { lmpObjects 1 }

lmpOperStatus OBJECT-TYPE
   SYNTAX         INTEGER { up(1), down(2) }
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "The actual operational status of LMP on the node."
   ::= { lmpObjects 2 }


-- LMP Neighbor Table

lmpNbrTable OBJECT-TYPE
   SYNTAX         SEQUENCE OF LmpNbrEntry
   MAX-ACCESS     not-accessible
   STATUS         current
   DESCRIPTION
       "This table specifies the neighbor node(s) to which control
        channels may be established."
   ::= { lmpObjects 3 }

lmpNbrEntry OBJECT-TYPE
   SYNTAX         LmpNbrEntry
   MAX-ACCESS     not-accessible
   STATUS         current
   DESCRIPTION
       "An entry in this table is created by a LMP-enabled device for
        every pair of nodes that can establish control channels."
   INDEX         { lmpNbrNodeId }
   ::= { lmpNbrTable 1 }

LmpNbrEntry ::= SEQUENCE {
  lmpNbrNodeId               LmpNodeId,
  lmpNbrRetransmitInterval   LmpRetransmitInterval,
```

```
   lmpNbrRetryLimit            Unsigned32,
   lmpNbrRetransmitDelta       Unsigned32,
   lmpNbrAdminStatus           INTEGER,
   lmpNbrOperStatus            INTEGER,
   lmpNbrRowStatus             RowStatus,
   lmpNbrStorageType           StorageType
}

lmpNbrNodeId OBJECT-TYPE
    SYNTAX         LmpNodeId
    MAX-ACCESS     not-accessible
    STATUS         current
    DESCRIPTION
        "This is a unique index for an entry in the LmpNbrTable.
         This value represents the remote Node ID."
    ::= { lmpNbrEntry 1 }

lmpNbrRetransmitInterval OBJECT-TYPE
    SYNTAX         LmpRetransmitInterval
    MAX-ACCESS     read-create
    STATUS         current
    DESCRIPTION
        "This object specifies the initial retransmission interval that
         is used for the retransmission of messages that require
         acknowledgement.  This object along with lmpNbrRetryLimit is
         used to implement congestion-handling mechanism as defined in
         Section 10 of the Link Management Protocol specification,
         which is based on RFC 2914."
    REFERENCE
        "Link Management Protocol, RFC 4204.

         Congestion Control Principles, RFC 2914."
    DEFVAL         { 500 }
    ::= { lmpNbrEntry 2 }

lmpNbrRetryLimit OBJECT-TYPE
    SYNTAX         Unsigned32
    MAX-ACCESS     read-create
    STATUS         current
    DESCRIPTION
        "This object specifies the maximum number of times a message
         is transmitted without being acknowledged.  A value of 0 is used
         to indicate that a node should never stop retransmission.
         This object along with lmpNbrRetransmitInterval is
         used to implement congestion-handling mechanism as defined in
         Section 10 of the Link Management Protocol specification,
         which is based on RFC 2914."
    REFERENCE
```

```
         "Link Management Protocol, RFC 4204.

          Congestion Control Principles, RFC 2914."
    DEFVAL          { 3 }
    ::= { lmpNbrEntry 3 }


lmpNbrRetransmitDelta OBJECT-TYPE
    SYNTAX          Unsigned32
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
         "This object governs the speed with which the sender increases
          the retransmission interval as explained in section 10 of the
          Link Management Protocol specification, which is based on
          RFC 2914.  This value is a power used to express the
          exponential backoff.  The ratio of two successive retransmission
          intervals is (1 + Delta)."
    REFERENCE
         "Link Management Protocol, RFC 4204.

          Congestion Control Principles, RFC 2914."
    DEFVAL          { 1 }
    ::= { lmpNbrEntry 4 }


lmpNbrAdminStatus OBJECT-TYPE
    SYNTAX          INTEGER { up(1), down(2) }
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
         "The desired operational status of LMP to this remote node."
    ::= { lmpNbrEntry 5 }


lmpNbrOperStatus OBJECT-TYPE
    SYNTAX          INTEGER { up(1), down(2) }
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
         "The actual operational status of LMP to this remote node."
    ::= { lmpNbrEntry 6 }


lmpNbrRowStatus OBJECT-TYPE
    SYNTAX          RowStatus
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
         "This variable is used to create, modify, and/or
          delete a row in this table.  None of the writable objects
          in a row can be changed if the status is active(1).
```

          All read-create objects must have valid and consistent
          values before the row can be activated."
       ::= { lmpNbrEntry 7 }


lmpNbrStorageType OBJECT-TYPE
    SYNTAX          StorageType
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
         "The storage type for this conceptual row in the
          lmpNbrTable.  Conceptual rows having the value
          'permanent' need not allow write-access to any
          columnar object in the row."
    DEFVAL          { nonVolatile }
    ::= { lmpNbrEntry 8 }

-- End of lmpNbrTable


lmpCcHelloIntervalDefault OBJECT-TYPE
    SYNTAX          LmpInterval
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
         "This object specifies the default value for the HelloInterval
          parameter used in the Hello protocol keep-alive phase.  It
          indicates how frequently LMP Hello messages will be sent.  It
          is used a the default value for lmpCcHelloInterval.
          Implementations should save the value of this object in
          persistent memory so that it survives restarts or reboot."
    REFERENCE
         "Link Management Protocol, RFC 4204"
    ::= { lmpObjects 4 }

lmpCcHelloIntervalDefaultMin OBJECT-TYPE
    SYNTAX          LmpInterval
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
         "This object specifies the default minimum value for the
          HelloInterval parameter.  It is used as a default value
          for lmpCcHelloIntervalMin.  Implementations should save the
          value of this object in persistent memory so that it survives
          restarts or reboot."
    ::= { lmpObjects 5 }

lmpCcHelloIntervalDefaultMax OBJECT-TYPE
    SYNTAX          LmpInterval

```
   MAX-ACCESS     read-write
   STATUS         current
   DESCRIPTION
       "This object specifies the default maximum value for the
        HelloInterval parameter.  It is used as a default value
        for lmpCcHelloIntervalMax.  Implementations should save the
        value of this object in persistent memory so that it survives
        restarts or reboot."
   ::= { lmpObjects 6 }

lmpCcHelloDeadIntervalDefault OBJECT-TYPE
   SYNTAX         LmpInterval
   MAX-ACCESS     read-write
   STATUS         current
   DESCRIPTION
       "This object specifies the default HelloDeadInterval parameter
        to use in the Hello protocol keep-alive phase.  It indicates
        how long a device should wait before declaring the control
        channel dead.  The HelloDeadInterval parameter should be at
        least three times the value of HelloInterval.  It is used as
        a default value for lmpCcHelloDeadInterval.  Implementations
        should save the value of this object in persistent memory so
        that it survives restarts or reboot."
   REFERENCE
       "Link Management Protocol, RFC 4204"
   ::= { lmpObjects 7 }

lmpCcHelloDeadIntervalDefaultMin OBJECT-TYPE
   SYNTAX         LmpInterval
   MAX-ACCESS     read-write
   STATUS         current
   DESCRIPTION
       "This object specifies the default minimum value for the
        HelloDeadInterval parameter.  It is used as a default value
        for lmpCcHelloDeadIntervalMin.  Implementations should save
        the value of this object in persistent memory so that it
        survives restarts or reboot."
   ::= { lmpObjects 8 }

lmpCcHelloDeadIntervalDefaultMax OBJECT-TYPE
   SYNTAX         LmpInterval
   MAX-ACCESS     read-write
   STATUS         current
   DESCRIPTION
       "This object specifies the default maximum value for the
        HelloDeadInterval parameter.  It is used as a default value
        for lmpCcHelloDeadIntervalMax.  Implementations should save the
        value of this object in persistent memory so that it survives
```

```
        restarts or reboot."
    ::= { lmpObjects 9 }


-- LMP Control Channel Table

lmpControlChannelTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF LmpControlChannelEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This table specifies LMP control channel information."
    ::= { lmpObjects 10 }

lmpControlChannelEntry OBJECT-TYPE
    SYNTAX          LmpControlChannelEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry in this table is created by a LMP-enabled device for
         every control channel.  Whenever a new entry is created with
         lmpCcIsIf set to true(2), then a corresponding entry is
         created in ifTable as well (see RFC 2863)."
    INDEX           { lmpCcId }
    ::= { lmpControlChannelTable 1 }

LmpControlChannelEntry ::= SEQUENCE {
  lmpCcId                          Unsigned32,
  lmpCcUnderlyingIfIndex           InterfaceIndexOrZero,
  lmpCcIsIf                        TruthValue,
  lmpCcNbrNodeId                   LmpNodeId,
  lmpCcRemoteId                    Unsigned32,
  lmpCcRemoteAddressType           InetAddressType,
  lmpCcRemoteIpAddr                InetAddress,
  lmpCcSetupRole                   INTEGER,
  lmpCcAuthentication              TruthValue,
  lmpCcHelloInterval               LmpInterval,
  lmpCcHelloIntervalMin            LmpInterval,
  lmpCcHelloIntervalMax            LmpInterval,
  lmpCcHelloIntervalNegotiated     LmpInterval,
  lmpCcHelloDeadInterval           LmpInterval,
  lmpCcHelloDeadIntervalMin        LmpInterval,
  lmpCcHelloDeadIntervalMax        LmpInterval,
  lmpCcHelloDeadIntervalNegotiated LmpInterval,
  lmpCcLastChange                  TimeTicks,
  lmpCcAdminStatus                 INTEGER,
  lmpCcOperStatus                  INTEGER,
  lmpCcRowStatus                   RowStatus,
```

```
  lmpCcStorageType                          StorageType
}


lmpCcId OBJECT-TYPE
   SYNTAX         Unsigned32 (1..4294967295)
   MAX-ACCESS    not-accessible
   STATUS        current
   DESCRIPTION
       "This value represents the local control channel identifier.
        The control channel identifier is a non-zero 32-bit number."
   ::= { lmpControlChannelEntry 1 }

lmpCcUnderlyingIfIndex OBJECT-TYPE
   SYNTAX         InterfaceIndexOrZero
   MAX-ACCESS    read-create
   STATUS        current
   DESCRIPTION
       "If lmpCcIsIf is set to true(1), this object carries the
        index into the ifTable of the entry that represents the
        LMP interface over which LMP will transmit its traffic.
        If this object is set to zero, but lmpCcIsIf is set to
        true(1), the control channel is not currently associated
        with any underlying interface and the control channel's
        operational status must not be up(1), nor should the
        control channel forward or receive traffic.
        If lmpCcIsIf is set to false(2), this object should be set
        to zero and should be ignored."
   ::= { lmpControlChannelEntry 2 }

lmpCcIsIf OBJECT-TYPE
   SYNTAX         TruthValue
   MAX-ACCESS    read-create
   STATUS        current
   DESCRIPTION
       "In implementations where the control channels are modeled
        as interfaces, the value of this object is true(1) and
        this control channel is represented by an interface in
        the interfaces group table as indicated by the value of
        lmpCcUnderlyingIfIndex.  If control channels are not
        modeled as interfaces, the value of this object is
        false(2) and there is no corresponding interface for
        this control channel in the interfaces group table,
        and the value of lmpCcUnderlyingIfIndex should be
        ignored."
   ::= { lmpControlChannelEntry 3 }

lmpCcNbrNodeId OBJECT-TYPE
   SYNTAX         LmpNodeId
```

```
   MAX-ACCESS      read-create
   STATUS          current
   DESCRIPTION
       "This is the Node ID of the control channel remote node.
        This value either is configured or gets created by the node
        when a Config message is received or when an outgoing Config
        message is acknowledged by the remote node."
   ::= { lmpControlChannelEntry 4 }

lmpCcRemoteId OBJECT-TYPE
   SYNTAX          Unsigned32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This value represents the remote control channel identifier
        (32-bit number).  It is determined during the negotiation
        phase.  A value of zero means that the remote control channel
        identifier has not yet been learnt."
   ::= { lmpControlChannelEntry 5 }

lmpCcRemoteAddressType OBJECT-TYPE
   SYNTAX          InetAddressType
   MAX-ACCESS      read-create
   STATUS          current
   DESCRIPTION
       "This value represents the remote control channel IP address
        type.  In point-to-point configuration, this value can be set
        to unknown(0)."
   ::= { lmpControlChannelEntry 6 }

lmpCcRemoteIpAddr OBJECT-TYPE
   SYNTAX          InetAddress
   MAX-ACCESS      read-create
   STATUS          current
   DESCRIPTION
       "This value represents the remote control channel Internet
        address for numbered control channel.  The type of this
        address is determined by lmpCcRemoteAddressType.
        Control channel must be numbered on non-point-to-point
        configuration.  For point-to-point configuration, the
        remote control channel address can be of type unknown
        in which case this object must be a zero-length string.  The
        lmpCcRemoteId object then identifies the unnumbered
        address."
   ::= { lmpControlChannelEntry 7 }

lmpCcSetupRole OBJECT-TYPE
   SYNTAX          INTEGER { active(1), passive(2) }
```

