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Definitions of Managed Objects for the
Multiprotocol Label Switching (MPLS),
Label Distribution Protocol (LDP)

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects for the Multiprotocol Label Switching, Label Distribution Protocol (LDP).

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1. Introduction

This document defines 4 MIB Modules which together support the configuration and monitoring of the Label Distribution Protocol (LDP). The Label Distribution Protocol (LDP) [RFC3036] is one type of Multiprotocol Label Switching (MPLS) protocols described in [RFC3031] and [RFC3032]. Utilizing all 4 MIB Modules allows an operator to configure LDP sessions using 3 different Layer 2 media. The Layer 2 media supported by the MIB Modules are Ethernet, ATM and Frame Relay as described in [RFC3036], [RFC3034] and [RFC3035].

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].

For an introduction to the concepts of MPLS, see [RFC3031]. For further on LDP refer to [RFC3037] and [RFC3215].

2. The Internet-Standard Management Framework

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

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

3. Structure of the MIB Modules

This section describes the structure of the LDP MIB Modules.

3.1. Overview

There are 4 MIB Modules in this document. These MIB Modules are the MPLS-LDP-STD-MIB, the MPLS-LDP-GENERIC-STD-MIB, the MPLS-LDP-ATM-STD-MIB and the MPLS-LDP-FRAME-RELAY-STD-MIB. The MPLS-LDP-STD-MIB defines objects which are common to all LDP implementations. The MPLS-LDP-GENERIC-STD-MIB defines Layer 2 Per Platform Label Space objects for use with the MPLS-LDP-STD-MIB. The MPLS-LDP-ATM-STD-MIB defines Layer 2 Asynchronous Transfer Mode (ATM) objects for use with the MPLS-LDP-STD-MIB. The MPLS-LDP-FRAME-RELAY-STD-MIB defines Layer 2 FRAME-RELAY objects for use with the MPLS-LDP-STD-MIB.

The MPLS-LDP-STD-MIB Module MUST be implemented and at least one of the Layer 2 MIB Modules MUST be implemented by an Agent developer on an Label Switching Router (LSR) or Label Edge Router (LER). As an example, if a Label Switching Router (LSR) or Label Edge Router (LER) implementation intends to support LDP utilizing a Layer 2 of Ethernet, then the MPLS-LDP-STD-MIB and the MPLS-LDP-GENERIC-STD-MIB Modules MUST be implemented. If an LSR/LER implementation intends to support LDP utilizing a Layer 2 of ATM, then the MPLS-LDP-STD-MIB Module and the MPLS-LDP-ATM-MIB Module MUST be implemented. If an LSR/LER implementation intends to support LDP utilizing a Layer 2 of

FRAME-RELAY, then the MPLS-LDP-STD-MIB Module and the MPLS-LDP-FRAME-RELAY-STD-MIB Module MUST be implemented. An LDP implementation that utilizes all three Layer 2 media (Ethernet, Frame-Relay, ATM) MUST support all 4 MIB Modules. Each of the Modules will be discussed in detail in the following sections.

There are 2 compliance statements for each MIB Module. One compliance statement is for full compliance which allows both configuration and monitoring via SNMP. The other compliance statement is for read-only compliance which allows only monitoring via SNMP.

3.2. Future Considerations

The LDP Specification [RFC3036] does not specify the use of VPNs or multicast for LDP, and thus, objects related to these areas have not been included.

[RFC2684] does not describe VP merge capability and so this feature has not been included.

These areas need to be specified in the LDP Specification or other specifications prior to being added in this or any other MIB document.

3.3. Interface Indexing

Interface Indexes as specified in [RFC2863] are used in these MIB Modules. The descriptions of the ifIndexes denote which ifIndex is being used. The use of ifIndex is for actual existing connections.

3.4. Differences from the LDP Specification

Currently, there are 3 differences between this specification and the LDP Specification. As described in the Introduction, this document is almost entirely based on the LDP specification. The differences are documented here.

The first difference is that the LDP Entity Table contains some DEFVAL clauses which are not specified explicitly in the LDP Specification. These values, although not documented in the LDP Specification, are widely used by existing LDP MIB implementations and thus, have been adopted within this MPLS-LDP-STD-MIB module. Please note, they can certainly be changed during row creation or a subsequent SET request.

A second difference is the `mplsLdpEntityGenericLRTable` in the MPLS-LDP-GENERIC-STD-MIB Module. This table, although provided as a way to reserve a range of generic labels, does not exist in the LDP Specification. It was added to the MIB due to a request from the working group and because this table was considered useful for reserving a range of generic labels.

The third difference is documented by the TEXTUAL-CONVENTION, `MplsAtmVcIdentifier` which is in the MPLS-TC-STD-MIB [RFC3811]. This TC was added to restrict vci values to be greater than 31 as described in RFC 3035 [RFC3035].

3.5. The MPLS-LDP-STD-MIB Module

This MIB Module contains objects which are common to all LDP implementations. This MIB Module MUST always be implemented along with one or more of the Layer 2 MIB Modules. This MIB Module IMPORTS `IndexInteger` and `IndexIntegerNextFree` TEXTUAL-CONVENTIONS from [RFC3289], and IMPORTS `InetAddressPrefixLength`, `InetAddressType`, `InetAddressInetPortNumber` TEXTUAL-CONVENTIONS from [RFC3291].

The `mplsLdpEntityTable` table allows the Label Edge Router (LER) or the Label Switching Router (LSR) to initiate and/or receive requests to establish LDP sessions. As the LDP protocol distributes labels and establishes sessions with Peers most of the tables in this module are populated by the agent as instructed by the LDP protocol. The exception is the `mplsFecTable` and the `mplsLdpLspFecTable` which can be configured by the operator to specify Forwarding Equivalence Class information for an LSP.

Some scalars and each table in the MPLS-LDP-STD-MIB Module are described in the following subsections.

3.5.1. LDP Scalar Objects

There are several scalar objects in the LDP MIB module. The `mplsLdpLsrId` is a read-only scalar object which reports Label Switching Router's (LSR's) Identifier. This MUST be a globally unique value, such as the 32-bit router ID assigned to the LSR.

The `mplsLdpLsrLoopDetectionCapable` scalar object denotes whether the LSR is capable of supporting loop detection and if so, which form of loop detection.

There are two LastChange scalar objects, `mplsLdpEntityLastChange` and `mplsLdpPeerLastChange`. These objects give an indication of there was a change in the number of entries in the table, or if any of the values in the respective tables changed. Please see the object's description for more details.

The `mplsLdpEntityIndexNext` scalar object is described in the next section.

3.5.2. The LDP Entity Table

The MPLS-LDP-STD-MIB provides objects to configure/set-up potential LDP sessions on a specific LSR/LER. The `mplsLdpEntityTable` is used to configure information which is used by the LDP protocol to setup potential LDP Sessions.

Each entry/row in this table represents a single LDP Entity. There is no maximum number of LDP Entities specified. However, there is an `mplsLdpEntityIndexNext` object which should be retrieved by the command generator prior to creating an LDP Entity. If the `mplsLdpEntityIndexNext` object is zero, this indicates that the LSR/LER is not able to create another LDP Entity at that time.

3.5.2.1. Changing Values After Session Establishment

One way to manually modify a session's parameters is by using SNMP to change the MIB objects related to that session. Please note, special care should be taken if MIB objects which are used in the MPLS LDP Session Initialization need to be modified. If the modification of any of these MIB variables takes place anytime after the start of session initialization, then the entire session must be halted. Any information learned by that session must be discarded. The objects should then be modified, and session initialization started. Assuming that the configuration was done correctly, then a new session will be created.

For example, assume that an operator wishes to change the configuration of a Label Range which is used by a Session that has already been established. The operator should change the `mplsLdpEntityAdminStatus` to "disable(2)". Setting the `mplsLdpEntityAdminStatus` to "disable(2)" will cause the session to be torn down (i.e., this will signal to LDP that it should send out tear down messages for that session). Also, all information related to that session should be removed from this MIB by the Agent. This includes Peer information (i.e., relevant row in the `mplsPeerTable`) and Session statistics (i.e., relevant row in the `mplsLdpSessionTable`). Also, if the MPLS-LSR-STD-MIB module [RFC3813] is implemented and the optional Mapping Table objects are

implemented, then all information related to the LSPs in this session should be removed from these MIB modules. [For more information please see the section on "The Mapping Tables".] At this point, the operator could modify the Label Range. Lastly, the operator should set the `mplsLdpEntityAdminStatus` to "enable(1)". At this point session initialization should occur. The LDP Entity goes through the Session Initialization in order to communicate the new Label Ranges to the Peer and establish new LSPs.

3.5.3. The LDP Entity Statistics Table

The `mplsLdpEntityStatsTable` is a read-only table which contains statistical information related to failed attempts to establish sessions. Each row in this table AUGMENTS an `mplsLdpEntityEntry`. This table could be used to give insight into how to reconfigure values so that a session could be successfully established. For example, if the `mplsLdpEntityStatsSessionRejectedLRErrors` Counter object was increasing, then this would indicate that the Label Range (LR) may need to be adjusted.

3.5.4. The LDP Peer Table

The `mplsLdpPeerTable` is a read-only table which contains information about LDP Peers known to LDP Entities. In other words, the Peer information is learned by LDP through initialization or discovery. This table should be populated by the agent as directed by the LDP protocol.

A row in this table is related to one or more rows in the Hello Adjacency Table and related to a single row in the Session Table. The values in the Peer table are specific to a Peer and may or may not be the same values used in the session. The reason is that the Peer and Entity negotiate certain values. The Entity's values are configured in the `mplsLdpEntityTable` and the Peer's values are learned (and placed into the `mplsLdpPeerTable`). The `mplsLdpSessionTable` shows the values used in establishing the session.

One example, of when the Peer's values and the Session's values may differ is with the Peer's Path Limit information. The Peer's Path Limit information is learned from the session initialization phase. The actual value for the Path Vector Limit is the Peer's value and may not be the same value that appears in the session. There could be a mismatch in this value between the Entity and the Peer. In the event of a mismatch, then the session will use the Path Limit set by the Entity (and not the Peer).

The Peer Table information was placed in a separate table from the Session information to allow for a more comprehensive and coherent MIB model.

3.5.5. The LDP Session Table

The `mplsLdpSessionTable` is a read-only table. Each entry in this table represents a single session between an LDP Entity and a Peer. The `mplsLdpSessionEntry` AUGMENTS the `mplsLdpPeerEntry`.

The information in this table is learned during session establishment. NOTE: rows in this table will appear during session initialization.

3.5.6. The LDP Session Statistics Table

The `mplsLdpSessionStatsTable` is a read-only table which contains statistical information on sessions. This table AUGMENTS the `mplsLdpPeerTable`.

3.5.7. The LDP Hello Adjacency Table

This is a table of all adjacencies between all LDP Entities and all LDP Peers. A Session may have one or more adjacencies. A session should not have zero adjacencies, because this indicates that the session has lost contact with the Peer. A session which has zero Hello Adjacencies should be removed.

