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

Status of This Memo

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Abstract

This document provides minor corrections to and obsoletes RFC 4327.

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 the 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. This example is not meant to illustrate every nuance of the MIB module, but it is intended as an aid to understanding some of the key concepts. It is meant to be read after one goes 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) and 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(2),
      lmpCcAuthentication              = false(2),
      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(2),
      lmpCcAuthentication              = false(2),
      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(1),
      lmpTeLinkFaultManagement     = true(1),
      lmpTeLinkDwdm                = false(2),
      lmpTeLinkRowStatus           = createAndGo(4),
      lmpTeLinkStorageType         = nonVolatile(3)
   }
```

and in lmpLinkVerificationTable:

```
   {
      ifIndex                          = 20,
      lmpLinkVerifyInterval            = 100,
      lmpLinkVerifyDeadInterval        = 300,
      lmpLinkVerifyTransportMechanism  = j0Trace(3),
      lmpLinkVerifyAllLinks            = true(1),
      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].

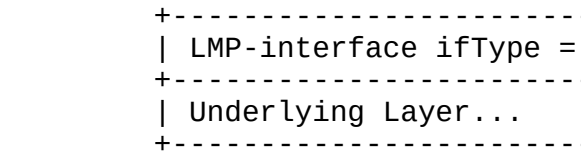
In parallel with the entry created in the lmpTeLinkTable, an entry may be created in the teLinkTable of the TE Link MIB module [RFC4220].

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 (1). 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:



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              -- RFC 2578

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

   TEXTUAL-CONVENTION, TruthValue, RowStatus, StorageType,
   TimeStamp
```

```
      FROM SNMPv2-TC                -- RFC 2579

   InterfaceIndexOrZero, ifIndex
      FROM IF-MIB                   -- RFC 2863

   InetAddressType, InetAddress
      FROM INET-ADDRESS-MIB         -- RFC 4001

   teLinkRemoteIpAddr, teLinkIncomingIfId, TeLinkEncodingType
      FROM TE-LINK-STD-MIB;         -- RFC 4220

lmpMIB MODULE-IDENTITY
   LAST-UPDATED "200608140000Z"  -- 14 August 2006
   ORGANIZATION "Common Control and Measurement Protocols (CCAMP)
                 Working Group"
   CONTACT-INFO
       "        Martin Dubuc
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   DESCRIPTION
       "Copyright (C) 2006 The Internet Society.  This version of
        the MIB module is part of RFC 4631; 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
       "200608140000Z"  -- 14 August 2006
   DESCRIPTION
       "Revised version:
        - Fixes textual descriptions of TruthValue settings such that
          True is always 1 and False is always 2.
        - Adds punctuation to REFERENCE clauses.
```

```
         This revision published as RFC 4631"
    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 the congestion-handling mechanism 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 the 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 as 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 an LMP-enabled device for
        every control channel.  Whenever a new entry is created with
        lmpCcIsIf set to true(1), 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 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;
        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 learned."
    ::= { 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.
         The 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
         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 the
        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 the 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 whether 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 whether 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 whether 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 that 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(1) 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
         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 links 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; 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; 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
         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 this MIB was designed, care was taken to minimize the
        amount of notifications generated for LMP purposes.  Wherever
        possible, notifications are state driven, meaning that the
        notifications are sent only when the system changes state.
        The only notifications that are repeated and that 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, where 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 that 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(1), 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(1), 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(1), 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(1), 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(1), 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(1).  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(1).  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 is more than one
        control channel 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(1)."
   ::= { 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(1)."
   ::= { 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(1)."
   ::= { 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(1)."
   ::= { 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(1)."
   ::= { 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(1).  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 constraint applies:
           lmpCcIsIf must at least be read-only, returning false(2)."

      GROUP lmpCcIsInterfaceGroup
      DESCRIPTION
          "This group is mandatory for devices that support
           control channels that are interfaces, in addition to
           lmpControlChannelGroup.  The following constraint applies:
           lmpCcIsIf must at least be read-only, returning true(1)."

      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), or
           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 constraint applies:
           lmpCcIsIf must at least be read-only, returning false(2)."

      GROUP lmpCcIsInterfaceGroup
```

```
      DESCRIPTION
          "This group is mandatory for devices that support
           control channels that are interfaces, in addition to
           lmpControlChannelGroup.  The following constraint applies:
           lmpCcIsIf must at least be read-only, returning true(1)."

      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), or
             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
            "The size of the data-bearing link IP address depends on
             the type of data-bearing link.  Data-bearing link IP
             address size is zero if the link is unnumbered, four if
             the link IP address is IPv4, and sixteen if the 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 the network provider’s node IP addresses.

- lmpControlChannelTable exposes the network provider’s control network.

- lmpDataLinkTable exposes the 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

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12. Acknowledgements

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

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13. IANA Considerations

No new IANA actions are requested in this document. All IANA actions from RFC 4327 still hold and are reproduced here for information.

Note that 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. Changes from RFC 4327 to RFC 4631

The following changes have been made relative to RFC 4327.

a. Show that this document obsoletes RFC 4327.
b. Indicate in Abstract that this document provides minor corrections to RFC 4327.
c. Correct use of TruthValue settings such that True is always 1, and False is always 2.
d. Update to acknowledgements section.
e. Note in IANA section to show no further action required.
f. Remove identification of RFC 4327 and request RFC Editor to insert new RFC number.
g. Update timestamps.

h. Update author information.
i. Added punctuation to REFERENCE clauses.
j. Update Revision History clause.
k. Add this section.
l. Remove square braces from references to external documents from within the MIB module itself.
m. Minor editorial corrections to text and DESCRIPTIONS clauses.

15. References

15.1. 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., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.

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

[RFC2580] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "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. and J. Lang, "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.

15.2. 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) Label Switching Router (LSR) Management Information Base (MIB)", RFC 3813, June 2004.

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