```
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "The role that this node should take during establishment
         of this control channel.  An active node will initiate
         establishment.  A passive node will wait for the remote node
         to initiate.  A pair of nodes that both take the passive role
         will never establish communications."
    DEFVAL          { active }
    ::= { lmpControlChannelEntry 8 }

lmpCcAuthentication OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object indicates whether the control channel must use
         authentication."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpControlChannelEntry 9 }

lmpCcHelloInterval OBJECT-TYPE
    SYNTAX          LmpInterval
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object specifies the value of the HelloInterval
         parameter.  The default value for this object should be
         set to lmpCcHelloIntervalDefault."
    ::= { lmpControlChannelEntry 10 }

lmpCcHelloIntervalMin OBJECT-TYPE
    SYNTAX          LmpInterval
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object specifies the minimum value for the
         HelloInterval parameter.  The default value for this
         object should be set to lmpCcHelloIntervalMinDefault."
    ::= { lmpControlChannelEntry 11 }

lmpCcHelloIntervalMax OBJECT-TYPE
    SYNTAX          LmpInterval
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object specifies the maximum value for the
```

```
        HelloInterval parameter.  The default value for this
        object should be set to lmpCcHelloIntervalMaxDefault."
   ::= { lmpControlChannelEntry 12 }


lmpCcHelloIntervalNegotiated OBJECT-TYPE
   SYNTAX         LmpInterval
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "Once the control channel is active, this object represents
        the negotiated HelloInterval value."
   ::= { lmpControlChannelEntry 13 }


lmpCcHelloDeadInterval OBJECT-TYPE
   SYNTAX         LmpInterval
   MAX-ACCESS     read-create
   STATUS         current
   DESCRIPTION
       "This object specifies the value of the HelloDeadInterval
        parameter.  The default value for this object should be
        set to lmpCcHelloDeadIntervalDefault."
   ::= { lmpControlChannelEntry 14 }


lmpCcHelloDeadIntervalMin OBJECT-TYPE
   SYNTAX         LmpInterval
   MAX-ACCESS     read-create
   STATUS         current
   DESCRIPTION
       "This object specifies the minimum value for the
        HelloDeadInterval parameter.  The default value for this
        object should be set to lmpCcHelloDeadIntervalMinDefault."
   ::= { lmpControlChannelEntry 15 }


lmpCcHelloDeadIntervalMax OBJECT-TYPE
   SYNTAX         LmpInterval
   MAX-ACCESS     read-create
   STATUS         current
   DESCRIPTION
       "This object specifies the maximum value for the
        HelloDeadInterval parameter.  The default value for this
        object should be set to lmpCcHelloIntervalMaxDefault."
   ::= { lmpControlChannelEntry 16 }


lmpCcHelloDeadIntervalNegotiated OBJECT-TYPE
   SYNTAX         LmpInterval
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
```

          "Once the control channel is active, this object represents
           the negotiated HelloDeadInterval value."
      ::= { lmpControlChannelEntry 17 }


   lmpCcLastChange OBJECT-TYPE
      SYNTAX        TimeTicks
      MAX-ACCESS    read-only
      STATUS        current
      DESCRIPTION
          "The value of sysUpTime at the time the control channel entered
           its current operational state.  If the current state was
           entered prior to the last re-initialization of the local
           network management subsystem, then this object contains a
           zero value."
      ::= { lmpControlChannelEntry 18 }


   lmpCcAdminStatus OBJECT-TYPE
      SYNTAX        INTEGER { up(1), down(2) }
      MAX-ACCESS    read-create
      STATUS        current
      DESCRIPTION
          "The desired operational status of this control channel."
      ::= { lmpControlChannelEntry 19 }


   lmpCcOperStatus OBJECT-TYPE
      SYNTAX        INTEGER {
                        up(1),
                        down(2),
                        configSnd(3),
                        configRcv(4),
                        active(5),
                        goingDown(6)
                    }
      MAX-ACCESS    read-only
      STATUS        current
      DESCRIPTION
          "The actual operational status of this control channel."
      ::= { lmpControlChannelEntry 20 }


   lmpCcRowStatus OBJECT-TYPE
      SYNTAX        RowStatus
      MAX-ACCESS    read-create
      STATUS        current
      DESCRIPTION
          "This variable is used to create, modify, and/or
           delete a row in this table.  None of the writable objects
           in a row can be changed if the status is active(1).
           All read-create objects must have valid and consistent

```
        values before the row can be activated."
    ::= { lmpControlChannelEntry 21 }

lmpCcStorageType OBJECT-TYPE
    SYNTAX          StorageType
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "The storage type for this conceptual row in the
         lmpControlChannelTable.  Conceptual rows having the value
         'permanent' need not allow write-access to any
         columnar object in the row."
    DEFVAL          { nonVolatile }
    ::= { lmpControlChannelEntry 22 }

-- End of lmpControlChannelTable


-- LMP Control Channel Performance Table

lmpControlChannelPerfTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF LmpControlChannelPerfEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This table specifies LMP control channel performance
         counters."
    ::= { lmpObjects 11 }

lmpControlChannelPerfEntry OBJECT-TYPE
    SYNTAX          LmpControlChannelPerfEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry in this table is created by a LMP-enabled device for
         every control channel.  lmpCcCounterDiscontinuityTime is used
         to indicate potential discontinuity for all counter objects
         in this table."
    INDEX           { lmpCcId }
    ::= { lmpControlChannelPerfTable 1 }

LmpControlChannelPerfEntry ::= SEQUENCE {
  lmpCcInOctets                     Counter32,
  lmpCcInDiscards                   Counter32,
  lmpCcInErrors                     Counter32,
  lmpCcOutOctets                    Counter32,
  lmpCcOutDiscards                  Counter32,
  lmpCcOutErrors                    Counter32,
```

```
   lmpCcConfigReceived                 Counter32,
   lmpCcConfigSent                     Counter32,
   lmpCcConfigRetransmit               Counter32,
   lmpCcConfigAckReceived              Counter32,
   lmpCcConfigAckSent                  Counter32,
   lmpCcConfigNackReceived             Counter32,
   lmpCcConfigNackSent                 Counter32,
   lmpCcHelloReceived                  Counter32,
   lmpCcHelloSent                      Counter32,
   lmpCcBeginVerifyReceived            Counter32,
   lmpCcBeginVerifySent                Counter32,
   lmpCcBeginVerifyRetransmit          Counter32,
   lmpCcBeginVerifyAckReceived         Counter32,
   lmpCcBeginVerifyAckSent             Counter32,
   lmpCcBeginVerifyNackReceived        Counter32,
   lmpCcBeginVerifyNackSent            Counter32,
   lmpCcEndVerifyReceived              Counter32,
   lmpCcEndVerifySent                  Counter32,
   lmpCcEndVerifyRetransmit            Counter32,
   lmpCcEndVerifyAckReceived           Counter32,
   lmpCcEndVerifyAckSent               Counter32,
   lmpCcTestStatusSuccessReceived      Counter32,
   lmpCcTestStatusSuccessSent          Counter32,
   lmpCcTestStatusSuccessRetransmit    Counter32,
   lmpCcTestStatusFailureReceived      Counter32,
   lmpCcTestStatusFailureSent          Counter32,
   lmpCcTestStatusFailureRetransmit    Counter32,
   lmpCcTestStatusAckReceived          Counter32,
   lmpCcTestStatusAckSent              Counter32,
   lmpCcLinkSummaryReceived            Counter32,
   lmpCcLinkSummarySent                Counter32,
   lmpCcLinkSummaryRetransmit          Counter32,
   lmpCcLinkSummaryAckReceived         Counter32,
   lmpCcLinkSummaryAckSent             Counter32,
   lmpCcLinkSummaryNackReceived        Counter32,
   lmpCcLinkSummaryNackSent            Counter32,
   lmpCcChannelStatusReceived          Counter32,
   lmpCcChannelStatusSent              Counter32,
   lmpCcChannelStatusRetransmit        Counter32,
   lmpCcChannelStatusAckReceived       Counter32,
   lmpCcChannelStatusAckSent           Counter32,
   lmpCcChannelStatusReqReceived       Counter32,
   lmpCcChannelStatusReqSent           Counter32,
   lmpCcChannelStatusReqRetransmit     Counter32,
   lmpCcChannelStatusRspReceived       Counter32,
   lmpCcChannelStatusRspSent           Counter32,
   lmpCcCounterDiscontinuityTime       TimeStamp
}
```

```
lmpCcInOctets OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The total number of LMP message octets received on the
             control channel."
    ::= { lmpControlChannelPerfEntry 1 }

lmpCcInDiscards OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of inbound packets that were chosen to be
             discarded even though no errors had been detected.  One
             possible reason for discarding such a packet could be to
             free up buffer space."
    ::= { lmpControlChannelPerfEntry 2 }

lmpCcInErrors OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of inbound packets that contained errors
             preventing them from being processed by LMP."
    ::= { lmpControlChannelPerfEntry 3 }

lmpCcOutOctets OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The total number of LMP message octets transmitted out of
             the control channel."
    ::= { lmpControlChannelPerfEntry 4 }

lmpCcOutDiscards OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of outbound packets that were chosen to be
             discarded even though no errors had been detected to
             prevent their being transmitted.  One possible reason
             for discarding such a packet could be to free up buffer
             space."
```