3.5.8. The LDP LSP Tables

The Label Information Base (LIB) contains information about labels learned by the LSR. The LIB for LDP, CR-LDP and MPLS-RSVP (i.e., all currently defined MPLS protocols) is represented in the LSR MIB [RFC3813]. The LIB is represented by the LSR MIB's `mplsXCTable` (`mpls Cross Connect Table`), `mplsInSegmentTable` (`mpls In Segment Table`) and the `mplsOutSegmentTable` (`mpls Out Segment Table`). The `mplsXCTable` models the cross-connection of the incoming label with a specific outgoing label. The `mplsInSegmentTable` stores the incoming label's information, and the `mplsOutSegmentTable` stores the outgoing label's information.

The LDP Session that created the LSP and the LSP's (incoming label, outgoing label) pair along with other information is contained in the MPLS-LSR-STD-MIB module's `mplsXCTable`, the `mplsInSegmentTable` and the `mplsOutSegmentTable`.

In order to utilize the MPLS-LSR-STD-MIB module's `mplsXCTable`, `mplsInSegmentTable` and `mplsOutSegmentTable` for LDP LSPs, there needs to be a mechanism to associate LDP sessions with LDP LSPs created as a result of those LDP sessions. The `mplsInSegmentLdpLspTable` and `mplsOutSegmentLdpLspTable` in this MIB contain information to find the LDP LSP entries in the `mplsInSegmentTable`, `mplsOutSegmentTable` and the `mplsXCTable`.

These two tables, the `mplsInSegmentLdpLspTable` and `mplsOutSegmentLdpLspTable`, have been made optional in the conformance section of the MIB. They only need to be supported if the LSR MIBs `mplsInSegmentTable`, `mplsOutSegmentTable` and `mplsXCTable` are implemented.

As discussed in the section, "Changing Values after Session Establishment", if a session is torn down, then all the information related to this session, must be removed from the both LDP MIB and, if implemented, from the LSR MIB.

3.5.9. The FEC Tables

The `mplsLdpFecTable` is a table which contains FEC (Forwarding Equivalence Class) information. Each entry/row represents a single FEC Element. There is also an LDP LSP FEC Table, `mplsLdpLspFecTable`, which associates FECs with the LSPs.

3.5.10. The LDP Session Peer Address Table

The `mplsLdpSessionPeerAddrTable` is a table which extends the `mplsLdpSessionTable`. This table is a read-only table which stores Addresses learned after session initialization via Address Message advertisement.

3.6. LDP Notifications

Currently, there are several notifications which are specific for LDP. These are described in this section. There are no objects which enable or disable notifications from being generated. RFC 3413 [RFC3413] contains MIB modules which can be implemented that will enable or disable these notifications from being generated.

The `mplsLdpInitSessionThresholdExceeded` notification indicates to the operator that there may be a misconfigured `mplsLdpEntityEntry` because the session associated with this Entity is not being established, and the Entity keeps trying to establish the session. A side effect of this situation is that a row in the `mplsLdpSessionTable` may not be reaching the operational state as indicated by the `mplsLdpSessionState` object. If the value of

mplsLdpEntityInitSessionThreshold is 0 (zero) then this is equal to specifying the value of infinity for the threshold, and the mplsLdpInitSessionThresholdExceeded notification will never be sent.

The mplsLdpPathVectorLimitMismatch notification is generated when there is a mismatch in the Path Vector Limits between the Entity and Peer during session initialization. The session uses the value which is configured as the Entity's Path Vector Limit. However, a notification should be generated to indicate that a mismatch occurred. For further details, please see Section 3.5.3 of the LDP Specification [RFC3036].

The mplsLdpSessionUp and mplsLdpSessionDown notifications are generated when there is an appropriate change in the mplsLdpSessionState object, e.g., when sessions change state (Up to Down for the mplsLdpSessionDown notification, or Down to Up for the mplsLdpSessionUp notification). There was discussion about combining these two notifications into a single notification, however, some NMS applications can utilize two different notifications, rather than having to parse the varbind list of a single notification. For example, the SessionDown is matched to a SessionUp notification more easily by some NMS applications, than having to parse a Varbind list in a SessionChange type of notification.

3.7. LDP Notification Frequency

LDP Notifications are expected to be few in number when LDP is ubiquitously deployed in a relatively stable network. A notification receiver, e.g., an NMS, that receives these notifications should not be overwhelmed by the frequency of LDP notifications. If this assertion proves to be inaccurate, then a throttling object to throttle these notifications may be added to future versions of the MPLS-LDP-STD-MIB.

4. MPLS Label Distribution Protocol MIB Definitions

```
MPLS-LDP-STD-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    OBJECT-TYPE, MODULE-IDENTITY, NOTIFICATION-TYPE,  
    Integer32, Counter32, Unsigned32  
    FROM SNMPv2-SMI
```

```
-- [RFC2578]
```

```
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP  
    FROM SNMPv2-CONF
```

```
-- [RFC2580]
```

```
    RowStatus, TimeInterval, TruthValue,  
    TimeStamp, StorageType
```

```

        FROM SNMPv2-TC                                -- [RFC2579]

InetAddressPrefixLength,
InetAddressType,
InetAddress,
InetPortNumber
    FROM INET-ADDRESS-MIB                            -- [RFC3291]

IndexInteger,
IndexIntegerNextFree
    FROM DIFFSERV-MIB                                -- [RFC3289]

mplsStdMIB,
MplsLabelDistributionMethod,
MplsLdpIdentifier,
MplsLdpLabelType,
MplsLspType,
MplsLsrIdentifier,
MplsRetentionMode
    FROM MPLS-TC-STD-MIB                            -- [RFC3811]

MplsIndexType
    FROM MPLS-LSR-STD-MIB;                            -- [RFC3813]

mplsLdpStdMIB MODULE-IDENTITY
    LAST-UPDATED "200406030000Z" -- June 3, 2004
    ORGANIZATION "Multiprotocol Label Switching (mpls)
                  Working Group"
    CONTACT-INFO

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        MPLS Working Group, email: mpls@uu.net"

DESCRIPTION
    "Copyright (C) The Internet Society (2004). The
    initial version of this MIB module was published

```

in RFC 3815. For full legal notices see the RFC
itself or see:
<http://www.ietf.org/copyrights/ianamib.html>

This MIB contains managed object definitions for the
'Multiprotocol Label Switching, Label Distribution
Protocol, LDP' document."

REVISION "200406030000Z" -- June 3, 2004

DESCRIPTION

"Initial version published as part of RFC 3815."

::= { mplsStdMIB 4 }

--*****

mplsLdpNotifications OBJECT IDENTIFIER ::= { mplsLdpStdMIB 0 }
mplsLdpObjects OBJECT IDENTIFIER ::= { mplsLdpStdMIB 1 }
mplsLdpConformance OBJECT IDENTIFIER ::= { mplsLdpStdMIB 2 }

--*****

-- MPLS LDP Objects

--*****

mplsLdpLsrObjects OBJECT IDENTIFIER ::= { mplsLdpObjects 1 }

mplsLdpEntityObjects OBJECT IDENTIFIER ::= { mplsLdpObjects 2 }

--

-- The MPLS Label Distribution Protocol's

-- Label Switching Router Objects

--

mplsLdpLsrId OBJECT-TYPE

SYNTAX MplsLsrIdentifier

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The Label Switching Router's Identifier."

::= { mplsLdpLsrObjects 1 }

mplsLdpLsrLoopDetectionCapable OBJECT-TYPE

SYNTAX INTEGER {
 none(1),
 other(2),
 hopCount(3),
 pathVector(4),
 hopCountAndPathVector(5)

```

    }
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "A indication of whether this
        Label Switching Router supports
        loop detection.

        none(1) -- Loop Detection is not supported
                  on this LSR.

        other(2) -- Loop Detection is supported but
                  by a method other than those
                  listed below.

        hopCount(3) -- Loop Detection is supported by
                     Hop Count only.

        pathVector(4) -- Loop Detection is supported by
                        Path Vector only.

        hopCountAndPathVector(5) -- Loop Detection is
                                   supported by both Hop Count
                                   And Path Vector.

```

Since Loop Detection is determined during Session Initialization, an individual session may not be running with loop detection. This object simply gives an indication of whether or not the LSR has the ability to support Loop Detection and which types."

```
 ::= { mplsLdpLsrObjects 2 }
```

```

--
-- The MPLS Label Distribution Protocol Entity Objects
--

```

```

mplsLdpEntityLastChange OBJECT-TYPE
    SYNTAX    TimeStamp
    MAX-ACCESS read-only
    STATUS    current
    DESCRIPTION
        "The value of sysUpTime at the time of the most
        recent addition or deletion of an entry
        to/from the mplsLdpEntityTable/mplsLdpEntityStatsTable, or
        the most recent change in value of any objects in the
        mplsLdpEntityTable.

```

If no such changes have occurred since the last re-initialization of the local management subsystem, then this object contains a zero value."

::= { mplsLdpEntityObjects 1 }

mplsLdpEntityIndexNext OBJECT-TYPE

SYNTAX IndexIntegerNextFree

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains an appropriate value to be used for mplsLdpEntityIndex when creating entries in the mplsLdpEntityTable. The value 0 indicates that no unassigned entries are available."

::= { mplsLdpEntityObjects 2 }

mplsLdpEntityTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsLdpEntityEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains information about the MPLS Label Distribution Protocol Entities which exist on this Label Switching Router (LSR) or Label Edge Router (LER)."

::= { mplsLdpEntityObjects 3 }

mplsLdpEntityEntry OBJECT-TYPE

SYNTAX MplsLdpEntityEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents an LDP entity. An entry can be created by a network administrator or by an SNMP agent as instructed by LDP."

INDEX { mplsLdpEntityLdpId, mplsLdpEntityIndex }

::= { mplsLdpEntityTable 1 }

MplsLdpEntityEntry ::= SEQUENCE {

mplsLdpEntityLdpId MplsLdpIdentifier,

mplsLdpEntityIndex IndexInteger,

mplsLdpEntityProtocolVersion Unsigned32,

mplsLdpEntityAdminStatus INTEGER,

mplsLdpEntityOperStatus INTEGER,

mplsLdpEntityTcpPort InetPortNumber,

mplsLdpEntityUdpDscPort InetPortNumber,

```

mplsLdpEntityMaxPduLength      Unsigned32,
mplsLdpEntityKeepAliveHoldTimer Unsigned32,
mplsLdpEntityHelloHoldTimer   Unsigned32,
mplsLdpEntityInitSessionThreshold Integer32,
mplsLdpEntityLabelDistMethod  MplsLabelDistributionMethod,
mplsLdpEntityLabelRetentionMode MplsRetentionMode,
mplsLdpEntityPathVectorLimit   Integer32,
mplsLdpEntityHopCountLimit     Integer32,
mplsLdpEntityTransportAddrKind INTEGER,
mplsLdpEntityTargetPeer        TruthValue,
mplsLdpEntityTargetPeerAddrType InetAddressType,
mplsLdpEntityTargetPeerAddr    InetAddress,
mplsLdpEntityLabelType         MplsLdpLabelType,
mplsLdpEntityDiscontinuityTime TimeStamp,
mplsLdpEntityStorageType       StorageType,
mplsLdpEntityRowStatus          RowStatus
}

```

`mplsLdpEntityLdpId` OBJECT-TYPE

SYNTAX MplsLdpIdentifier

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The LDP identifier."

REFERENCE

"RFC3036, LDP Specification, Section on LDP Identifiers."

::= { mplsLdpEntityEntry 1 }

`mplsLdpEntityIndex` OBJECT-TYPE

SYNTAX IndexInteger

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This index is used as a secondary index to uniquely identify this row. Before creating a row in this table, the 'mplsLdpEntityIndexNext' object should be retrieved. That value should be used for the value of this index when creating a row in this table. NOTE: if a value of zero (0) is retrieved, that indicates that no rows can be created in this table at this time.

A secondary index (this object) is meaningful to some but not all, LDP implementations. For example an LDP implementation which uses PPP would use this index to differentiate PPP sub-links.

Another way to use this index is to give this the value of ifIndex. However, this is dependant

```
        on the implementation."
 ::= { mplsLdpEntityEntry 2 }

mplsLdpEntityProtocolVersion OBJECT-TYPE
    SYNTAX      Unsigned32(1..65535)
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The version number of the LDP protocol which will be
        used in the session initialization message.

        Section 3.5.3 in the LDP Specification specifies
        that the version of the LDP protocol is negotiated during
        session establishment. The value of this object
        represents the value that is sent in the initialization
        message."
    REFERENCE
        "RFC3036, LDP Specification, Section 3.5.3 Initialization
        Message."
    DEFVAL { 1 }
 ::= { mplsLdpEntityEntry 3 }

mplsLdpEntityAdminStatus OBJECT-TYPE
    SYNTAX      INTEGER {
                    enable(1),
                    disable(2)
                }
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The administrative status of this LDP Entity.
        If this object is changed from 'enable' to 'disable'
        and this entity has already attempted to establish
        contact with a Peer, then all contact with that
        Peer is lost and all information from that Peer
        needs to be removed from the MIB. (This implies
        that the network management subsystem should clean
        up any related entry in the mplsLdpPeerTable. This
        further implies that a 'tear-down' for that session
        is issued and the session and all information related
        to that session cease to exist).

        At this point the operator is able to change values
        which are related to this entity.

        When the admin status is set back to 'enable', then
        this Entity will attempt to establish a new session
        with the Peer."
```



```

DEFVAL { enable }
 ::= { mplsLdpEntityEntry 4 }

mplsLdpEntityOperStatus OBJECT-TYPE
    SYNTAX      INTEGER {
                    unknown(1),
                    enabled(2),
                    disabled(3)
                }
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The operational status of this LDP Entity.

        The value of unknown(1) indicates that the
        operational status cannot be determined at
        this time. The value of unknown should be
        a transient condition before changing
        to enabled(2) or disabled(3)."
```

```

 ::= { mplsLdpEntityEntry 5 }

mplsLdpEntityTcpPort OBJECT-TYPE
    SYNTAX      InetPortNumber
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The TCP Port for
        LDP. The default value is the well-known
        value of this port."
```

```

    REFERENCE
        "RFC3036, LDP Specification, Section 3.10, Well-known
        Numbers, and Section 3.10.1. UDP and TCP Ports."
    DEFVAL { 646 }
    ::= { mplsLdpEntityEntry 6 }

mplsLdpEntityUdpDscPort OBJECT-TYPE
    SYNTAX      InetPortNumber
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The UDP Discovery Port for
        LDP. The default value is the
        well-known value for this port."
```

```

    REFERENCE
        "RFC3036, LDP Specification, Section 2.4.1,
        Basic Discovery Mechanism, Section 2.4.2,
        Extended Discovery Mechanism, Section
        3.10, Well-known Numbers, and Section 3.10.1.
```

UDP and TCP Ports."
DEFVAL { 646 }
::= { mplsLdpEntityEntry 7 }

mplsLdpEntityMaxPduLength OBJECT-TYPE

SYNTAX Unsigned32 (256..65535)

UNITS "octets"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The maximum PDU Length that is sent in the Common Session Parameters of an Initialization Message. According to the LDP Specification [RFC3036] a value of 255 or less specifies the default maximum length of 4096 octets, this is why the value of this object starts at 256. The operator should explicitly choose the default value (i.e., 4096), or some other value.

The receiving LSR MUST calculate the maximum PDU length for the session by using the smaller of its and its peer's proposals for Max PDU Length."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3. Initialization Message."

DEFVAL { 4096 }

::= { mplsLdpEntityEntry 8 }

mplsLdpEntityKeepAliveHoldTimer OBJECT-TYPE

SYNTAX Unsigned32 (1..65535)

UNITS "seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The 16-bit integer value which is the proposed keep alive hold timer for this LDP Entity."

DEFVAL { 40 }

::= { mplsLdpEntityEntry 9 }

mplsLdpEntityHelloHoldTimer OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

UNITS "seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The 16-bit integer value which is the proposed Hello hold timer for this LDP Entity. The Hello Hold time in seconds.

An LSR maintains a record of Hellos received from potential peers. This object represents the Hold Time in the Common Hello Parameters TLV of the Hello Message.

A value of 0 is a default value and should be interpreted in conjunction with the `mplsLdpEntityTargetPeer` object.

If the value of this object is 0: if the value of the `mplsLdpEntityTargetPeer` object is `false(2)`, then this specifies that the Hold Time's actual default value is 15 seconds (i.e., the default Hold time for Link Hellos is 15 seconds). Otherwise if the value of the `mplsLdpEntityTargetPeer` object is `true(1)`, then this specifies that the Hold Time's actual default value is 45 seconds (i.e., the default Hold time for Targeted Hellos is 45 seconds).

A value of 65535 means infinite (i.e., wait forever).

All other values represent the amount of time in seconds to wait for a Hello Message. Setting the hold time to a value smaller than 15 is not recommended, although not forbidden according to RFC3036."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.2.,
Hello Message."

DEFVAL { 0 }

::= { `mplsLdpEntityEntry` 10 }

`mplsLdpEntityInitSessionThreshold` OBJECT-TYPE

SYNTAX Integer32(0..100)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"When attempting to establish a session with a given Peer, the given LDP Entity should send out the SNMP notification, '`mplsLdpInitSessionThresholdExceeded`', when the number of Session Initialization messages sent exceeds this threshold.

The notification is used to notify an operator when this Entity and its Peer are possibly engaged in an endless sequence of messages as each NAKs the other's

Initialization messages with Error Notification messages. Setting this threshold which triggers the notification is one way to notify the operator. The notification should be generated each time this threshold is exceeded and for every subsequent Initialization message which is NAK'd with an Error Notification message after this threshold is exceeded.

A value of 0 (zero) for this object indicates that the threshold is infinity, thus the SNMP notification will never be generated."

REFERENCE

"RFC3036, LDP Specification,
Section 2.5.3 Session Initialization."

DEFVAL { 8 }

::= { mplsLdpEntityEntry 11 }

mplsLdpEntityLabelDistMethod OBJECT-TYPE

SYNTAX MplsLabelDistributionMethod

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"For any given LDP session, the method of label distribution must be specified."

::= { mplsLdpEntityEntry 12 }

mplsLdpEntityLabelRetentionMode OBJECT-TYPE

SYNTAX MplsRetentionMode

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The LDP Entity can be configured to use either conservative or liberal label retention mode.

If the value of this object is conservative(1) then advertized label mappings are retained only if they will be used to forward packets, i.e., if label came from a valid next hop.

If the value of this object is liberal(2) then all advertized label mappings are retained whether they are from a valid next hop or not."

::= { mplsLdpEntityEntry 13 }

mplsLdpEntityPathVectorLimit OBJECT-TYPE

SYNTAX Integer32 (0..255)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If the value of this object is 0 (zero) then Loop Detection for Path Vectors is disabled.

Otherwise, if this object has a value greater than zero, then Loop Detection for Path Vectors is enabled, and the Path Vector Limit is this value.

Also, the value of the object, 'mplsLdpLsrLoopDetectionCapable', must be set to either 'pathVector(4)' or 'hopCountAndPathVector(5)', if this object has a value greater than 0 (zero), otherwise it is ignored."

REFERENCE

"RFC3036, LDP Specification, Section 2.8 Loop Detection, Section 3.4.5 Path Vector TLV."

::= { mplsLdpEntityEntry 14 }

mplsLdpEntityHopCountLimit OBJECT-TYPE

SYNTAX Integer32 (0..255)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If the value of this object is 0 (zero), then Loop Detection using Hop Counters is disabled.

If the value of this object is greater than 0 (zero) then Loop Detection using Hop Counters is enabled, and this object specifies this Entity's maximum allowable value for the Hop Count.

Also, the value of the object mplsLdpLsrLoopDetectionCapable must be set to either 'hopCount(3)' or 'hopCountAndPathVector(5)' if this object has a value greater than 0 (zero), otherwise it is ignored."

DEFVAL { 0 }

::= { mplsLdpEntityEntry 15 }

mplsLdpEntityTransportAddrKind OBJECT-TYPE

SYNTAX INTEGER {
 interface(1),
 loopback(2)
 }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This specifies whether the loopback or interface address is to be used as the transport address in the transport address TLV of the hello message.

If the value is interface(1), then the IP address of the interface from which hello messages are sent is used as the transport address in the hello message.

Otherwise, if the value is loopback(2), then the IP address of the loopback interface is used as the transport address in the hello message."

DEFVAL { loopback }
::= { mplsLdpEntityEntry 16 }

mplsLdpEntityTargetPeer OBJECT-TYPE

SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"If this LDP entity uses targeted peer then set this to true."

DEFVAL { false }
::= { mplsLdpEntityEntry 17 }

mplsLdpEntityTargetPeerAddrType OBJECT-TYPE

SYNTAX InetAddressType
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The type of the internetwork layer address used for the Extended Discovery. This object indicates how the value of mplsLdpEntityTargetPeerAddr is to be interpreted."

::= { mplsLdpEntityEntry 18 }

mplsLdpEntityTargetPeerAddr OBJECT-TYPE

SYNTAX InetAddress
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The value of the internetwork layer address used for the Extended Discovery. The value of mplsLdpEntityTargetPeerAddrType specifies how this address is to be interpreted."

::= { mplsLdpEntityEntry 19 }

`mplsLdpEntityLabelType OBJECT-TYPE``SYNTAX MplsLdpLabelType``MAX-ACCESS read-create``STATUS current``DESCRIPTION`

"Specifies the optional parameters for the LDP Initialization Message.