```
   ::= { lmpControlChannelPerfEntry 5 }


lmpCcOutErrors OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
            "The number of outbound packets that could not be
             transmitted because of errors."
    ::= { lmpControlChannelPerfEntry 6 }


lmpCcConfigReceived OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "This object counts the number of Config messages that have
         been received on this control channel."
    ::= { lmpControlChannelPerfEntry 7 }


lmpCcConfigSent OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "This object counts the number of Config messages that have
         been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 8 }


lmpCcConfigRetransmit OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "This object counts the number of Config messages that
         have been retransmitted over this control channel."
    ::= { lmpControlChannelPerfEntry 9 }


lmpCcConfigAckReceived OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "This object counts the number of ConfigAck messages that have
         been received on this control channel."
    ::= { lmpControlChannelPerfEntry 10 }


lmpCcConfigAckSent OBJECT-TYPE
```

```
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ConfigAck messages that have
         been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 11 }


lmpCcConfigNackReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ConfigNack messages that have
         been received on this control channel."
    ::= { lmpControlChannelPerfEntry 12 }


lmpCcConfigNackSent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ConfigNack messages that have
         been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 13 }


lmpCcHelloReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of Hello messages that have
         been received on this control channel."
    ::= { lmpControlChannelPerfEntry 14 }


lmpCcHelloSent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of Hello messages that have
         been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 15 }


lmpCcBeginVerifyReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
```

```
    DESCRIPTION
        "This object counts the number of BeginVerify messages that have
         been received on this control channel."
    ::= { lmpControlChannelPerfEntry 16 }

lmpCcBeginVerifySent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of BeginVerify messages that have
         been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 17 }

lmpCcBeginVerifyRetransmit OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of BeginVerify messages that
         have been retransmitted over this control channel."
    ::= { lmpControlChannelPerfEntry 18 }

lmpCcBeginVerifyAckReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of BeginVerifyAck messages that
         have been received on this control channel."
    ::= { lmpControlChannelPerfEntry 19 }

lmpCcBeginVerifyAckSent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of BeginVerifyAck messages that
         have been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 20 }

lmpCcBeginVerifyNackReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of BeginVerifyNack messages that
         have been received on this control channel."
```

       ::= { lmpControlChannelPerfEntry 21 }


   lmpCcBeginVerifyNackSent OBJECT-TYPE
       SYNTAX          Counter32
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "This object counts the number of BeginVerifyNack messages that
            have been sent on this control channel."
       ::= { lmpControlChannelPerfEntry 22 }


   lmpCcEndVerifyReceived OBJECT-TYPE
       SYNTAX          Counter32
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "This object counts the number of EndVerify messages that have
            been received on this control channel."
       ::= { lmpControlChannelPerfEntry 23 }


   lmpCcEndVerifySent OBJECT-TYPE
       SYNTAX          Counter32
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "This object counts the number of EndVerify messages that have
            been sent on this control channel."
       ::= { lmpControlChannelPerfEntry 24 }


   lmpCcEndVerifyRetransmit OBJECT-TYPE
       SYNTAX          Counter32
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "This object counts the number of EndVerify messages that
            have been retransmitted over this control channel."
       ::= { lmpControlChannelPerfEntry 25 }


   lmpCcEndVerifyAckReceived OBJECT-TYPE
       SYNTAX          Counter32
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "This object counts the number of EndVerifyAck messages that
            have been received on this control channel."
       ::= { lmpControlChannelPerfEntry 26 }


   lmpCcEndVerifyAckSent OBJECT-TYPE

```
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of EndVerifyAck messages that
        have been sent on this control channel."
   ::= { lmpControlChannelPerfEntry 27 }

lmpCcTestStatusSuccessReceived OBJECT-TYPE
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of TestStatusSuccess messages
        that have been received on this control channel."
   ::= { lmpControlChannelPerfEntry 28 }

lmpCcTestStatusSuccessSent OBJECT-TYPE
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of TestStatusSuccess messages
        that have been sent on this control channel."
   ::= { lmpControlChannelPerfEntry 29 }

lmpCcTestStatusSuccessRetransmit OBJECT-TYPE
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of TestStatusSuccess messages
        that have been retransmitted over this control channel."
   ::= { lmpControlChannelPerfEntry 30 }

lmpCcTestStatusFailureReceived OBJECT-TYPE
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of TestStatusFailure messages
        that have been received on this control channel."
   ::= { lmpControlChannelPerfEntry 31 }

lmpCcTestStatusFailureSent OBJECT-TYPE
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
```

```
    DESCRIPTION
        "This object counts the number of TestStatusFailure messages
         that have been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 32 }


lmpCcTestStatusFailureRetransmit OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of TestStatusFailure messages
         that have been retransmitted over this control channel."
    ::= { lmpControlChannelPerfEntry 33 }


lmpCcTestStatusAckReceived OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of TestStatusAck messages
         that have been received on this control channel."
    ::= { lmpControlChannelPerfEntry 34 }


lmpCcTestStatusAckSent OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of TestStatusAck messages
         that have been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 35 }


lmpCcLinkSummaryReceived OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of LinkSummary messages
         that have been received on this control channel."
    ::= { lmpControlChannelPerfEntry 36 }


lmpCcLinkSummarySent OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of LinkSummary messages
         that have been sent on this control channel."
```

```
   ::= { lmpControlChannelPerfEntry 37 }

lmpCcLinkSummaryRetransmit OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of LinkSummary messages that
        have been retransmitted over this control channel."
   ::= { lmpControlChannelPerfEntry 38 }

lmpCcLinkSummaryAckReceived OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of LinkSummaryAck messages
        that have been received on this control channel."
   ::= { lmpControlChannelPerfEntry 39 }

lmpCcLinkSummaryAckSent OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of LinkSummaryAck messages
        that have been sent on this control channel."
   ::= { lmpControlChannelPerfEntry 40 }

lmpCcLinkSummaryNackReceived OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of LinkSummaryNack messages
        that have been received on this control channel."
   ::= { lmpControlChannelPerfEntry 41 }

lmpCcLinkSummaryNackSent OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of LinkSummaryNack messages
        that have been sent on this control channel."
   ::= { lmpControlChannelPerfEntry 42 }

lmpCcChannelStatusReceived OBJECT-TYPE
```

```
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of ChannelStatus messages
        that have been received on this control channel."
   ::= { lmpControlChannelPerfEntry 43 }

lmpCcChannelStatusSent OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of ChannelStatus messages
        that have been sent on this control channel."
   ::= { lmpControlChannelPerfEntry 44 }

lmpCcChannelStatusRetransmit OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of ChannelStatus messages
        that have been retransmitted on this control channel."
   ::= { lmpControlChannelPerfEntry 45 }

lmpCcChannelStatusAckReceived OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of ChannelStatusAck messages
        that have been received on this control channel."
   ::= { lmpControlChannelPerfEntry 46 }

lmpCcChannelStatusAckSent OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of ChannelStatus messages
        that have been sent on this control channel."
   ::= { lmpControlChannelPerfEntry 47 }

lmpCcChannelStatusReqReceived OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
```

```
    DESCRIPTION
        "This object counts the number of ChannelStatusRequest messages
         that have been received on this control channel."
    ::= { lmpControlChannelPerfEntry 48 }


lmpCcChannelStatusReqSent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatusRequest messages
         that have been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 49 }


lmpCcChannelStatusReqRetransmit OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatusRequest messages
         that have been retransmitted on this control channel."
    ::= { lmpControlChannelPerfEntry 50 }


lmpCcChannelStatusRspReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatusResponse messages
         that have been received on this control channel."
    ::= { lmpControlChannelPerfEntry 51 }


lmpCcChannelStatusRspSent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatusResponse messages
         that have been sent on this control channel."
    ::= { lmpControlChannelPerfEntry 52 }


lmpCcCounterDiscontinuityTime OBJECT-TYPE
    SYNTAX          TimeStamp
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The value of sysUpTime on the most recent occasion at which
         any one or more of this control channel's counters suffered a
```

                discontinuity.  The relevant counters are the specific
                instances associated with this control channel of any
                Counter32 object contained in the lmpControlChannelPerfTable.
                If no such discontinuities have occurred since the last re-
                initialization of the local management subsystem, then this
                object contains a zero value."
         ::= { lmpControlChannelPerfEntry 53 }

-- End of lmpControlChannelPerfTable


-- LMP TE Link Table

lmpTeLinkTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF LmpTeLinkEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This table specifies the LMP-specific TE link information.
         Overall TE link information is kept in three separate tables:
         ifTable for interface-specific information, lmpTeLinkTable
         for LMP specific information, and teLinkTable for generic
         TE link information.  ifIndex is the common index to all
         tables."
    ::= { lmpObjects 12 }

lmpTeLinkEntry OBJECT-TYPE
    SYNTAX          LmpTeLinkEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry in this table exists for each ifEntry with an
         ifType of teLink(200) that is managed by LMP.  An ifEntry with
         an ifIndex must exist before the corresponding lmpTeLinkEntry is
         created.  If a TE link entry in the ifTable is destroyed, then
         so is the corresponding entry in the lmpTeLinkTable.  The
         administrative status value is controlled from the ifEntry.
         Setting the administrative status to testing prompts LMP to
         start link verification on the TE link.  Information about the
         TE link that is not LMP specific is contained in teLinkTable of
         the TE-LINK-STD-MIB MIB module."
    INDEX           { ifIndex }
    ::= { lmpTeLinkTable 1 }

LmpTeLinkEntry ::= SEQUENCE {
  lmpTeLinkNbrRemoteNodeId  LmpNodeId,
  lmpTeLinkVerification     TruthValue,
  lmpTeLinkFaultManagement  TruthValue,

```
   lmpTeLinkDwdm                 TruthValue,
   lmpTeLinkOperStatus           INTEGER,
   lmpTeLinkRowStatus            RowStatus,
   lmpTeLinkStorageType          StorageType
}


lmpTeLinkNbrRemoteNodeId OBJECT-TYPE
    SYNTAX        LmpNodeId
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "This is the Node ID of the TE link remote node.  This value
         may be learned during control channel parameter negotiation
         phase (in the Config message).  Node ID is an address whose
         type must be IPv4."
    ::= { lmpTeLinkEntry 1 }

lmpTeLinkVerification OBJECT-TYPE
    SYNTAX        TruthValue
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "This object indicates if the LMP link verification procedure
         is enabled for this TE link."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpTeLinkEntry 2 }

lmpTeLinkFaultManagement OBJECT-TYPE
    SYNTAX        TruthValue
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "This object indicates if the LMP fault management procedure
         is enabled on this TE link."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpTeLinkEntry 3 }

lmpTeLinkDwdm OBJECT-TYPE
    SYNTAX        TruthValue
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "This object indicates if the LMP DWDM procedure is enabled
         on this TE link."
    REFERENCE
        "Link Management Protocol (LMP) for Dense Wavelength Division
```

            Multiplexing (DWDM) Optical Line Systems, RFC 4209"
       ::= { lmpTeLinkEntry 4 }

   lmpTeLinkOperStatus OBJECT-TYPE
       SYNTAX          INTEGER {
                          up(1), down(2), testing(3), init(4), degraded(5)
                       }
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "The actual operational status of this TE link.  The status
            is set to testing when the TE link is performing link
            verification.  A degraded state indicates that there is
            no active control channel between the pair of nodes that
            form the endpoints of the TE link, but yet at least one
            data-bearing link on the TE link is allocated."
       ::= { lmpTeLinkEntry 5 }

   lmpTeLinkRowStatus OBJECT-TYPE
       SYNTAX          RowStatus
       MAX-ACCESS      read-create
       STATUS          current
       DESCRIPTION
           "This variable is used to create, modify, and/or
            delete a row in this table.  None of the writable objects
            in a row can be changed if the status is active(1).
            All read-create objects must have valid and consistent
            values before the row can be activated."
       ::= { lmpTeLinkEntry 6 }

   lmpTeLinkStorageType OBJECT-TYPE
       SYNTAX          StorageType
       MAX-ACCESS      read-create
       STATUS          current
       DESCRIPTION
           "The storage type for this conceptual row in the
            lmpTeLinkTable.  Conceptual rows having the value
            'permanent' need not allow write-access to any
            columnar object in the row."
       DEFVAL          { nonVolatile }
       ::= { lmpTeLinkEntry 7 }

   -- End of lmpTeLinkTable


   lmpGlobalLinkVerificationInterval OBJECT-TYPE
       SYNTAX          Unsigned32
       UNITS           "milliseconds"