If the value is generic(1) then no optional parameters will be sent in the LDP Initialization message associated with this Entity.

If the value is atmParameters(2) then a row must be created in the mplsLdpEntityAtmTable, which corresponds to this entry.

If the value is frameRelayParameters(3) then a row must be created in the mplsLdpEntityFrameRelayTable, which corresponds to this entry."

`REFERENCE`

"RFC3036, LDP Specification, Section 3.5.3., Initialization Message."

`::= { mplsLdpEntityEntry 20 }``mplsLdpEntityDiscontinuityTime OBJECT-TYPE``SYNTAX TimeStamp``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The value of sysUpTime on the most recent occasion at which any one or more of this entity's counters suffered a discontinuity. The relevant counters are the specific instances associated with this entity of any Counter32 object contained in the 'mplsLdpEntityStatsTable'. If no such discontinuities have occurred since the last re-initialization of the local management subsystem, then this object contains a zero value."

`::= { mplsLdpEntityEntry 21 }``mplsLdpEntityStorageType OBJECT-TYPE``SYNTAX StorageType``MAX-ACCESS read-create``STATUS current`

DESCRIPTION

"The storage type for this conceptual row. Conceptual rows having the value 'permanent(4)' need not allow write-access to any columnar objects in the row."

DEFVAL{ nonVolatile }

::= { mplsLdpEntityEntry 22 }

mplsLdpEntityRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this conceptual row. All writable objects in this row may be modified at any time, however, as described in detail in the section entitled, 'Changing Values After Session Establishment', and again described in the DESCRIPTION clause of the mplsLdpEntityAdminStatus object, if a session has been initiated with a Peer, changing objects in this table will wreak havoc with the session and interrupt traffic. To repeat again: the recommended procedure is to set the mplsLdpEntityAdminStatus to down, thereby explicitly causing a session to be torn down. Then, change objects in this entry, then set the mplsLdpEntityAdminStatus to enable, which enables a new session to be initiated."

::= { mplsLdpEntityEntry 23 }

--

-- The MPLS LDP Entity Statistics Table

--

mplsLdpEntityStatsTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsLdpEntityStatsEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table is a read-only table which augments the mplsLdpEntityTable. The purpose of this table is to keep statistical information about the LDP Entities on the LSR."

::= { mplsLdpEntityObjects 4 }

mplsLdpEntityStatsEntry OBJECT-TYPE

SYNTAX MplsLdpEntityStatsEntry

MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION

"A row in this table contains statistical information about an LDP Entity. Some counters contained in a row are for fatal errors received during a former LDP Session associated with this entry. For example, an LDP PDU received on a TCP connection during an LDP Session contains a fatal error. That error is counted here, because the session is terminated.

If the error is NOT fatal (i.e., the Session remains), then the error is counted in the mplslDpSessionStatsEntry."

AUGMENTS { mplslDpEntityEntry }
 ::= { mplslDpEntityStatsTable 1 }

```
mplslDpEntityStatsEntry ::= SEQUENCE {
    mplslDpEntityStatsSessionAttempts          Counter32,
    mplslDpEntityStatsSessionRejectedNoHelloErrors Counter32,
    mplslDpEntityStatsSessionRejectedAdErrors  Counter32,
    mplslDpEntityStatsSessionRejectedMaxPduErrors Counter32,
    mplslDpEntityStatsSessionRejectedLRErrors Counter32,
    mplslDpEntityStatsBadLdpIdentifierErrors   Counter32,
    mplslDpEntityStatsBadPduLengthErrors       Counter32,
    mplslDpEntityStatsBadMessageLengthErrors   Counter32,
    mplslDpEntityStatsBadTlvLengthErrors       Counter32,
    mplslDpEntityStatsMalformedTlvValueErrors  Counter32,
    mplslDpEntityStatsKeepAliveTimerExpErrors  Counter32,
    mplslDpEntityStatsShutdownReceivedNotifications Counter32,
    mplslDpEntityStatsShutdownSentNotifications Counter32
}
```

mplslDpEntityStatsSessionAttempts OBJECT-TYPE

SYNTAX Counter32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION

"A count of the Session Initialization messages which were sent or received by this LDP Entity and were NAK'd. In other words, this counter counts the number of session initializations that failed.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of mplslDpEntityDiscontinuityTime."

```
::= { mplsLdpEntityStatsEntry 1 }
```

```
mplsLdpEntityStatsSessionRejectedNoHelloErrors OBJECT-TYPE
```

```
SYNTAX Counter32
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"A count of the Session Rejected/No Hello Error
Notification Messages sent or received by
this LDP Entity.
```

```
Discontinuities in the value of this counter can occur
at re-initialization of the management system, and at
other times as indicated by the value of
mplsLdpEntityDiscontinuityTime."
```

```
::= { mplsLdpEntityStatsEntry 2 }
```

```
mplsLdpEntityStatsSessionRejectedAdErrors OBJECT-TYPE
```

```
SYNTAX Counter32
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"A count of the Session Rejected/Parameters
Advertisement Mode Error Notification Messages sent
or received by this LDP Entity.
```

```
Discontinuities in the value of this counter can occur
at re-initialization of the management system, and at
other times as indicated by the value of
mplsLdpEntityDiscontinuityTime."
```

```
::= { mplsLdpEntityStatsEntry 3 }
```

```
mplsLdpEntityStatsSessionRejectedMaxPduErrors OBJECT-TYPE
```

```
SYNTAX Counter32
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"A count of the Session Rejected/Parameters
```

```
Max Pdu Length Error Notification Messages sent
or received by this LDP Entity.
```

```
Discontinuities in the value of this counter can occur
at re-initialization of the management system, and at
other times as indicated by the value of
mplsLdpEntityDiscontinuityTime."
```

```
::= { mplsLdpEntityStatsEntry 4 }
```

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

"A count of the Session Rejected/Parameters
Label Range Notification Messages sent
or received by this LDP Entity.

Discontinuities in the value of this counter can occur
at re-initialization of the management system, and at
other times as indicated by the value of
`mplsLdpEntityDiscontinuityTime`."

`::= { mplsLdpEntityStatsEntry 5 }``mplsLdpEntityStatsBadLdpIdentifierErrors OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"This object counts the number of Bad LDP Identifier
Fatal Errors detected by the session(s)
(past and present) associated with this LDP Entity.

Discontinuities in the value of this counter can occur
at re-initialization of the management system, and at
other times as indicated by the value of
`mplsLdpEntityDiscontinuityTime`."

`REFERENCE`

"RFC3036, LDP Specification, Section 3.5.1.2."

`::= { mplsLdpEntityStatsEntry 6 }``mplsLdpEntityStatsBadPduLengthErrors OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"This object counts the number of Bad PDU Length
Fatal Errors detected by the session(s)
(past and present) associated with this LDP Entity.

Discontinuities in the value of this counter can occur
at re-initialization of the management system, and at
other times as indicated by the value of
`mplsLdpEntityDiscontinuityTime`."

`REFERENCE`

"RFC3036, LDP Specification, Section 3.5.1.2."

`::= { mplsLdpEntityStatsEntry 7 }`

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

"This object counts the number of Bad Message Length Fatal Errors detected by the session(s) (past and present) associated with this LDP Entity.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of `mplsLdpEntityDiscontinuityTime`."

`REFERENCE`

"RFC3036, LDP Specification, Section 3.5.1.2."

::= { mplsLdpEntityStatsEntry 8 }

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

"This object counts the number of Bad TLV Length Fatal Errors detected by the session(s) (past and present) associated with this LDP Entity.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of `mplsLdpEntityDiscontinuityTime`."

`REFERENCE`

"RFC3036, LDP Specification, Section 3.5.1.2."

::= { mplsLdpEntityStatsEntry 9 }

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

"This object counts the number of Malformed TLV Value Fatal Errors detected by the session(s) (past and present) associated with this LDP Entity.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of `mplsLdpEntityDiscontinuityTime`."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.1.2."

::= { mplsLdpEntityStatsEntry 10 }

mplsLdpEntityStatsKeepAliveTimerExpErrors OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object counts the number of Session Keep Alive Timer Expired Errors detected by the session(s) (past and present) associated with this LDP Entity.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of mplsLdpEntityDiscontinuityTime."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.1.2."

::= { mplsLdpEntityStatsEntry 11 }

mplsLdpEntityStatsShutdownReceivedNotifications OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object counts the number of Shutdown Notifications received related to session(s) (past and present) associated with this LDP Entity.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of mplsLdpEntityDiscontinuityTime."

::= { mplsLdpEntityStatsEntry 12 }

mplsLdpEntityStatsShutdownSentNotifications OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object counts the number of Shutdown Notifications sent related to session(s) (past and present) associated with this LDP Entity.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of

```

        mplsLdpEntityDiscontinuityTime."
    ::= { mplsLdpEntityStatsEntry 13 }

--
-- The MPLS LDP Peer Table
--

mplsLdpSessionObjects OBJECT IDENTIFIER ::= { mplsLdpObjects 3 }

mplsLdpPeerLastChange OBJECT-TYPE
    SYNTAX      TimeStamp
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The value of sysUpTime at the time of the most
        recent addition or deletion to/from the
        mplsLdpPeerTable/mpsLdpSessionTable."
    ::= { mplsLdpSessionObjects 1 }

mplsLdpPeerTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLdpPeerEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Information about LDP peers known by Entities in
        the mplsLdpEntityTable. The information in this table
        is based on information from the Entity-Peer interaction
        during session initialization but is not appropriate
        for the mplsLdpSessionTable, because objects in this
        table may or may not be used in session establishment."
    ::= { mplsLdpSessionObjects 2 }

mplsLdpPeerEntry OBJECT-TYPE
    SYNTAX      MplsLdpPeerEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Information about a single Peer which is related
        to a Session. This table is augmented by
        the mplsLdpSessionTable."
    INDEX      { mplsLdpEntityLdpId,
                  mplsLdpEntityIndex,
                  mplsLdpPeerLdpId }
    ::= { mplsLdpPeerTable 1 }

MplsLdpPeerEntry ::= SEQUENCE {
    mplsLdpPeerLdpId          MplsLdpIdentifier,
    mplsLdpPeerLabelDistMethod MplsLabelDistributionMethod,

```

```

mplsLdpPeerPathVectorLimit      Integer32,
mplsLdpPeerTransportAddrType    InetAddressType,
mplsLdpPeerTransportAddr        InetAddress
}

mplsLdpPeerLdpId OBJECT-TYPE
    SYNTAX      MplsLdpIdentifier
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The LDP identifier of this LDP Peer."
    ::= { mplsLdpPeerEntry 1 }

mplsLdpPeerLabelDistMethod OBJECT-TYPE
    SYNTAX      MplsLabelDistributionMethod
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "For any given LDP session, the method of
        label distribution must be specified."
    ::= { mplsLdpPeerEntry 2 }

mplsLdpPeerPathVectorLimit OBJECT-TYPE
    SYNTAX      Integer32 (0..255)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "If the value of this object is 0 (zero) then
        Loop Dection for Path Vectors for this Peer
        is disabled.

        Otherwise, if this object has a value greater than
        zero, then Loop Dection for Path Vectors for this
        Peer is enabled and the Path Vector Limit is this value."
    REFERENCE
        "RFC3036, LDP Specification, Section 2.8 Loop Dection,
        Section 3.4.5 Path Vector TLV."
    ::= { mplsLdpPeerEntry 3 }

mplsLdpPeerTransportAddrType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The type of the Internet address for the
        mplsLdpPeerTransportAddr object. The LDP
        specification describes this as being either
        an IPv4 Transport Address or IPv6 Transport

```

Address which is used in opening the LDP session's TCP connection, or if the optional TLV is not present, then this is the IPv4/IPv6 source address for the UDP packet carrying the Hellos.

This object specifies how the value of the mplsLdpPeerTransportAddr object should be interpreted."

REFERENCE

"RFC3036, LDP Specification, Section 2.5.2 Transport Connection Establishment and Section 3.5.2.1 Hello Message Procedures."

::= { mplsLdpPeerEntry 4 }

mplsLdpPeerTransportAddr OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The Internet address advertised by the peer in the Hello Message or the Hello source address.

The type of this address is specified by the value of the mplsLdpPeerTransportAddrType object."

REFERENCE

"RFC3036, LDP Specification, Section 2.5.2 Transport Connection Establishment and Section 3.5.2.1 Hello Message Procedures."

::= { mplsLdpPeerEntry 5 }

--

-- The MPLS LDP Sessions Table

--

mplsLdpSessionTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsLdpSessionEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table of Sessions between the LDP Entities and LDP Peers. This table AUGMENTS the mplsLdpPeerTable. Each row in this table represents a single session."

::= { mplsLdpSessionObjects 3 }

mplsLdpSessionEntry OBJECT-TYPE

SYNTAX MplsLdpSessionEntry

MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION

"An entry in this table represents information on a single session between an LDP Entity and LDP Peer. The information contained in a row is read-only.

Please note: the Path Vector Limit for the Session is the value which is configured in the corresponding mplsLdpEntityEntry. The Peer's Path Vector Limit is in the mplsLdpPeerPathVectorLimit object in the mplsLdpPeerTable.

Values which may differ from those configured are noted in the objects of this table, the mplsLdpAtmSessionTable and the mplsLdpFrameRelaySessionTable. A value will differ if it was negotiated between the Entity and the Peer. Values may or may not be negotiated. For example, if the values are the same then no negotiation takes place. If they are negotiated, then they may differ."

AUGMENTS { mplsLdpPeerEntry }
 ::= { mplsLdpSessionTable 1 }

```
MplsLdpSessionEntry ::= SEQUENCE {
    mplsLdpSessionStateLastChange      TimeStamp,
    mplsLdpSessionState                 INTEGER,
    mplsLdpSessionRole                  INTEGER,
    mplsLdpSessionProtocolVersion       Unsigned32,
    mplsLdpSessionKeepAliveHoldTimeRem TimeInterval,
    mplsLdpSessionKeepAliveTime         Unsigned32,
    mplsLdpSessionMaxPduLength          Unsigned32,
    mplsLdpSessionDiscontinuityTime     TimeStamp
}
```

mplsLdpSessionStateLastChange OBJECT-TYPE
 SYNTAX TimeStamp
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The value of sysUpTime at the time this Session entered its current state as denoted by the mplsLdpSessionState object."
 ::= { mplsLdpSessionEntry 1 }

```
mplsLdpSessionState OBJECT-TYPE
    SYNTAX      INTEGER {
        nonexistent(1),
        initialized(2),
        openrec(3),
        opensent(4),
        operational(5)
    }
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The current state of the session, all of the
        states 1 to 5 are based on the state machine
        for session negotiation behavior."
    REFERENCE
        "RFC3036, LDP Specification, Section 2.5.4,
        Initialization State Machine."
    ::= { mplsLdpSessionEntry 2 }

mplsLdpSessionRole OBJECT-TYPE
    SYNTAX      INTEGER {
        unknown(1),
        active(2),
        passive(3)
    }
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "During session establishment the LSR/LER takes either
        the active role or the passive role based on address
        comparisons.  This object indicates whether this LSR/LER
        was behaving in an active role or passive role during
        this session's establishment.

        The value of unknown(1), indicates that the role is not
        able to be determined at the present time."
    REFERENCE
        "RFC3036, LDP Specification, Section 2.5.3.,
        Session Initialization"
    ::= { mplsLdpSessionEntry 3 }

mplsLdpSessionProtocolVersion OBJECT-TYPE
    SYNTAX      Unsigned32(1..65535)
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The version of the LDP Protocol which
        this session is using.  This is the version of
```

the LDP protocol which has been negotiated during session initialization."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3, Initialization Message."

::= { mplsLdpSessionEntry 4 }

mplsLdpSessionKeepAliveHoldTimeRem OBJECT-TYPE

SYNTAX TimeInterval

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The keep alive hold time remaining for this session."

::= { mplsLdpSessionEntry 5 }

mplsLdpSessionKeepAliveTime OBJECT-TYPE

SYNTAX Unsigned32 (1..65535)

UNITS "seconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The negotiated KeepAlive Time which represents the amount of seconds between keep alive messages. The mplsLdpEntityKeepAliveHoldTimer related to this Session is the value that was proposed as the KeepAlive Time for this session.

This value is negotiated during session initialization between the entity's proposed value (i.e., the value configured in mplsLdpEntityKeepAliveHoldTimer) and the peer's proposed KeepAlive Hold Timer value. This value is the smaller of the two proposed values."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3, Initialization Message."

::= { mplsLdpSessionEntry 6 }

mplsLdpSessionMaxPduLength OBJECT-TYPE

SYNTAX Unsigned32 (1..65535)

UNITS "octets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of maximum allowable length for LDP PDUs for this session. This value may have been negotiated during the Session Initialization. This object is related to the mplsLdpEntityMaxPduLength object. The mplsLdpEntityMaxPduLength object specifies the requested LDP PDU length, and this object reflects the negotiated LDP PDU length between the Entity and the Peer."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3, Initialization Message."

::= { mplsLdpSessionEntry 7 }

mplsLdpSessionDiscontinuityTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which any one or more of this session's counters suffered a discontinuity. The relevant counters are the specific instances associated with this session of any Counter32 object contained in the mplsLdpSessionStatsTable.

The initial value of this object is the value of sysUpTime when the entry was created in this table.

Also, a command generator can distinguish when a session between a given Entity and Peer goes away and a new session is established. This value would change and thus indicate to the command generator that this is a different session."

::= { mplsLdpSessionEntry 8 }

--

-- The MPLS LDP Session Statistics Table

--

mplsLdpSessionStatsTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsLdpSessionStatsEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table of statistics for Sessions between LDP Entities and LDP Peers. This table AUGMENTS

```

        the mplsLdpPeerTable."
 ::= { mplsLdpSessionObjects 4 }

mplsLdpSessionStatsEntry OBJECT-TYPE
    SYNTAX      MplsLdpSessionStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An entry in this table represents statistical
        information on a single session between an LDP
        Entity and LDP Peer."

    AUGMENTS    { mplsLdpPeerEntry }
 ::= { mplsLdpSessionStatsTable 1 }

MplsLdpSessionStatsEntry ::= SEQUENCE {
    mplsLdpSessionStatsUnknownMesTypeErrors  Counter32,
    mplsLdpSessionStatsUnknownTlvErrors      Counter32
}

mplsLdpSessionStatsUnknownMesTypeErrors OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object counts the number of Unknown Message Type
        Errors detected by this LSR/LER during this session.

        Discontinuities in the value of this counter can occur
        at re-initialization of the management system, and at
        other times as indicated by the value of
        mplsLdpSessionDiscontinuityTime."
 ::= { mplsLdpSessionStatsEntry 1 }

mplsLdpSessionStatsUnknownTlvErrors OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object counts the number of Unknown TLV Errors
        detected by this LSR/LER during this session.

        Discontinuities in the value of this counter can occur
        at re-initialization of the management system, and at
        other times as indicated by the value of
        mplsLdpSessionDiscontinuityTime."
 ::= { mplsLdpSessionStatsEntry 2 }

```

```

--
-- The MPLS LDP Hello Adjacency Table
--

mplsLdpHelloAdjacencyObjects OBJECT IDENTIFIER ::=
    { mplsLdpSessionObjects 5 }

mplsLdpHelloAdjacencyTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLdpHelloAdjacencyEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table of Hello Adjacencies for Sessions."
    ::= { mplsLdpHelloAdjacencyObjects 1 }

mplsLdpHelloAdjacencyEntry OBJECT-TYPE
    SYNTAX      MplsLdpHelloAdjacencyEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Each row represents a single LDP Hello Adjacency.
        An LDP Session can have one or more Hello
        Adjacencies."
    INDEX       { mplsLdpEntityLdpId,
                  mplsLdpEntityIndex,
                  mplsLdpPeerLdpId,
                  mplsLdpHelloAdjacencyIndex }
    ::= { mplsLdpHelloAdjacencyTable 1 }

MplsLdpHelloAdjacencyEntry ::= SEQUENCE {
    mplsLdpHelloAdjacencyIndex      Unsigned32,
    mplsLdpHelloAdjacencyHoldTimeRem TimeInterval,
    mplsLdpHelloAdjacencyHoldTime   Unsigned32,
    mplsLdpHelloAdjacencyType        INTEGER
}

mplsLdpHelloAdjacencyIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An identifier for this specific adjacency."
    ::= { mplsLdpHelloAdjacencyEntry 1 }

mplsLdpHelloAdjacencyHoldTimeRem OBJECT-TYPE
    SYNTAX      TimeInterval
    UNITS        "seconds"
    MAX-ACCESS  read-only

```

STATUS current

DESCRIPTION

"If the value of this object is 65535, this means that the hold time is infinite (i.e., wait forever).

Otherwise, the time remaining for this Hello Adjacency to receive its next Hello Message.

This interval will change when the 'next' Hello Message which corresponds to this Hello Adjacency is received unless it is infinite."

::= { mplsLdpHelloAdjacencyEntry 2 }

mplsLdpHelloAdjacencyHoldTime OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The Hello hold time which is negotiated between the Entity and the Peer. The entity associated with this Hello Adjacency issues a proposed Hello Hold Time value in the mplsLdpEntityHelloHoldTimer object. The peer also proposes a value and this object represents the negotiated value.