```
      MAX-ACCESS      read-write
      STATUS          current
      DESCRIPTION
          "This object indicates how often the link verification
           procedure is executed.  The interval is in milliseconds.
           A value of 0 is used to indicate that the link
           verification procedure should not be executed.  The
           interval specified in this object should be large enough
           to allow the verification procedure to be completed
           before the start of the next interval.
           Implementations should save the value of this object in
           persistent memory so that it survives restarts or reboot."
      ::= { lmpObjects 13 }


-- LMP Link Verification Table

lmpLinkVerificationTable OBJECT-TYPE
      SYNTAX          SEQUENCE OF LmpLinkVerificationEntry
      MAX-ACCESS      not-accessible
      STATUS          current
      DESCRIPTION
          "This table specifies TE link information associated with the
           LMP verification procedure."
      ::= { lmpObjects 14 }

lmpLinkVerificationEntry OBJECT-TYPE
      SYNTAX          LmpLinkVerificationEntry
      MAX-ACCESS      not-accessible
      STATUS          current
      DESCRIPTION
          "An entry in this table is created by an LMP-enabled device for
           every TE link that supports the LMP verification
           procedure."
      INDEX           { ifIndex }
      ::= { lmpLinkVerificationTable 1 }

LmpLinkVerificationEntry ::= SEQUENCE {
  lmpLinkVerifyInterval            LmpInterval,
  lmpLinkVerifyDeadInterval        LmpInterval,
  lmpLinkVerifyTransportMechanism BITS,
  lmpLinkVerifyAllLinks            TruthValue,
  lmpLinkVerifyTransmissionRate    Unsigned32,
  lmpLinkVerifyWavelength          Unsigned32,
  lmpLinkVerifyRowStatus           RowStatus,
  lmpLinkVerifyStorageType         StorageType
}
```

```
lmpLinkVerifyInterval OBJECT-TYPE
    SYNTAX          LmpInterval
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object specifies the VerifyInterval parameter used
         in the LMP link verification process.  It indicates the
         interval at which the Test messages are sent."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpLinkVerificationEntry 1 }

lmpLinkVerifyDeadInterval OBJECT-TYPE
    SYNTAX          LmpInterval
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object specifies the VerifyDeadInterval parameter used
         in the verification of the physical connectivity of data-
         bearing links.  It specifies the observation period used to
         detect a Test message at the remote node."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpLinkVerificationEntry 2 }

lmpLinkVerifyTransportMechanism OBJECT-TYPE
    SYNTAX          BITS {
                        -- All encoding types:
                        payload(0),
                        -- SONET/SDH encoding type:
                        dccSectionOverheadBytes(1),
                        dccLineOverheadBytes(2),
                        j0Trace(3),
                        j1Trace(4),
                        j2Trace(5)
                    }
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This defines the transport mechanism for the Test messages.  The
         scope of this bit mask is restricted to each link encoding
         type.  The local node will set the bits corresponding to the
         various mechanisms it can support for transmitting LMP Test
         messages.  The receiver chooses the appropriate mechanism in the
         BeginVerifyAck message."
    REFERENCE
        "Link Management Protocol, RFC 4204
```

```
        Synchronous Optical Network (SONET)/Synchronous Digital
        Hierarchy (SDH) Encoding for Link Management Protocol (LMP)
        Test Messages, RFC 4207"
    ::= { lmpLinkVerificationEntry 3 }


lmpLinkVerifyAllLinks OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "A value of true(2) for this object indicates that the
        verification process checks all unallocated links, otherwise
        only the new ports or component links that have been added to
        this TE link are verified."
    ::= { lmpLinkVerificationEntry 4 }


lmpLinkVerifyTransmissionRate OBJECT-TYPE
    SYNTAX          Unsigned32
    UNITS           "bytes per second"
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This is the transmission rate of the data link over which
        the Test messages will be transmitted and is expressed in
        bytes per second."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpLinkVerificationEntry 5 }


lmpLinkVerifyWavelength OBJECT-TYPE
    SYNTAX          Unsigned32
    UNITS           "nanometers"
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This value corresponds to the wavelength at
        which the Test messages will be transmitted and is
        measured in nanometers (nm).  If each data-bearing link
        corresponds to a separate wavelength, then this value should
        be set to 0."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpLinkVerificationEntry 6 }


lmpLinkVerifyRowStatus OBJECT-TYPE
    SYNTAX          RowStatus
    MAX-ACCESS      read-create
    STATUS          current
```

```
   DESCRIPTION
       "This variable is used to create, modify, and/or
        delete a row in this table.  None of the writable objects
        in a row can be changed if the status is active(1).
        All read-create objects must have valid and consistent
        values before the row can be activated."
    ::= { lmpLinkVerificationEntry 7 }


lmpLinkVerifyStorageType OBJECT-TYPE
    SYNTAX         StorageType
    MAX-ACCESS     read-create
    STATUS         current
    DESCRIPTION
       "The storage type for this conceptual row in the
        lmpLinkVerificationTable.  Conceptual rows having the value
        'permanent' need not allow write-access to any
        columnar object in the row."
    DEFVAL         { nonVolatile }
    ::= { lmpLinkVerificationEntry 8 }

-- End of lmpLinkVerificationTable


-- LMP TE Link Performance Table

lmpTeLinkPerfTable OBJECT-TYPE
    SYNTAX         SEQUENCE OF LmpTeLinkPerfEntry
    MAX-ACCESS     not-accessible
    STATUS         current
    DESCRIPTION
       "This table specifies LMP TE link performance counters."
    ::= { lmpObjects 15 }


lmpTeLinkPerfEntry OBJECT-TYPE
    SYNTAX         LmpTeLinkPerfEntry
    MAX-ACCESS     not-accessible
    STATUS         current
    DESCRIPTION
       "An entry in this table is created by an LMP-enabled device for
        every TE link.  lmpTeCounterDiscontinuityTime is used
        to indicate potential discontinuity for all counter objects
        in this table."
    INDEX          { ifIndex }
    ::= { lmpTeLinkPerfTable 1 }

LmpTeLinkPerfEntry ::= SEQUENCE {
  lmpTeInOctets                       Counter32,
  lmpTeOutOctets                      Counter32,
```

```
    lmpTeBeginVerifyReceived         Counter32,
    lmpTeBeginVerifySent             Counter32,
    lmpTeBeginVerifyRetransmit       Counter32,
    lmpTeBeginVerifyAckReceived      Counter32,
    lmpTeBeginVerifyAckSent          Counter32,
    lmpTeBeginVerifyNackReceived     Counter32,
    lmpTeBeginVerifyNackSent         Counter32,
    lmpTeEndVerifyReceived           Counter32,
    lmpTeEndVerifySent               Counter32,
    lmpTeEndVerifyRetransmit         Counter32,
    lmpTeEndVerifyAckReceived        Counter32,
    lmpTeEndVerifyAckSent            Counter32,
    lmpTeTestStatusSuccessReceived   Counter32,
    lmpTeTestStatusSuccessSent       Counter32,
    lmpTeTestStatusSuccessRetransmit Counter32,
    lmpTeTestStatusFailureReceived   Counter32,
    lmpTeTestStatusFailureSent       Counter32,
    lmpTeTestStatusFailureRetransmit Counter32,
    lmpTeTestStatusAckReceived       Counter32,
    lmpTeTestStatusAckSent           Counter32,
    lmpTeLinkSummaryReceived         Counter32,
    lmpTeLinkSummarySent             Counter32,
    lmpTeLinkSummaryRetransmit       Counter32,
    lmpTeLinkSummaryAckReceived      Counter32,
    lmpTeLinkSummaryAckSent          Counter32,
    lmpTeLinkSummaryNackReceived     Counter32,
    lmpTeLinkSummaryNackSent         Counter32,
    lmpTeChannelStatusReceived       Counter32,
    lmpTeChannelStatusSent           Counter32,
    lmpTeChannelStatusRetransmit     Counter32,
    lmpTeChannelStatusAckReceived    Counter32,
    lmpTeChannelStatusAckSent        Counter32,
    lmpTeChannelStatusReqReceived    Counter32,
    lmpTeChannelStatusReqSent        Counter32,
    lmpTeChannelStatusReqRetransmit  Counter32,
    lmpTeChannelStatusRspReceived    Counter32,
    lmpTeChannelStatusRspSent        Counter32,
    lmpTeCounterDiscontinuityTime    TimeStamp
}

lmpTeInOctets OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
            "The total number of LMP message octets received for
             this TE link."
    ::= { lmpTeLinkPerfEntry 1 }
```

```
lmpTeOutOctets OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
            "The total number of LMP message octets transmitted out
             for this TE link."
    ::= { lmpTeLinkPerfEntry 2 }

lmpTeBeginVerifyReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of BeginVerify messages that have
         been received for this TE link."
    ::= { lmpTeLinkPerfEntry 3 }

lmpTeBeginVerifySent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of BeginVerify messages that have
         been sent for this TE link."
    ::= { lmpTeLinkPerfEntry 4 }

lmpTeBeginVerifyRetransmit OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of BeginVerify messages that
         have been retransmitted for this TE link."
    ::= { lmpTeLinkPerfEntry 5 }

lmpTeBeginVerifyAckReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of BeginVerifyAck messages that
         have been received for this TE link."
    ::= { lmpTeLinkPerfEntry 6 }

lmpTeBeginVerifyAckSent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
```

```
   STATUS        current
   DESCRIPTION
      "This object counts the number of BeginVerifyAck messages that
       have been sent for this TE link."
   ::= { lmpTeLinkPerfEntry 7 }


lmpTeBeginVerifyNackReceived OBJECT-TYPE
   SYNTAX        Counter32
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
      "This object counts the number of BeginVerifyNack messages that
       have been received for this TE link."
   ::= { lmpTeLinkPerfEntry 8 }


lmpTeBeginVerifyNackSent OBJECT-TYPE
   SYNTAX        Counter32
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
      "This object counts the number of BeginVerifyNack messages that
       have been sent for this TE link."
   ::= { lmpTeLinkPerfEntry 9 }


lmpTeEndVerifyReceived OBJECT-TYPE
   SYNTAX        Counter32
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
      "This object counts the number of EndVerify messages that have
       been received for this TE link."
   ::= { lmpTeLinkPerfEntry 10 }


lmpTeEndVerifySent OBJECT-TYPE
   SYNTAX        Counter32
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
      "This object counts the number of EndVerify messages that have
       been sent for this TE link."
   ::= { lmpTeLinkPerfEntry 11 }


lmpTeEndVerifyRetransmit OBJECT-TYPE
   SYNTAX        Counter32
   MAX-ACCESS    read-only
   STATUS        current
   DESCRIPTION
      "This object counts the number of EndVerify messages that
```

```
        have been retransmitted over this control channel."
    ::= { lmpTeLinkPerfEntry 12 }


lmpTeEndVerifyAckReceived OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of EndVerifyAck messages that
         have been received for this TE link."
    ::= { lmpTeLinkPerfEntry 13 }


lmpTeEndVerifyAckSent OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of EndVerifyAck messages that
         have been sent for this TE link."
    ::= { lmpTeLinkPerfEntry 14 }


lmpTeTestStatusSuccessReceived OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of TestStatusSuccess messages
         that have been received for this TE link."
    ::= { lmpTeLinkPerfEntry 15 }


lmpTeTestStatusSuccessSent OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of TestStatusSuccess messages
         that have been sent for this TE link."
    ::= { lmpTeLinkPerfEntry 16 }


lmpTeTestStatusSuccessRetransmit OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object counts the number of TestStatusSuccess messages
         that have been retransmitted for this TE link."
    ::= { lmpTeLinkPerfEntry 17 }
```

```
lmpTeTestStatusFailureReceived OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of TestStatusFailure messages
        that have been received for this TE link."
   ::= { lmpTeLinkPerfEntry 18 }

lmpTeTestStatusFailureSent OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of TestStatusFailure messages
        that have been sent for this TE link."
   ::= { lmpTeLinkPerfEntry 19 }

lmpTeTestStatusFailureRetransmit OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of TestStatusFailure messages
        that have been retransmitted on this TE link."
   ::= { lmpTeLinkPerfEntry 20 }

lmpTeTestStatusAckReceived OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of TestStatusAck messages that
        have been received for this TE link."
   ::= { lmpTeLinkPerfEntry 21 }

lmpTeTestStatusAckSent OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
   STATUS         current
   DESCRIPTION
       "This object counts the number of TestStatusAck messages that
        have been sent for this TE link."
   ::= { lmpTeLinkPerfEntry 22 }

lmpTeLinkSummaryReceived OBJECT-TYPE
   SYNTAX         Counter32
   MAX-ACCESS     read-only
```

```
      STATUS          current
      DESCRIPTION
          "This object counts the number of LinkSummary messages that
           have been received for this TE link."
      ::= { lmpTeLinkPerfEntry 23 }


  lmpTeLinkSummarySent OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of LinkSummary messages that
           have been sent for this TE link."
      ::= { lmpTeLinkPerfEntry 24 }


  lmpTeLinkSummaryRetransmit OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of LinkSummary messages that
           have been retransmitted over this control channel."
      ::= { lmpTeLinkPerfEntry 25 }


  lmpTeLinkSummaryAckReceived OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of LinkSummaryAck messages that
           have been received for this TE link."
      ::= { lmpTeLinkPerfEntry 26 }


  lmpTeLinkSummaryAckSent OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of LinkSummaryAck messages that
           have been sent for this TE link."
      ::= { lmpTeLinkPerfEntry 27 }


  lmpTeLinkSummaryNackReceived OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of LinkSummaryNack messages that
```

          have been received for this TE link."
      ::= { lmpTeLinkPerfEntry 28 }


lmpTeLinkSummaryNackSent OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of LinkSummaryNack messages that
           have been sent for this TE link."
      ::= { lmpTeLinkPerfEntry 29 }


lmpTeChannelStatusReceived OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of ChannelStatus messages that
           have been received for this TE link."
      ::= { lmpTeLinkPerfEntry 30 }


lmpTeChannelStatusSent OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of ChannelStatus messages that
           have been sent for this TE link."
      ::= { lmpTeLinkPerfEntry 31 }


lmpTeChannelStatusRetransmit OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of ChannelStatus messages that
           have been retransmitted for this TE link."
      ::= { lmpTeLinkPerfEntry 32 }


lmpTeChannelStatusAckReceived OBJECT-TYPE
      SYNTAX          Counter32
      MAX-ACCESS      read-only
      STATUS          current
      DESCRIPTION
          "This object counts the number of ChannelStatusAck messages
           that have been received for this TE link."
      ::= { lmpTeLinkPerfEntry 33 }

```
lmpTeChannelStatusAckSent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatus messages
         that have been sent for this TE link."
    ::= { lmpTeLinkPerfEntry 34 }

lmpTeChannelStatusReqReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatusRequest messages
         that have been received for this TE link."
    ::= { lmpTeLinkPerfEntry 35 }

lmpTeChannelStatusReqSent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatusRequest messages
         that have been sent for this TE link."
    ::= { lmpTeLinkPerfEntry 36 }

lmpTeChannelStatusReqRetransmit OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatusRequest messages
         that have been retransmitted for this TE link."
    ::= { lmpTeLinkPerfEntry 37 }

lmpTeChannelStatusRspReceived OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatusResponse messages
         that have been received for this TE link."
    ::= { lmpTeLinkPerfEntry 38 }

lmpTeChannelStatusRspSent OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
```

```
    STATUS          current
    DESCRIPTION
        "This object counts the number of ChannelStatusResponse messages
         that have been sent for this TE link."
    ::= { lmpTeLinkPerfEntry 39 }


lmpTeCounterDiscontinuityTime OBJECT-TYPE
    SYNTAX          TimeStamp
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The value of sysUpTime on the most recent occasion at which
         any one or more of this TE link's counters suffered a
         discontinuity.  The relevant counters are the specific
         instances associated with this TE link of any Counter32
         object contained in the lmpTeLinkPerfTable.  If
         no such discontinuities have occurred since the last re-
         initialization of the local management subsystem, then this
         object contains a zero value."
     ::= { lmpTeLinkPerfEntry 40 }

-- End of lmpTeLinkPerfTable


-- LMP Data Link Table

lmpDataLinkTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF LmpDataLinkEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This table specifies the data-bearing links managed by the
         LMP."
    ::= { lmpObjects 16 }

lmpDataLinkEntry OBJECT-TYPE
    SYNTAX          LmpDataLinkEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry in this table exists for each ifEntry that represents
         a data-bearing link.  An ifEntry with an ifIndex must exist
         before the corresponding lmpDataLinkEntry is created.
         If an entry representing the data-bearing link is destroyed in
         the ifTable, then so is the corresponding entry in the
         lmpDataLinkTable.  The administrative status value is
         controlled from the ifEntry.  The index to this table is also
         used to get information in the componentLinkTable
```

```
        of the TE-LINK-STD-MIB MIB module."
    INDEX          { ifIndex }
    ::= { lmpDataLinkTable 1 }

LmpDataLinkEntry ::= SEQUENCE {
    lmpDataLinkType             INTEGER,
    lmpDataLinkAddressType      InetAddressType,
    lmpDataLinkIpAddr           InetAddress,
    lmpDataLinkRemoteIpAddress  InetAddress,
    lmpDataLinkRemoteIfId       InterfaceIndexOrZero,
    lmpDataLinkEncodingType     TeLinkEncodingType,
    lmpDataLinkActiveOperStatus INTEGER,
    lmpDataLinkPassiveOperStatus INTEGER,
    lmpDataLinkRowStatus        RowStatus,
    lmpDataLinkStorageType      StorageType
}

lmpDataLinkType OBJECT-TYPE
    SYNTAX         INTEGER {
                    port(1),
                    componentLink(2)
                }
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "This attribute specifies whether this data-bearing link is
         a port or a component link.  Component link are multiplex
         capable, whereas ports are not multiplex capable."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpDataLinkEntry 1 }

lmpDataLinkAddressType OBJECT-TYPE
    SYNTAX         InetAddressType
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "This attribute specifies the data-bearing link IP address
         type.  If the data-bearing link is unnumbered, the address
         type must be set to unknown(0)."
    ::= { lmpDataLinkEntry 2 }

lmpDataLinkIpAddr OBJECT-TYPE
    SYNTAX         InetAddress
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "The local Internet address for numbered links.  The type
```

        of this address is determined by the value of
        lmpDataLinkAddressType object.

        For IPv4 and IPv6 numbered links, this object represents
        the local IP address associated with the data-bearing
        link.  For an unnumbered link, the local address is
        of type unknown and this object is set to the zero-length
        string and the ifIndex object then identifies the
        unnumbered address."
    ::= { lmpDataLinkEntry 3 }

lmpDataLinkRemoteIpAddress OBJECT-TYPE
    SYNTAX          InetAddress
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "The remote Internet address for numbered data-bearing links.
         The type of this address is determined by the
         lmpDataLinkAddressType object.

         For IPv4 and IPv6 numbered links, this object represents the
         remote IP address associated with the data-bearing link.  For
         an unnumbered link, the remote address is of type unknown
         and this object is set to the zero-length string and the
         lmpDataLinkRemoteIfId object then identifies the unnumbered
         address.

         This information is either configured manually or
         communicated by the remote node during the link verification
         procedure."
    ::= { lmpDataLinkEntry 4 }

lmpDataLinkRemoteIfId OBJECT-TYPE
    SYNTAX          InterfaceIndexOrZero
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "Interface identifier of the remote end point.  This
         information is either configured manually or
         communicated by the remote node during the link verification
         procedure."
    ::= { lmpDataLinkEntry 5 }

lmpDataLinkEncodingType OBJECT-TYPE
    SYNTAX          TeLinkEncodingType
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION

```
        "The encoding type of the data-bearing link."
    REFERENCE
        "Generalized MPLS Signaling Functional Description, RFC 3471"
    ::= { lmpDataLinkEntry 6 }

lmpDataLinkActiveOperStatus OBJECT-TYPE
    SYNTAX          INTEGER {
                        upAlloc(1),
                        upFree(2),
                        down(3),
                        testing(4) }
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The actual operational status of this data-bearing link
         (active FSM)."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpDataLinkEntry 7 }

lmpDataLinkPassiveOperStatus OBJECT-TYPE
    SYNTAX          INTEGER {
                        upAlloc(1),
                        upFree(2),
                        down(3),
                        psvTst(4) }
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The actual operational status of this data-bearing link
         (passive FSM)."
    REFERENCE
        "Link Management Protocol, RFC 4204"
    ::= { lmpDataLinkEntry 8 }

lmpDataLinkRowStatus OBJECT-TYPE
    SYNTAX          RowStatus
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This variable is used to create, modify, and/or
         delete a row in this table.  None of the writable objects
         in a row can be changed if the status is active(1).
         All read-create objects must have valid and consistent
         values before the row can be activated."
    ::= { lmpDataLinkEntry 9 }

lmpDataLinkStorageType OBJECT-TYPE
```

```
   SYNTAX          StorageType
   MAX-ACCESS      read-create
   STATUS          current
   DESCRIPTION
       "The storage type for this conceptual row in the
        lmpDataLinkTable.  Conceptual rows having the value
        'permanent' need not allow write-access to any
        columnar object in the row."
   DEFVAL          { nonVolatile }
   ::= { lmpDataLinkEntry 10 }

-- End of lmpDataLinkTable


-- LMP Data Link Performance Table

lmpDataLinkPerfTable OBJECT-TYPE
   SYNTAX          SEQUENCE OF LmpDataLinkPerfEntry
   MAX-ACCESS      not-accessible
   STATUS          current
   DESCRIPTION
       "This table specifies the data-bearing links LMP performance
        counters."
   ::= { lmpObjects 17 }

lmpDataLinkPerfEntry OBJECT-TYPE
   SYNTAX          LmpDataLinkPerfEntry
   MAX-ACCESS      not-accessible
   STATUS          current
   DESCRIPTION
       "An entry in this table contains information about
        the LMP performance counters for the data-bearing links.
        lmpDataLinkDiscontinuityTime is used to indicate potential
        discontinuity for all counter objects in this table."
   INDEX           { ifIndex }
   ::= { lmpDataLinkPerfTable 1 }