A value of 0 means the default, which is 15 seconds for Link Hellos and 45 seconds for Targeted Hellos. A value of 65535 indicates an infinite hold time."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.2 Hello Message"

::= { mplsLdpHelloAdjacencyEntry 3 }

mplsLdpHelloAdjacencyType OBJECT-TYPE

SYNTAX INTEGER {
link(1),
targeted(2)
}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This adjacency is the result of a 'link' hello if the value of this object is link(1).

```

        Otherwise, it is a result of a 'targeted'
        hello, targeted(2)."
 ::= { mplsLdpHelloAdjacencyEntry 4 }

--
-- Session Label (LSP) Mapping to LSR MIB's
-- In Segment LIB Information.
--
--
-- NOTE: the next 2 tables map to the
-- MPLS-LSR-STD-MIB's MplsInSegmentTable
-- and MplsOutSegmentTable. The
-- cross-connect (XC) information is not
-- represented here as it can be gleaned
-- from the MPLS-LSR-STD-MIB.
--

mplsInSegmentLdpLspTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsInSegmentLdpLspEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table of LDP LSP's which
        map to the mplsInSegmentTable in the
        MPLS-LSR-STD-MIB module."
    ::= { mplsLdpSessionObjects 6 }

mplsInSegmentLdpLspEntry OBJECT-TYPE
    SYNTAX      MplsInSegmentLdpLspEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An entry in this table represents information
        on a single LDP LSP which is represented by
        a session's index triple (mplsLdpEntityLdpId,
        mplsLdpEntityIndex, mplsLdpPeerLdpId) AND the
        index for the mplsInSegmentTable
        (mplsInSegmentLdpLspLabelIndex) from the
        MPLS-LSR-STD-MIB.

        The information contained in a row is read-only."
    INDEX      { mplsLdpEntityLdpId,
                 mplsLdpEntityIndex,
                 mplsLdpPeerLdpId,
                 mplsInSegmentLdpLspIndex
               }
    ::= { mplsInSegmentLdpLspTable 1 }

```



```

MplsInSegmentLdpLspEntry ::= SEQUENCE {
    mplsInSegmentLdpLspIndex          MplsIndexType,
    mplsInSegmentLdpLspLabelType      MplsLdpLabelType,
    mplsInSegmentLdpLspType           MplsLspType
}

mplsInSegmentLdpLspIndex OBJECT-TYPE
    SYNTAX      MplsIndexType
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This contains the same value as the
        mplsInSegmentIndex in the
        MPLS-LSR-STD-MIB's mplsInSegmentTable."
    ::= { mplsInSegmentLdpLspEntry 1 }

mplsInSegmentLdpLspLabelType OBJECT-TYPE
    SYNTAX      MplsLdpLabelType
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The Layer 2 Label Type."
    ::= { mplsInSegmentLdpLspEntry 2 }

mplsInSegmentLdpLspType OBJECT-TYPE
    SYNTAX      MplsLspType
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The type of LSP connection."
    ::= { mplsInSegmentLdpLspEntry 3 }

--
-- Session Label (LSP) Mapping to LSR MIB's
-- Out Segment LIB Information.
--

mplsOutSegmentLdpLspTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsOutSegmentLdpLspEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "A table of LDP LSP's which
        map to the mplsOutSegmentTable in the
        MPLS-LSR-STD-MIB."
    ::= { mplsLdpSessionObjects 7 }

mplsOutSegmentLdpLspEntry OBJECT-TYPE

```

```

SYNTAX      MplsOutSegmentLdpLspEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "An entry in this table represents information
    on a single LDP LSP which is represented by
    a session's index triple (mplsLdpEntityLdpId,
    mplsLdpEntityIndex, mplsLdpPeerLdpId) AND the
    index (mplsOutSegmentLdpLspIndex)
    for the mplsOutSegmentTable.

    The information contained in a row is read-only."
INDEX       { mplsLdpEntityLdpId,
              mplsLdpEntityIndex,
              mplsLdpPeerLdpId,
              mplsOutSegmentLdpLspIndex
            }
 ::= { mplsOutSegmentLdpLspTable 1 }

MplsOutSegmentLdpLspEntry ::= SEQUENCE {
    mplsOutSegmentLdpLspIndex          MplsIndexType,
    mplsOutSegmentLdpLspLabelType      MplsLdpLabelType,
    mplsOutSegmentLdpLspType           MplsLspType
}

mplsOutSegmentLdpLspIndex OBJECT-TYPE
    SYNTAX      MplsIndexType
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This contains the same value as the
        mplsOutSegmentIndex in the
        MPLS-LSR-STD-MIB's mplsOutSegmentTable."
    ::= { mplsOutSegmentLdpLspEntry 1 }

mplsOutSegmentLdpLspLabelType OBJECT-TYPE
    SYNTAX      MplsLdpLabelType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The Layer 2 Label Type."
    ::= { mplsOutSegmentLdpLspEntry 2 }

mplsOutSegmentLdpLspType OBJECT-TYPE
    SYNTAX      MplsLspType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION

```

```
        "The type of LSP connection."
 ::= { mplsOutSegmentLdpLspEntry 3 }

--
-- Mpls FEC Table
--

mplsFecObjects OBJECT IDENTIFIER ::=
    { mplsLdpSessionObjects 8 }

mplsFecLastChange OBJECT-TYPE
    SYNTAX      TimeStamp
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The value of sysUpTime at the time of the most
        recent addition/deletion of an entry
        to/from the mplsLdpFecTable or
        the most recent change in values to any objects
        in the mplsLdpFecTable.

        If no such changes have occurred since the last
        re-initialization of the local management subsystem,
        then this object contains a zero value."
    ::= { mplsFecObjects 1 }

mplsFecIndexNext OBJECT-TYPE
    SYNTAX      IndexIntegerNextFree
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains an appropriate value to
        be used for mplsFecIndex when creating
        entries in the mplsFecTable. The value
        0 indicates that no unassigned entries are
        available."
    ::= { mplsFecObjects 2 }

mplsFecTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsFecEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table represents the FEC
        (Forwarding Equivalence Class)
        Information associated with an LSP."
    ::= { mplsFecObjects 3 }
```

```

mplsFecEntry OBJECT-TYPE
    SYNTAX      MplsFecEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Each row represents a single FEC Element."
    INDEX       { mplsFecIndex }
    ::= { mplsFecTable 1 }

MplsFecEntry ::= SEQUENCE {
    mplsFecIndex      IndexInteger,
    mplsFecType       INTEGER,
    mplsFecAddrType   InetAddressType,
    mplsFecAddr       InetAddress,
    mplsFecAddrPrefixLength  InetAddressPrefixLength,
    mplsFecStorageType   StorageType,
    mplsFecRowStatus    RowStatus
}

mplsFecIndex OBJECT-TYPE
    SYNTAX      IndexInteger
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The index which uniquely identifies this entry."
    ::= { mplsFecEntry 1 }

mplsFecType OBJECT-TYPE
    SYNTAX      INTEGER {
                    prefix(1),
                    hostAddress(2)
                }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The type of the FEC.  If the value of this object
        is 'prefix(1)' then the FEC type described by this
        row is an address prefix.

        If the value of this object is 'hostAddress(2)' then
        the FEC type described by this row is a host address."
    REFERENCE
        "RFC3036, Section 3.4.1. FEC TLV."
    ::= { mplsFecEntry 2 }

mplsFecAddrType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS  read-create

```

STATUS current
 DESCRIPTION
 "The value of this object is the type of the Internet address. The value of this object, decides how the value of the mplsFecAddr object is interpreted."

REFERENCE
 "RFC3036, Section 3.4.1. FEC TLV."
 ::= { mplsFecEntry 4 }

mplsFecAddr OBJECT-TYPE
 SYNTAX InetAddress
 MAX-ACCESS read-create
 STATUS current
 DESCRIPTION
 "The value of this object is interpreted based on the value of the 'mplsFecAddrType' object.

 This address is then further interpreted as an being used with the address prefix, or as the host address. This further interpretation is indicated by the 'mplsFecType' object. In other words, the FEC element is populated according to the Prefix FEC Element value encoding, or the Host Address FEC Element encoding."

REFERENCE
 "RFC3036, Section 3.4.1 FEC TLV."
 ::= { mplsFecEntry 5 }

mplsFecAddrPrefixLength OBJECT-TYPE
 SYNTAX InetAddressPrefixLength
 MAX-ACCESS read-create
 STATUS current
 DESCRIPTION
 "If the value of the 'mplsFecType' is 'hostAddress(2)' then this object is undefined.

 If the value of 'mplsFecType' is 'prefix(1)' then the value of this object is the length in bits of the address prefix represented by 'mplsFecAddr', or zero. If the value of this object is zero, this indicates that the prefix matches all addresses. In this case the address prefix MUST also be zero (i.e., 'mplsFecAddr' should have the value of zero.)"

REFERENCE
 "RFC3036, Section 3.4.1. FEC TLV."
 DEFVAL { 0 }

```

 ::= { mplsFecEntry 3 }

mplsFecStorageType OBJECT-TYPE
    SYNTAX      StorageType
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The storage type for this conceptual row.
        Conceptual rows having the value 'permanent(4)'
        need not allow write-access to any columnar
        objects in the row."
    DEFVAL { nonVolatile }
    ::= { mplsFecEntry 6 }

mplsFecRowStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The status of this conceptual row.  If the value of this
        object is 'active(1)', then none of the writable objects
        of this entry can be modified, except to set this object
        to 'destroy(6)'.

        NOTE: if this row is being referenced by any entry in
        the mplsLdpLspFecTable, then a request to destroy
        this row, will result in an inconsistentValue error."
    ::= { mplsFecEntry 7 }

--
--  LDP LSP FEC Table
--

mplsLdpLspFecLastChange OBJECT-TYPE
    SYNTAX      TimeStamp
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The value of sysUpTime at the time of the most
        recent addition/deletion of an entry
        to/from the mplsLdpLspFecTable or
        the most recent change in values to any objects in the
        mplsLdpLspFecTable.

        If no such changes have occurred since the last
        re-initialization of the local management subsystem,
        then this object contains a zero value."
    ::= { mplsLdpSessionObjects 9 }

```

```

mplsLdpLspFecTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLdpLspFecEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table which shows the relationship between
        LDP LSPs and FECs. Each row represents
        a single LDP LSP to FEC association."
    ::= { mplsLdpSessionObjects 10 }

mplsLdpLspFecEntry OBJECT-TYPE
    SYNTAX      MplsLdpLspFecEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An entry represents a LDP LSP
        to FEC association."
    INDEX       { mplsLdpEntityLdpId,
                  mplsLdpEntityIndex,
                  mplsLdpPeerLdpId,
                  mplsLdpLspFecSegment,
                  mplsLdpLspFecSegmentIndex,
                  mplsLdpLspFecIndex
                }
    ::= { mplsLdpLspFecTable 1 }

MplsLdpLspFecEntry ::= SEQUENCE {
    mplsLdpLspFecSegment      INTEGER,
    mplsLdpLspFecSegmentIndex MplsIndexType,
    mplsLdpLspFecIndex        IndexInteger,
    mplsLdpLspFecStorageType  StorageType,
    mplsLdpLspFecRowStatus    RowStatus
}

mplsLdpLspFecSegment OBJECT-TYPE
    SYNTAX INTEGER {
        inSegment(1),
        outSegment(2)
    }
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "If the value is inSegment(1), then this
        indicates that the following index,
        mplsLdpLspFecSegmentIndex, contains the same
        value as the mplsInSegmentLdpLspIndex.

        Otherwise, if the value of this object is

```

outSegment(2), then this indicates that following index, mplsLdpLspFecSegmentIndex, contains the same value as the mplsOutSegmentLdpLspIndex."
 ::= { mplsLdpLspFecEntry 1 }

mplsLdpLspFecSegmentIndex OBJECT-TYPE

SYNTAX MplsIndexType
 MAX-ACCESS not-accessible
 STATUS current

DESCRIPTION

"This index is interpreted by using the value of the mplsLdpLspFecSegment.