LmpDataLinkPerfEntry ::= SEQUENCE {
  lmpDataLinkTestReceived        Counter32,
  lmpDataLinkTestSent            Counter32,
  lmpDataLinkActiveTestSuccess   Counter32,
  lmpDataLinkActiveTestFailure   Counter32,
  lmpDataLinkPassiveTestSuccess  Counter32,
  lmpDataLinkPassiveTestFailure  Counter32,
  lmpDataLinkDiscontinuityTime   TimeStamp
}

lmpDataLinkTestReceived OBJECT-TYPE
```

```
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of Test messages that have
        been received on this data-bearing link."
   ::= { lmpDataLinkPerfEntry 1 }

lmpDataLinkTestSent OBJECT-TYPE
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of Test messages that have
        been sent on this data-bearing link."
   ::= { lmpDataLinkPerfEntry 2 }

lmpDataLinkActiveTestSuccess OBJECT-TYPE
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of data-bearing link tests
        that were successful on the active side of this data-
        bearing link."
   ::= { lmpDataLinkPerfEntry 3 }

lmpDataLinkActiveTestFailure OBJECT-TYPE
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of data-bearing link tests
        that failed on the active side of this data-bearing link."
   ::= { lmpDataLinkPerfEntry 4 }

lmpDataLinkPassiveTestSuccess OBJECT-TYPE
   SYNTAX          Counter32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
       "This object counts the number of data-bearing link tests
        that were successful on the passive side of this data-
        bearing link."
   ::= { lmpDataLinkPerfEntry 5 }

lmpDataLinkPassiveTestFailure OBJECT-TYPE
   SYNTAX          Counter32
```

       MAX-ACCESS     read-only
       STATUS         current
       DESCRIPTION
           "This object counts the number of data-bearing link tests
            that failed on the passive side of this data-bearing link."
       ::= { lmpDataLinkPerfEntry 6 }


   lmpDataLinkDiscontinuityTime OBJECT-TYPE
       SYNTAX         TimeStamp
       MAX-ACCESS     read-only
       STATUS         current
       DESCRIPTION
           "The value of sysUpTime on the most recent occasion at which
            any one or more of this data-bearing link's counters suffered
            a discontinuity.  The relevant counters are the specific
            instances associated with this data-bearing link of any
            Counter32 object contained in the lmpDataLinkPerfTable.  If
            no such discontinuities have occurred since the last re-
            initialization of the local management subsystem, then this
            object contains a zero value."
        ::= { lmpDataLinkPerfEntry 7 }

   -- End of lmpDataLinkPerfTable


   -- Notification Configuration

   lmpNotificationMaxRate OBJECT-TYPE
       SYNTAX         Unsigned32
       MAX-ACCESS     read-write
       STATUS         current
       DESCRIPTION
           "The LMP notification rate depends on the size of the network,
            the type of links, the network configuration, the
            reliability of the network, etc.

            When designing this MIB, care has been taken to minimize the
            amount of notifications generated for LMP purposes.  Wherever
            possible, notifications are state driven, meaning the
            notifications are sent only when the system changes state.
            The only notifications that are repeated and could cause a
            problem as far as congestion is concerned are the ones
            associated with data link verification.
            Without any considerations to handling of these
            notifications, a problem may arise if the number of data
            links is high.  Since the data link verification notifications
            can happen only once per data link per link verification
            interval, the notification rate should be sustainable if one

         chooses an appropriate link verification interval for a given
         network configuration.  For instance, a network of 100 nodes
         with 5 links of 128 wavelengths each and a link verification
         of 1 minute with no more than 10% of the links failed at any
         given time would have 1 notification per second sent from
         each node, or 100 notifications per second for the whole
         network.  The rest of the notifications are negligible
         compared to this number.

         To alleviate the congestion problem, the
         lmpNotificationMaxRate object can be used to implement a
         throttling mechanism.  It is also possible to enable/disable
         certain type of notifications.

         This variable indicates the maximum number of
         notifications issued per minute.  If events occur
         more rapidly, the implementation may simply fail to
         emit these notifications during that period, or may
         queue them until an appropriate time.  A value of 0
         means no throttling is applied and events may be
         notified at the rate at which they occur.
         Implementations should save the value of this object in
         persistent memory so that it survives restarts or reboot."
      ::= { lmpObjects 18 }

lmpLinkPropertyNotificationsEnabled OBJECT-TYPE
   SYNTAX          TruthValue
   MAX-ACCESS      read-write
   STATUS          current
   DESCRIPTION
         "If this object is true, then it enables the
         generation of lmpTeLinkPropertyMismatch
         and lmpDataLinkPropertyMismatch notifications,
         otherwise these notifications are not emitted.
         Implementations should save the value of this object in
         persistent memory so that it survives restarts or reboot."
   DEFVAL        { false }
   ::= { lmpObjects 19 }

lmpUnprotectedNotificationsEnabled OBJECT-TYPE
   SYNTAX          TruthValue
   MAX-ACCESS      read-write
   STATUS          current
   DESCRIPTION
         "If this object is true, then it enables the
         generation of lmpUnprotected notifications,
         otherwise these notifications are not emitted.
         Implementations should save the value of this object in

```
        persistent memory so that it survives restarts or reboot."
   DEFVAL        { false }
   ::= { lmpObjects 20 }

lmpCcUpDownNotificationsEnabled OBJECT-TYPE
   SYNTAX        TruthValue
   MAX-ACCESS    read-write
   STATUS        current
   DESCRIPTION
       "If this object is true, then it enables the generation of
        lmpControlChannelUp and lmpControlChannelDown notifications,
        otherwise these notifications are not emitted.
        Implementations should save the value of this object in
        persistent memory so that it survives restarts or reboot."
   DEFVAL        { false }
   ::= { lmpObjects 21 }

lmpTeLinkNotificationsEnabled OBJECT-TYPE
   SYNTAX        TruthValue
   MAX-ACCESS    read-write
   STATUS        current
   DESCRIPTION
       "If this object is true, then it enables the
        generation of lmpTeLinkDegraded and lmpTeLinkNotDegraded
        notifications, otherwise these notifications are not emitted.
        Implementations should save the value of this object in
        persistent memory so that it survives restarts or reboot."
   DEFVAL        { false }
   ::= { lmpObjects 22 }

lmpDataLinkNotificationsEnabled OBJECT-TYPE
   SYNTAX        TruthValue
   MAX-ACCESS    read-write
   STATUS        current
   DESCRIPTION
       "If this object is true, then it enables the
        generation of lmpDataLinkVerificationFailure
        notification, otherwise these notifications are not emitted.
        Implementations should save the value of this object in
        persistent memory so that it survives restarts or reboot."
   DEFVAL        { false }
   ::= { lmpObjects 23 }


-- Notifications

-- Link Property Mismatch Notifications
```

```
lmpTeLinkPropertyMismatch NOTIFICATION-TYPE
    OBJECTS         { teLinkRemoteIpAddr,
                      teLinkIncomingIfId }
    STATUS          current
    DESCRIPTION
        "This notification is generated when a TE link property
         mismatch is detected on the node.  The received remote TE link
         ID of the misconfigured TE link is represented by either
         teLinkRemoteIpAddr or teLinkIncomingIfId depending on whether
         the TE link is numbered or unnumbered.  This notification
         should not be sent unless lmpLinkPropertyNotificationsEnabled
         is true.  It is recommended that this notification be reported
         only the first time a mismatch is detected.  Otherwise, for a
         given TE link, this notification can occur no more than once
         per verification interval (lmpGlobalLinkVerificationInterval)."
    ::= { lmpNotifications 1 }

lmpDataLinkPropertyMismatch NOTIFICATION-TYPE
    OBJECTS         { lmpDataLinkType, lmpDataLinkRemoteIfId }
    STATUS          current
    DESCRIPTION
        "This notification is generated when a data-bearing link
         property mismatch is detected on the node.  lmpDataLinkType
         is used to identify the local identifiers associated with
         the data link (the data link interface index can be used
         to determine the TE link interface index as this
         relationship is captured in the interface stack table).
         The remote entity interface ID is the remote entity
         interface ID received in the LinkSummary message.
         This notification should not be sent unless
         lmpLinkPropertyNotificationsEnabled is true.  It is
         recommended that this notification be reported only the
         first time a mismatch is detected.  Otherwise, for a given
         data link, this notification can occur no more than once
         per verification interval (lmpGlobalLinkVerificationInterval)."
    ::= { lmpNotifications 2 }

-- Neighbor Notification

lmpUnprotected NOTIFICATION-TYPE
    OBJECTS         { lmpCcNbrNodeId }
    STATUS          current
    DESCRIPTION
        "This notification is generated when there are more than one
         control channels between LMP neighbors and the last redundant
         control channel has failed.  If the remaining operational
         control channel fails, then there will be no more control
         channels between the pair of nodes and all the TE links
```

        between the pair of nodes will go to degraded state.  This
        notification should not be sent unless
        lmpUnprotectedNotificationsEnabled is set to true."
    ::= { lmpNotifications 3 }

-- Control Channel Notifications

lmpControlChannelUp NOTIFICATION-TYPE
    OBJECTS         { lmpCcAdminStatus, lmpCcOperStatus }
    STATUS          current
    DESCRIPTION
        "This notification is generated when a control
         channel transitions to the up operational state.  This
         notification should not be sent unless
         lmpCcUpDownNotificationsEnabled is true."
    ::= { lmpNotifications 4 }

lmpControlChannelDown NOTIFICATION-TYPE
    OBJECTS         { lmpCcAdminStatus, lmpCcOperStatus }
    STATUS          current
    DESCRIPTION
        "This notification is generated when a control channel
         transitions out of the up operational state.  This
         notification should not be sent unless
         lmpCcUpDownNotificationsEnabled is true."
    ::= { lmpNotifications 5 }

-- TE Link Notification

lmpTeLinkDegraded NOTIFICATION-TYPE
    OBJECTS         { lmpTeLinkOperStatus }
    STATUS          current
    DESCRIPTION
        "This notification is generated when a lmpTeLinkOperStatus
         object for a TE link enters the degraded state.  This
         notification should not be sent unless
         lmpTeLinkNotificationsEnabled is true."
    ::= { lmpNotifications 6 }

lmpTeLinkNotDegraded NOTIFICATION-TYPE
    OBJECTS         { lmpTeLinkOperStatus }
    STATUS          current
    DESCRIPTION
        "This notification is generated when a lmpTeLinkOperStatus
         object for a TE link leaves the degraded state.  This
         notification should not be sent unless
         lmpTeLinkNotificationsEnabled is true."
    ::= { lmpNotifications 7 }

-- Data-bearing Link Notification

lmpDataLinkVerificationFailure NOTIFICATION-TYPE
    OBJECTS        { lmpDataLinkActiveOperStatus,
                     lmpDataLinkPassiveOperStatus }
    STATUS         current
    DESCRIPTION
        "This notification is generated when a data-bearing
         link verification fails.  This notification should not be sent
         unless lmpDataLinkNotificationsEnabled is true.  For a given
         data link, this notification can occur no more than once per
         verification interval (lmpGlobalLinkVerificationInterval)."
    ::= { lmpNotifications 8 }

-- End of notifications


-- Module compliance

lmpCompliances
    OBJECT IDENTIFIER ::= { lmpConformance 1 }

lmpGroups
    OBJECT IDENTIFIER ::= { lmpConformance 2 }

lmpModuleFullCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "Compliance statement for agents that support the
         configuration and monitoring of LMP MIB."
    MODULE -- this module

        MANDATORY-GROUPS     { lmpNodeGroup,
                               lmpControlChannelGroup,
                               lmpLinkPropertyCorrelationGroup,
                               lmpPerfGroup,
                               lmpTeLinkGroup,
                               lmpDataLinkGroup }

        GROUP lmpCcIsNotInterfaceGroup
        DESCRIPTION
            "This group is mandatory for devices that support
             control channels that are not interfaces, in addition to
             lmpControlChannelGroup.  The following constraints apply:
             lmpCcIsIf must at least be read-only returning false(1)."

        GROUP lmpCcIsInterfaceGroup
        DESCRIPTION

```
        "This group is mandatory for devices that support
         control channels that are interfaces, in addition to
         lmpControlChannelGroup.  The following constraints apply:
         lmpCcIsIf must at least be read-only returning true(2)."

    GROUP lmpLinkVerificationGroup
    DESCRIPTION
        "This group is mandatory for devices that support
         the link verification procedure."

    GROUP lmpNotificationGroup
    DESCRIPTION
        "This group is optional."

    -- lmpNbrTable

    OBJECT      lmpNbrRowStatus
    SYNTAX      RowStatus { active(1), notInService(2) }
    WRITE-SYNTAX RowStatus { active(1), notInService(2),
                             createAndGo(4), destroy(6) }
    DESCRIPTION
        "Support for notReady(3) and createAndWait(5) is
         not required."

    -- lmpControlChannelTable

    OBJECT      lmpCcRemoteAddressType
    SYNTAX      INTEGER { unknown(0), ipv4(1), ipv6(2) }
    DESCRIPTION
        "Only ipv4(1) and ipv6(2) address types need to be
         supported for non-point-to-point configurations."

    OBJECT      lmpCcRemoteIpAddr
    SYNTAX      InetAddress (SIZE(0|4|16))
    DESCRIPTION
        "The size of the IP address depends on the address type."

    OBJECT      lmpCcRowStatus
    SYNTAX      RowStatus { active(1), notInService(2) }
    WRITE-SYNTAX RowStatus { active(1), notInService(2),
                             createAndGo(4), destroy(6) }
    DESCRIPTION
        "Support for notReady(3) and createAndWait(5) is
         not required."

    OBJECT      lmpCcOperStatus
    SYNTAX      INTEGER { up(1), down(2) }
    DESCRIPTION
```

```
        "A value of configSnd(3), configRcv(4), active(5),
         goingDown(6) need not be supported."


    -- lmpTeLinkTable


    OBJECT       lmpTeLinkOperStatus
    SYNTAX       INTEGER { up(1), down(2), degraded(5) }
    DESCRIPTION
        "The testing(3) and init(4) state need not be supported."


    OBJECT       lmpTeLinkRowStatus
    SYNTAX       RowStatus { active(1), notInService(2) }
    WRITE-SYNTAX RowStatus { active(1), notInService(2),
                             createAndGo(4), destroy(6) }
    DESCRIPTION
        "Support for notReady(3) and createAndWait(5) is
         not required."


    -- lmpDataLinkTable


    OBJECT       lmpDataLinkActiveOperStatus
    SYNTAX       INTEGER { upAlloc(1), upFree(2), down(3) }
    DESCRIPTION
        "A value of testing(4) need not be supported."


    OBJECT       lmpDataLinkPassiveOperStatus
    SYNTAX       INTEGER { upAlloc(1), upFree(2), down(3) }
    DESCRIPTION
        "A value of psvTst(4) need not be supported."


    OBJECT       lmpDataLinkRowStatus
    SYNTAX       RowStatus { active(1), notInService(2) }
    WRITE-SYNTAX RowStatus { active(1), notInService(2),
                             createAndGo(4), destroy(6) }
    DESCRIPTION
        "Support for notReady(3) and createAndWait(5) is
         not required."

 ::= { lmpCompliances 1 }

lmpModuleReadOnlyCompliance MODULE-COMPLIANCE
   STATUS current
   DESCRIPTION
       "Compliance statement for agents that support the
        monitoring of the LMP MIB."
   MODULE -- this module

    -- The mandatory groups have to be implemented
```

```
         -- by all LMP-enabled devices.  However, they may all be supported
         -- as read-only objects in the case where manual
         -- configuration is not supported.

         MANDATORY-GROUPS      { lmpNodeGroup,
                                 lmpControlChannelGroup,
                                 lmpLinkPropertyCorrelationGroup,
                                 lmpPerfGroup,
                                 lmpTeLinkGroup,
                                 lmpDataLinkGroup }

         GROUP lmpCcIsNotInterfaceGroup
         DESCRIPTION
             "This group is mandatory for devices that support
              control channels that are not interfaces, in addition to
              lmpControlChannelGroup.  The following constraints apply:
              lmpCcIsIf must at least be read-only returning false(1)."

         GROUP lmpCcIsInterfaceGroup
         DESCRIPTION
             "This group is mandatory for devices that support
              control channels that are interfaces, in addition to
              lmpControlChannelGroup.  The following constraints apply:
              lmpCcIsIf must at least be read-only returning true(2)."

         GROUP lmpLinkVerificationGroup
         DESCRIPTION
             "This group is mandatory for devices that support
              the link verification procedure."

         GROUP lmpNotificationGroup
         DESCRIPTION
             "This group is optional."

         -- Scalars

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

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

         OBJECT      lmpCcHelloIntervalDefault
         MIN-ACCESS  read-only
```

```
        DESCRIPTION
            "Write access is not required."

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

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

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

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

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

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

        -- lmpNbrTable

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

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

        OBJECT      lmpNbrRetransmitDelta
        MIN-ACCESS  read-only
        DESCRIPTION
```

```
        "Write access is not required."

OBJECT        lmpNbrRowStatus
SYNTAX        RowStatus { active(1) }
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required, and active(1) is the
     only status that needs to be supported."

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

-- lmpControlChannelTable

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

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

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

OBJECT        lmpCcRemoteAddressType
SYNTAX        INTEGER { unknown(0), ipv4(1), ipv6(2) }
MIN-ACCESS  read-only
DESCRIPTION
    "Only ipv4(1) and ipv6(2) address types need to be
     supported for non-point-to-point configurations."

OBJECT        lmpCcRemoteIpAddr
SYNTAX        InetAddress (SIZE(0|4|16))
MIN-ACCESS  read-only
DESCRIPTION
    "The size of the IP address depends on the address type."

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

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

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

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

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

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

          OBJECT        lmpCcRowStatus
          SYNTAX        RowStatus { active(1) }
          MIN-ACCESS  read-only
          DESCRIPTION
              "Write access is not required, and active(1) is the
               only status that needs to be supported."

          OBJECT        lmpCcOperStatus
          SYNTAX        INTEGER { up(1), down(2) }
          DESCRIPTION
              "A value of configSnd(3), configRcv(4), active(5),
               goingDown(6) need not be supported."

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

          -- lmpLinkVerificationTable

          OBJECT        lmpLinkVerifyInterval
          MIN-ACCESS  read-only
          DESCRIPTION

```
        "Write access is not required."


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


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


     -- lmpTeLinkTable


     OBJECT      lmpTeLinkNbrRemoteNodeId
     MIN-ACCESS  read-only
     DESCRIPTION
        "Write access is not required if the link verification
         procedure is enabled."


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


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


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


     OBJECT      lmpTeLinkOperStatus
     SYNTAX      INTEGER { up(1), down(2), degraded(5) }
     DESCRIPTION
        "The testing(3) and init(4) state need not be supported."


     OBJECT      lmpTeLinkRowStatus
     SYNTAX      RowStatus { active(1) }
     MIN-ACCESS  read-only
     DESCRIPTION
        "Write access is not required, and active(1) is the
         only status that needs to be supported."


     OBJECT      lmpTeLinkStorageType
```

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


        -- lmpTeLinkVerificationTable


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


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


        OBJECT      lmpLinkVerifyRowStatus
        SYNTAX      RowStatus { active(1) }
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required, and active(1) is the
             only status that needs to be supported."


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


        -- lmpDataLinkTable


        OBJECT      lmpDataLinkAddressType
        SYNTAX      INTEGER { unknown(0), ipv4(1), ipv6(2) }
        MIN-ACCESS  read-only
        DESCRIPTION
            "Only ipv4(1) and ipv6(2) address types need to be
             supported for numbered links.  For unnumbered links, the
             unknown(0) address type needs to be supported."


        OBJECT      lmpDataLinkIpAddr
        SYNTAX      InetAddress (SIZE(0|4|16))
        MIN-ACCESS  read-only
        DESCRIPTION
            "Size of data-bearing link IP address depends on type
             of data-bearing link.  Data-bearing link IP address size
             is zero if link is unnumbered, four if link IP address is
             IPv4, and sixteen if link IP address is IPv6."


        OBJECT      lmpDataLinkRemoteIpAddress
```

```
        SYNTAX       InetAddress (SIZE(0|4|16))
        MIN-ACCESS   read-only
        DESCRIPTION
            "Write access is not required if the link verification
             procedure is enabled."

        OBJECT       lmpDataLinkRemoteIfId
        MIN-ACCESS   read-only
        DESCRIPTION
            "Write access is not required if the link verification
             procedure is enabled."

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

        OBJECT       lmpDataLinkActiveOperStatus
        SYNTAX       INTEGER { upAlloc(1), upFree(2), down(3) }
        DESCRIPTION
            "A value of testing(4) need not be supported."

        OBJECT       lmpDataLinkPassiveOperStatus
        SYNTAX       INTEGER { upAlloc(1), upFree(2), down(3) }
        DESCRIPTION
            "A value of psvTst(4) need not be supported."

        OBJECT       lmpDataLinkRowStatus
        SYNTAX       RowStatus { active(1) }
        MIN-ACCESS   read-only
        DESCRIPTION
            "Write access is not required, and active(1) is the
             only status that needs to be supported."

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

    ::= { lmpCompliances 2 }

-- Units of conformance

lmpNodeGroup OBJECT-GROUP
    OBJECTS { lmpAdminStatus,
              lmpOperStatus,
              lmpNbrAdminStatus,
              lmpNbrOperStatus,
```

```
            lmpNbrRowStatus,
            lmpNbrStorageType,
            lmpUnprotectedNotificationsEnabled,
            lmpNotificationMaxRate
          }
    STATUS  current
    DESCRIPTION
          "Collection of objects that represent LMP node
           configuration."
    ::= { lmpGroups 1 }

lmpControlChannelGroup OBJECT-GROUP
    OBJECTS {
            lmpNbrRetransmitInterval,
            lmpNbrRetryLimit,
            lmpNbrRetransmitDelta,
            lmpNbrAdminStatus,
            lmpNbrOperStatus,
            lmpNbrRowStatus,
            lmpNbrStorageType,
            lmpCcHelloIntervalDefault,
            lmpCcHelloIntervalDefaultMin,
            lmpCcHelloIntervalDefaultMax,
            lmpCcHelloDeadIntervalDefault,
            lmpCcHelloDeadIntervalDefaultMin,
            lmpCcHelloDeadIntervalDefaultMax,
            lmpCcNbrNodeId,
            lmpCcRemoteId,
            lmpCcRemoteAddressType,
            lmpCcRemoteIpAddr,
            lmpCcSetupRole,
            lmpCcAuthentication,
            lmpCcHelloInterval,
            lmpCcHelloIntervalMin,
            lmpCcHelloIntervalMax,
            lmpCcHelloIntervalNegotiated,
            lmpCcHelloDeadInterval,
            lmpCcHelloDeadIntervalMin,
            lmpCcHelloDeadIntervalMax,
            lmpCcHelloDeadIntervalNegotiated,
            lmpCcOperStatus,
            lmpCcRowStatus,
            lmpCcStorageType,
            lmpCcUpDownNotificationsEnabled
          }
    STATUS  current
    DESCRIPTION
          "Objects that can be used to configure LMP interface."
```