If the mplsLdpLspFecSegment is inSegment(1), then this index has the same value as mplsInSegmentLdpLspIndex.

If the mplsLdpLspFecSegment is outSegment(2), then this index has the same value as mplsOutSegmentLdpLspIndex."

::= { mplsLdpLspFecEntry 2 }

mplsLdpLspFecIndex OBJECT-TYPE

SYNTAX IndexInteger
 MAX-ACCESS not-accessible
 STATUS current

DESCRIPTION

"This index identifies the FEC entry in the mplsFecTable associated with this session. In other words, the value of this index is the same as the value of the mplsFecIndex that denotes the FEC associated with this Session."

::= { mplsLdpLspFecEntry 3 }

mplsLdpLspFecStorageType OBJECT-TYPE

SYNTAX StorageType
 MAX-ACCESS read-create
 STATUS current

DESCRIPTION

"The storage type for this conceptual row. Conceptual rows having the value 'permanent(4)' need not allow write-access to any columnar objects in the row."

DEFVAL { nonVolatile }

::= { mplsLdpLspFecEntry 4 }

mplsLdpLspFecRowStatus OBJECT-TYPE

SYNTAX RowStatus
 MAX-ACCESS read-create
 STATUS current

DESCRIPTION

"The status of this conceptual row. If the value of this object is 'active(1)', then none of the writable objects of this entry can be modified.

The Agent should delete this row when the session ceases to exist. If an operator wants to associate the session with a different FEC, the recommended procedure is (as described in detail in the section entitled, 'Changing Values After Session Establishment', and again described in the DESCRIPTION clause of the mplsLdpEntityAdminStatus object) is to set the mplsLdpEntityAdminStatus to down, thereby explicitly causing a session to be torn down. This will also cause this entry to be deleted.

Then, set the mplsLdpEntityAdminStatus to enable which enables a new session to be initiated. Once the session is initiated, an entry may be added to this table to associate the new session with a FEC."

::= { mplsLdpLspFecEntry 5 }

--

-- Address Message/Address Withdraw Message Information

--

-- This information is associated with a specific Session
 -- because Label Address Messages are sent after session
 -- initialization has taken place.

--

mplsLdpSessionPeerAddrTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsLdpSessionPeerAddrEntry
 MAX-ACCESS not-accessible
 STATUS current

DESCRIPTION

"This table 'extends' the mplsLdpSessionTable. This table is used to store Label Address Information from Label Address Messages received by this LSR from Peers. This table is read-only and should be updated

when Label Withdraw Address Messages are received, i.e., Rows should be deleted as appropriate.

NOTE: since more than one address may be contained in a Label Address Message, this table 'sparse augments', the mplsLdpSessionTable's information."

```
::= { mplsLdpSessionObjects 11 }
```

mplsLdpSessionPeerAddrEntry OBJECT-TYPE

SYNTAX MplsLdpSessionPeerAddrEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents information on a session's single next hop address which was advertised in an Address Message from the LDP peer. The information contained in a row is read-only."

```
INDEX      { mplsLdpEntityLdpId,
              mplsLdpEntityIndex,
              mplsLdpPeerLdpId,
              mplsLdpSessionPeerAddrIndex
            }
```

```
::= { mplsLdpSessionPeerAddrTable 1 }
```

MplsLdpSessionPeerAddrEntry ::= SEQUENCE {

mplsLdpSessionPeerAddrIndex Unsigned32,

mplsLdpSessionPeerNextHopAddrType InetAddressType,

mplsLdpSessionPeerNextHopAddr InetAddress

}

mplsLdpSessionPeerAddrIndex OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An index which uniquely identifies this entry within a given session."

```
::= { mplsLdpSessionPeerAddrEntry 1 }
```

mplsLdpSessionPeerNextHopAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The internetwork layer address type of this Next Hop Address as specified in the Label Address Message associated with this Session. The value of this object indicates how to interpret the value of

```

        mplsLdpSessionPeerNextHopAddr."
 ::= { mplsLdpSessionPeerAddrEntry 2 }

mplsLdpSessionPeerNextHopAddr OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The next hop address.  The type of this address
         is specified by the value of the
         mplsLdpSessionPeerNextHopAddrType."
    REFERENCE
        "RFC3036, Section 2.7. LDP Identifiers
         and Next Hop Addresses"
 ::= { mplsLdpSessionPeerAddrEntry 3 }

---
--- Notifications
---

mplsLdpInitSessionThresholdExceeded NOTIFICATION-TYPE
    OBJECTS      {
                    mplsLdpEntityInitSessionThreshold
                }
    STATUS       current
    DESCRIPTION
        "This notification is generated when the value of
         the 'mplsLdpEntityInitSessionThreshold' object
         is not zero, and the number of Session
         Initialization messages exceeds the value
         of the 'mplsLdpEntityInitSessionThreshold' object."
 ::= { mplsLdpNotifications 1 }

mplsLdpPathVectorLimitMismatch NOTIFICATION-TYPE
    OBJECTS      {
                    mplsLdpEntityPathVectorLimit,
                    mplsLdpPeerPathVectorLimit
                }
    STATUS       current
    DESCRIPTION
        "This notification is sent when the
         'mplsLdpEntityPathVectorLimit' does NOT match
         the value of the 'mplsLdpPeerPathVectorLimit' for
         a specific Entity."
    REFERENCE
        "RFC3036, LDP Specification, Section 3.5.3."
 ::= { mplsLdpNotifications 2 }

```

```

mplsLdpSessionUp NOTIFICATION-TYPE
    OBJECTS      {
        mplsLdpSessionState,
        mplsLdpSessionDiscontinuityTime,
        mplsLdpSessionStatsUnknownMestypeErrors,
        mplsLdpSessionStatsUnknownTlvErrors
    }
    STATUS        current
    DESCRIPTION
        "If this notification is sent when the
         value of 'mplsLdpSessionState' enters
         the 'operational(5)' state."
        ::= { mplsLdpNotifications 3 }

mplsLdpSessionDown NOTIFICATION-TYPE
    OBJECTS      {
        mplsLdpSessionState,
        mplsLdpSessionDiscontinuityTime,
        mplsLdpSessionStatsUnknownMestypeErrors,
        mplsLdpSessionStatsUnknownTlvErrors
    }
    STATUS        current
    DESCRIPTION
        "This notification is sent when the
         value of 'mplsLdpSessionState' leaves
         the 'operational(5)' state."
        ::= { mplsLdpNotifications 4 }

--*****
-- Module Conformance Statement
--*****

mplsLdpGroups
    OBJECT IDENTIFIER ::= { mplsLdpConformance 1 }

mplsLdpCompliances
    OBJECT IDENTIFIER ::= { mplsLdpConformance 2 }

--
-- Full Compliance
--

mplsLdpModuleFullCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The Module is implemented with support
         for read-create and read-write.  In other

```

words, both monitoring and configuration
are available when using this MODULE-COMPLIANCE."

```
MODULE -- this module
    MANDATORY-GROUPS { mplsLdpGeneralGroup,
                        mplsLdpNotificationsGroup
                      }

GROUP mplsLdpLspGroup
DESCRIPTION
    "This group must be supported if the LSR MIB is
    implemented, specifically the mplsInSegmentTable,
    the mplsOutSegmentTable or the mplsXCTable."

OBJECT mplsLdpEntityTargetPeerAddrType
SYNTAX InetAddressType { unknown(0), ipv4(1), ipv6(2) }
DESCRIPTION
    "An implementation is only required to support
    'unknown(0)', IPv4 and globally unique IPv6 addresses."

OBJECT mplsLdpEntityTargetPeerAddr
SYNTAX InetAddress (SIZE(0|4|16))
DESCRIPTION
    "An implementation is only required to support IPv4 and
    globally unique IPv6 addresses."

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

OBJECT mplsFecAddrType
SYNTAX InetAddressType { unknown(0), ipv4(1), ipv6(2) }
DESCRIPTION
    "An implementation is only required to support
    'unknown(0)', IPv4 and globally unique IPv6 addresses."

OBJECT mplsFecAddr
SYNTAX InetAddress (SIZE(0|4|16))
DESCRIPTION
    "An implementation is only required to support IPv4 and
    globally unique IPv6 addresses."

OBJECT mplsFecRowStatus
SYNTAX RowStatus { active(1) }
WRITE-SYNTAX RowStatus { createAndGo(4), destroy(6) }
DESCRIPTION
```

"Support for createAndWait and notInService is not required."

```
OBJECT mplsLdpLspFecRowStatus
SYNTAX RowStatus { active(1) }
WRITE-SYNTAX RowStatus { createAndGo(4), destroy(6) }
DESCRIPTION
    "Support for createAndWait and notInService is not
    required."
```

```
OBJECT mplsLdpSessionPeerNextHopAddrType
SYNTAX InetAddressType { unknown(0), ipv4(1), ipv6(2) }
DESCRIPTION
    "An implementation is only required to support
    'unknown(0)', IPv4 and globally unique IPv6 addresses."
```

```
OBJECT mplsLdpSessionPeerNextHopAddr
SYNTAX InetAddress (SIZE(0|4|16))
DESCRIPTION
    "An implementation is only required to support IPv4
    and globally unique IPv6 addresses."
```

```
::= { mplsLdpCompliances 1 }
```

```
--
-- Read-Only Compliance
--
```

```
mplsLdpModuleReadOnlyCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
    "The Module is implemented with support
    for read-only. In other words, only monitoring
    is available by implementing this MODULE-COMPLIANCE."
```

```
MODULE -- this module
MANDATORY-GROUPS { mplsLdpGeneralGroup,
                    mplsLdpNotificationsGroup
                  }
```

```
GROUP mplsLdpLspGroup
DESCRIPTION
    "This group must be supported if the LSR MIB is
    implemented, specifically the mplsInSegmentTable,
    the mplsOutSegmentTable or the mplsXCTable."
```

```
OBJECT          mplsLdpEntityProtocolVersion
MIN-ACCESS      read-only
```

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityAdminStatus

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityTcpPort

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityUdpDscPort

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityMaxPduLength

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityKeepAliveHoldTimer

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityHelloHoldTimer

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityInitSessionThreshold

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityLabelDistMethod

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityLabelRetentionMode

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

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

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

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

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

OBJECT mplsLdpEntityTargetPeerAddrType
SYNTAX InetAddressType { unknown(0), ipv4(1), ipv6(2) }
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required.
An implementation is only required to support
'unknown(0)', IPv4 and globally unique IPv6 addresses."