```
   ::= { lmpGroups 2 }


lmpCcIsInterfaceGroup OBJECT-GROUP
   OBJECTS { lmpCcIsIf }
   STATUS  current
   DESCRIPTION
           "Objects that can be used to configure control channels
            that are interfaces."
   ::= { lmpGroups 3 }


lmpCcIsNotInterfaceGroup OBJECT-GROUP
   OBJECTS { lmpCcUnderlyingIfIndex,
             lmpCcIsIf,
             lmpCcLastChange,
             lmpCcAdminStatus
           }
   STATUS  current
   DESCRIPTION
           "Objects that can be used to configure control channels
            that are not interfaces."
   ::= { lmpGroups 4 }


lmpLinkPropertyCorrelationGroup OBJECT-GROUP
   OBJECTS { lmpLinkPropertyNotificationsEnabled }
   STATUS  current
   DESCRIPTION
           "Collection of objects used to configure the link
            property correlation procedure."
   ::= { lmpGroups 5 }


lmpLinkVerificationGroup OBJECT-GROUP
   OBJECTS { lmpGlobalLinkVerificationInterval,
             lmpLinkVerifyInterval,
             lmpLinkVerifyDeadInterval,
             lmpLinkVerifyTransportMechanism,
             lmpLinkVerifyAllLinks,
             lmpLinkVerifyTransmissionRate,
             lmpLinkVerifyWavelength,
             lmpLinkVerifyRowStatus,
             lmpLinkVerifyStorageType,
             lmpDataLinkNotificationsEnabled
           }
   STATUS  current
   DESCRIPTION
           "Collection of objects that represent the link
            verification procedure configuration."
   ::= { lmpGroups 6 }
```

     lmpPerfGroup OBJECT-GROUP
        OBJECTS { lmpCcInOctets,
                  lmpCcInDiscards,
                  lmpCcInErrors,
                  lmpCcOutOctets,
                  lmpCcOutDiscards,
                  lmpCcOutErrors,
                  lmpCcConfigReceived,
                  lmpCcConfigSent,
                  lmpCcConfigRetransmit,
                  lmpCcConfigAckReceived,
                  lmpCcConfigAckSent,
                  lmpCcConfigNackSent,
                  lmpCcConfigNackReceived,
                  lmpCcHelloReceived,
                  lmpCcHelloSent,
                  lmpCcBeginVerifyReceived,
                  lmpCcBeginVerifySent,
                  lmpCcBeginVerifyRetransmit,
                  lmpCcBeginVerifyAckReceived,
                  lmpCcBeginVerifyAckSent,
                  lmpCcBeginVerifyNackReceived,
                  lmpCcBeginVerifyNackSent,
                  lmpCcEndVerifyReceived,
                  lmpCcEndVerifySent,
                  lmpCcEndVerifyRetransmit,
                  lmpCcEndVerifyAckReceived,
                  lmpCcEndVerifyAckSent,
                  lmpCcTestStatusSuccessReceived,
                  lmpCcTestStatusSuccessSent,
                  lmpCcTestStatusSuccessRetransmit,
                  lmpCcTestStatusFailureReceived,
                  lmpCcTestStatusFailureSent,
                  lmpCcTestStatusFailureRetransmit,
                  lmpCcTestStatusAckReceived,
                  lmpCcTestStatusAckSent,
                  lmpCcLinkSummaryReceived,
                  lmpCcLinkSummarySent,
                  lmpCcLinkSummaryRetransmit,
                  lmpCcLinkSummaryAckReceived,
                  lmpCcLinkSummaryAckSent,
                  lmpCcLinkSummaryNackReceived,
                  lmpCcLinkSummaryNackSent,
                  lmpCcChannelStatusReceived,
                  lmpCcChannelStatusSent,
                  lmpCcChannelStatusRetransmit,
                  lmpCcChannelStatusAckReceived,
                  lmpCcChannelStatusAckSent,

```
            lmpCcChannelStatusReqReceived,
            lmpCcChannelStatusReqSent,
            lmpCcChannelStatusReqRetransmit,
            lmpCcChannelStatusRspReceived,
            lmpCcChannelStatusRspSent,
            lmpCcCounterDiscontinuityTime,
            lmpTeInOctets,
            lmpTeOutOctets,
            lmpTeBeginVerifyReceived,
            lmpTeBeginVerifySent,
            lmpTeBeginVerifyRetransmit,
            lmpTeBeginVerifyAckReceived,
            lmpTeBeginVerifyAckSent,
            lmpTeBeginVerifyNackReceived,
            lmpTeBeginVerifyNackSent,
            lmpTeEndVerifyReceived,
            lmpTeEndVerifySent,
            lmpTeEndVerifyRetransmit,
            lmpTeEndVerifyAckReceived,
            lmpTeEndVerifyAckSent,
            lmpTeTestStatusSuccessReceived,
            lmpTeTestStatusSuccessSent,
            lmpTeTestStatusSuccessRetransmit,
            lmpTeTestStatusFailureReceived,
            lmpTeTestStatusFailureSent,
            lmpTeTestStatusFailureRetransmit,
            lmpTeTestStatusAckReceived,
            lmpTeTestStatusAckSent,
            lmpTeLinkSummaryReceived,
            lmpTeLinkSummarySent,
            lmpTeLinkSummaryRetransmit,
            lmpTeLinkSummaryAckReceived,
            lmpTeLinkSummaryAckSent,
            lmpTeLinkSummaryNackReceived,
            lmpTeLinkSummaryNackSent,
            lmpTeChannelStatusReceived,
            lmpTeChannelStatusSent,
            lmpTeChannelStatusRetransmit,
            lmpTeChannelStatusAckReceived,
            lmpTeChannelStatusAckSent,
            lmpTeChannelStatusReqReceived,
            lmpTeChannelStatusReqSent,
            lmpTeChannelStatusReqRetransmit,
            lmpTeChannelStatusRspSent,
            lmpTeChannelStatusRspReceived,
            lmpTeCounterDiscontinuityTime,
            lmpDataLinkTestReceived,
            lmpDataLinkTestSent,
```

```
               lmpDataLinkActiveTestSuccess,
               lmpDataLinkActiveTestFailure,
               lmpDataLinkPassiveTestSuccess,
               lmpDataLinkPassiveTestFailure,
               lmpDataLinkDiscontinuityTime
              }
    STATUS   current
    DESCRIPTION
            "Collection of objects used to provide performance
             information about LMP interfaces and data-bearing links."
    ::= { lmpGroups 7 }

lmpTeLinkGroup OBJECT-GROUP
    OBJECTS { lmpTeLinkNbrRemoteNodeId,
               lmpTeLinkVerification,
               lmpTeLinkFaultManagement,
               lmpTeLinkDwdm,
               lmpTeLinkOperStatus,
               lmpTeLinkRowStatus,
               lmpTeLinkStorageType,
               lmpTeLinkNotificationsEnabled
              }
    STATUS   current
    DESCRIPTION
            "Objects that can be used to configure TE links."
    ::= { lmpGroups 8 }

lmpDataLinkGroup OBJECT-GROUP
    OBJECTS { lmpDataLinkType,
               lmpDataLinkAddressType,
               lmpDataLinkIpAddr,
               lmpDataLinkRemoteIpAddress,
               lmpDataLinkRemoteIfId,
               lmpDataLinkEncodingType,
               lmpDataLinkActiveOperStatus,
               lmpDataLinkPassiveOperStatus,
               lmpDataLinkRowStatus,
               lmpDataLinkStorageType
              }
    STATUS   current
    DESCRIPTION
            "Collection of objects that represent data-bearing link
             configuration."
    ::= { lmpGroups 9 }

lmpNotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS { lmpTeLinkPropertyMismatch,
                     lmpDataLinkPropertyMismatch,
```

```
                     lmpUnprotected,
                     lmpControlChannelUp,
                     lmpControlChannelDown,
                     lmpTeLinkDegraded,
                     lmpTeLinkNotDegraded,
                     lmpDataLinkVerificationFailure }
     STATUS   current
     DESCRIPTION
             "Set of notifications defined in this module."
     ::= { lmpGroups 10 }

-- End of LMP-MIB
END
```

## 10.  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 can have a negative effect on
network operations.  These are the tables and objects and their
sensitivity/vulnerability:

-   Unauthorized changes to the lmpNbrTable, lmpControlChannelTable,
    lmpTeLinkTable, and lmpDataLinkTable may disrupt allocation of
    resources in the network.

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 lmpNbrTable exposes network provider's node IP addresses.

-   lmpControlChannelTable exposes network provider's control
    network.

-   lmpDataLinkTable exposes network provider's data network.

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

It is RECOMMENDED that implementers consider the security features as
provided by the SNMPv3 framework (see [RFC3410], section 8),
including full support for the SNMPv3 cryptographic mechanisms (for
authentication and privacy).

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

## 11.  Contributors

Sudheer Dharanikota
EMail: sudheer@ieee.org

## 12.  Acknowledgements

The general structure of this document has been modeled around the
MPLS Label Switching Router (LSR) MIB [RFC3813].

The authors wish to thank Dmitry Ryumkin, Baktha Muralidharan and
George Wang.

## 13.  IANA Considerations

Each of the following "IANA Considerations" subsections requested
IANA for new assignments.  New assignments can only be made via a
Standards Action as specified in [RFC2434].

## 13.1.  IANA Considerations for lmp ifType

The IANA has assigned 227 ifType for LMP interfaces.

## 13.2.  IANA Considerations for LMP-MIB

The IANA has assigned { transmission 227 } to the LMP-MIB module
specified in this document.

14.  References

14.1.  Normative References

   [RFC2119]      Bradner, S., "Key words for use in RFCs to Indicate
                  Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC2434]      Narten, T. and H. Alvestrand, "Guidelines for Writing
                  an IANA Considerations Section in RFCs", BCP 26, RFC
                  2434, October 1998.

   [RFC2578]      McCloghrie, K., Perkins, D., and J. Schoenwaelder,
                  "Structure of Management Information Version 2
                  (SMIv2)", STD 58, RFC 2578, April 1999.

   [RFC2579]      McCloghrie, K., Perkins, D., and J. Schoenwaelder,
                  "Textual Conventions for SMIv2", STD 58, RFC 2579,
                  April 1999.

   [RFC2580]      McCloghrie, K., Perkins, D., and J. Schoenwaelder,
                  "Conformance Statements for SMIv2", STD 58, RFC 2580,
                  April 1999.

   [RFC2863]      McCloghrie, K. and F. Kastenholz, "The Interfaces Group
                  MIB", RFC 2863, June 2000.

   [RFC2914]      Floyd, S., "Congestion Control Principles", BCP 41, RFC
                  2914, September 2000.

   [RFC3471]      Berger, L., "Generalized Multi-Protocol Label Switching
                  (GMPLS) Signaling Functional Description", RFC 3471,
                  January 2003.

   [RFC4001]      Daniele, M., Haberman, B., Routhier, S., and J.
                  Schoenwaelder, "Textual Conventions for Internet
                  Network Addresses", RFC 4001, February 2005.

   [RFC4204]      Lang, J., "Link Management Protocol (LMP)", RFC 4204,
                  October 2005.

   [RFC4207]      Lang, J. and D. Papadimitriou, "Synchronous Optical
                  Network (SONET)/Synchronous Digital Hierarchy (SDH)
                  Encoding for Link Management Protocol (LMP) Test
                  Messages", RFC 4207, October 2005.

   [RFC4209]       Fredette, A., Ed. and J. Lang, Ed., "Link Management
                   Protocol (LMP) for Dense Wavelength Division
                   Multiplexing (DWDM) Optical Line Systems", RFC 4209,
                   October 2005.

   [RFC4220]       Dubuc, M., Nadeau, T., and J. Lang, "Traffic
                   Engineering Link Management Information Base", RFC
                   4220, November 2005.

14.2.  Informative References

   [RFC3410]       Case, J., Mundy, R., Partain, D., and B. Stewart,
                   "Introduction and Applicability Statements for
                   Internet-Standard Management Framework", RFC 3410,
                   December 2002.

   [RFC3813]       Srinivasan, C., Viswanathan, A., and T. Nadeau,
                   "Multiprotocol Label Switching (MPLS) Traffic
                   Engineering (TE) Management Information Base (MIB)",
                   RFC 3812, June 2004.

Authors' Addresses

    Martin Dubuc

    EMail: dubuc.consulting@sympatico.ca


    Thomas D. Nadeau
    Cisco Systems, Inc.
    1414 Massachusetts Ave.
    Boxborough, MA 01719

    EMail: tnadeau@cisco.com


    Jonathan P. Lang
    Sonos, Inc.
    223 E. De La Guerra St.
    Santa Barbara, CA 93101

    EMail: jplang@ieee.org


    Evan McGinnis
    Hammerhead Systems
    640 Clyde Court
    Mountain View, CA 94043

    EMail: emcginnis@hammerheadsystems.com