OBJECT mplsLdpEntityTargetPeerAddr
SYNTAX InetAddress (SIZE(0|4|16))
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required.
An implementation is only required to support IPv4 and
globally unique IPv6 addresses."

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

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

OBJECT mplsLdpEntityRowStatus
SYNTAX RowStatus { active(1) }

MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and active is the only status that needs to be supported."

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

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

OBJECT mplsFecAddrType
SYNTAX InetAddressType { unknown(0), ipv4(1), ipv6(2) }
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required.
An implementation is only required to support 'unknown(0)', IPv4 and globally unique IPv6 addresses."

OBJECT mplsFecAddr
SYNTAX InetAddress (SIZE(0|4|16))
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required.
An implementation is only required to support IPv4 and globally unique IPv6 addresses."

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

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

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

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

OBJECT mplsLdpSessionPeerNextHopAddrType
SYNTAX InetAddressType { unknown(0), ipv4(1), ipv6(2) }
DESCRIPTION
    "An implementation is only required to support
    'unknown(0)', IPv4 and globally unique IPv6 addresses."

OBJECT mplsLdpSessionPeerNextHopAddr
SYNTAX InetAddress (SIZE(0|4|16))
DESCRIPTION
    "An implementation is only required to support IPv4
    and globally unique IPv6 addresses."
```

```
::= { mplsLdpCompliances 2 }
```

```
-- units of conformance
```

```
mplsLdpGeneralGroup OBJECT-GROUP
    OBJECTS {
        mplsLdpLsrId,
        mplsLdpLsrLoopDetectionCapable,
        mplsLdpEntityLastChange,
        mplsLdpEntityIndexNext,
        mplsLdpEntityProtocolVersion,
        mplsLdpEntityAdminStatus,
        mplsLdpEntityOperStatus,
        mplsLdpEntityTcpPort,
        mplsLdpEntityUdpDscPort,
        mplsLdpEntityMaxPduLength,
        mplsLdpEntityKeepAliveHoldTimer,
        mplsLdpEntityHelloHoldTimer,
        mplsLdpEntityInitSessionThreshold,
        mplsLdpEntityLabelDistMethod,
        mplsLdpEntityLabelRetentionMode,
        mplsLdpEntityPathVectorLimit,
        mplsLdpEntityHopCountLimit,
        mplsLdpEntityTransportAddrKind,
        mplsLdpEntityTargetPeer,
        mplsLdpEntityTargetPeerAddrType,
        mplsLdpEntityTargetPeerAddr,
        mplsLdpEntityLabelType,
```

```

mplsLdpEntityDiscontinuityTime,
mplsLdpEntityStorageType,
mplsLdpEntityRowStatus,
mplsLdpEntityStatsSessionAttempts,
mplsLdpEntityStatsSessionRejectedNoHelloErrors,
mplsLdpEntityStatsSessionRejectedAdErrors,
mplsLdpEntityStatsSessionRejectedMaxPduErrors,
mplsLdpEntityStatsSessionRejectedLRErrors,
mplsLdpEntityStatsBadLdpIdentifierErrors,
mplsLdpEntityStatsBadPduLengthErrors,
mplsLdpEntityStatsBadMessageLengthErrors,
mplsLdpEntityStatsBadTlvLengthErrors,
mplsLdpEntityStatsMalformedTlvValueErrors,
mplsLdpEntityStatsKeepAliveTimerExpErrors,
mplsLdpEntityStatsShutdownReceivedNotifications,
mplsLdpEntityStatsShutdownSentNotifications,
mplsLdpPeerLastChange,
mplsLdpPeerLabelDistMethod,
mplsLdpPeerPathVectorLimit,
mplsLdpPeerTransportAddrType,
mplsLdpPeerTransportAddr,
mplsLdpHelloAdjacencyHoldTimeRem,
mplsLdpHelloAdjacencyHoldTime,
mplsLdpHelloAdjacencyType,
mplsLdpSessionStateLastChange,
mplsLdpSessionState,
mplsLdpSessionRole,
mplsLdpSessionProtocolVersion,
mplsLdpSessionKeepAliveHoldTimeRem,
mplsLdpSessionKeepAliveTime,
mplsLdpSessionMaxPduLength,
mplsLdpSessionDiscontinuityTime,
mplsLdpSessionStatsUnknownMesTypeErrors,
mplsLdpSessionStatsUnknownTlvErrors,
mplsLdpSessionPeerNextHopAddrType,
mplsLdpSessionPeerNextHopAddr,
mplsFecLastChange,
mplsFecIndexNext,
mplsFecType,
mplsFecAddrType,
mplsFecAddr,
mplsFecAddrPrefixLength,
mplsFecStorageType,
mplsFecRowStatus
}
STATUS      current
DESCRIPTION
    "Objects that apply to all MPLS LDP implementations."

```

```

 ::= { mplsLdpGroups 1 }

mplsLdpLspGroup OBJECT-GROUP
    OBJECTS {
        mplsInSegmentLdpLspLabelType,
        mplsInSegmentLdpLspType,
        mplsOutSegmentLdpLspLabelType,
        mplsOutSegmentLdpLspType,
        mplsLdpLspFecLastChange,
        mplsLdpLspFecStorageType,
        mplsLdpLspFecRowStatus
    }
    STATUS      current
    DESCRIPTION
        "These objects are for LDP implementations
        which interface to the Label Information Base (LIB)
        in the MPLS-LSR-STD-MIB. The LIB is
        represented in the mplsInSegmentTable,
        mplsOutSegmentTable and mplsXCTable."
 ::= { mplsLdpGroups 2 }

mplsLdpNotificationsGroup NOTIFICATION-GROUP
    NOTIFICATIONS { mplsLdpInitSessionThresholdExceeded,
                    mplsLdpPathVectorLimitMismatch,
                    mplsLdpSessionUp,
                    mplsLdpSessionDown
                    }
    STATUS      current
    DESCRIPTION
        "The notification for an MPLS LDP implementation."
 ::= { mplsLdpGroups 3 }

END

```

4.1. The MPLS-LDP-ATM-STD-MIB Module

This MIB Module MUST be supported if LDP uses ATM as the Layer 2 medium. There are three tables in this MIB Module. Two tables are for configuring LDP to use ATM. These tables are the mplsLdpEntityAtmTable and the mplsLdpEntityAtmLRTable. The third table is the mplsLdpAtmSessionTable which is a read-only table. This MIB Module IMPORTS the AtmVpIdentifier TEXTUAL-CONVENTION from [RFC2514].

4.1.1. The LDP Entity ATM Table

The `mplsLdpEntityAtmTable` provides a way to configure information which would be contained in the "Optional Parameter" portion of an LDP PDU Initialization Message.

4.1.2. The LDP Entity ATM Label Range Table

The `mplsLdpEntityAtmLRTable` provides a way to configure information which would be contained in the "ATM Label Range Components" portion of an LDP PDU Initialization Message, see [RFC3035] and [RFC3036].

4.1.3. The LDP ATM Session Table

The MPLS LDP ATM Session Table is a read-only table which contains session information specific to ATM.

MPLS-LDP-ATM-STD-MIB DEFINITIONS ::= BEGIN

IMPORTS

```

    OBJECT-TYPE, MODULE-IDENTITY,
    Unsigned32
        FROM SNMPv2-SMI -- [RFC2578]
    MODULE-COMPLIANCE, OBJECT-GROUP
        FROM SNMPv2-CONF -- [RFC2580]
    RowStatus,
    StorageType
        FROM SNMPv2-TC -- [RFC2579]

    InterfaceIndexOrZero
        FROM IF-MIB -- [RFC2020]

    AtmVpIdentifier
        FROM ATM-TC-MIB -- [RFC2514]

    mplsStdMIB,
    MplsAtmVcIdentifier
        FROM MPLS-TC-STD-MIB -- [RFC3811]

    mplsLdpEntityLdpId,
    mplsLdpEntityIndex,
    mplsLdpPeerLdpId
        FROM MPLS-LDP-STD-MIB -- [RFC3813]

```

;

```

mplsLdpAtmStdMIB MODULE-IDENTITY
    LAST-UPDATED "200406030000Z" -- June 3, 2004

```

ORGANIZATION "Multiprotocol Label Switching (mpls)
Working Group"

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"

DESCRIPTION

"Copyright (C) The Internet Society (2004). The
initial version of this MIB module was published
in RFC 3815. For full legal notices see the RFC
itself or see:
<http://www.ietf.org/copyrights/ianamib.html>

This MIB contains managed object definitions for
configuring and monitoring the Multiprotocol Label
Switching (MPLS), Label Distribution Protocol (LDP),
utilizing Asynchronous Transfer Mode (ATM) as the Layer 2
media."

REVISION "200406030000Z" -- June 3, 2004

DESCRIPTION

"Initial version published as part of RFC 3815."

::= { mplsStdMIB 5 }

--*****

```
mplsLdpAtmObjects      OBJECT IDENTIFIER
                        ::= { mplsLdpAtmStdMIB 1 }
mplsLdpAtmConformance  OBJECT IDENTIFIER
                        ::= { mplsLdpAtmStdMIB 2 }
```

--*****

-- MPLS LDP ATM Objects

--*****

--

-- Ldp Entity Objects for ATM

--

```
mplsLdpEntityAtmObjects OBJECT IDENTIFIER ::=
    { mplsLdpAtmObjects 1 }
```

```
mplsLdpEntityAtmTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLdpEntityAtmEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains ATM specific information
        which could be used in the
        'Optional Parameters' and other ATM specific
        information.

        This table 'sparse augments' the mplsLdpEntityTable
        when ATM is the Layer 2 medium."
    ::= { mplsLdpEntityAtmObjects 1 }
```

```
mplsLdpEntityAtmEntry OBJECT-TYPE
    SYNTAX      MplsLdpEntityAtmEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An entry in this table represents the ATM parameters
        and ATM information for this LDP entity."
    INDEX       { mplsLdpEntityLdpId,
                  mplsLdpEntityIndex
                }
    ::= { mplsLdpEntityAtmTable 1 }
```

```
MplsLdpEntityAtmEntry ::= SEQUENCE {
    mplsLdpEntityAtmIfIndexOrZero      InterfaceIndexOrZero,
    mplsLdpEntityAtmMergeCap           INTEGER,
    mplsLdpEntityAtmLRComponents       Unsigned32,
    mplsLdpEntityAtmVcDirectionality  INTEGER,
    mplsLdpEntityAtmLsrConnectivity    INTEGER,
    mplsLdpEntityAtmDefaultControlVpi  AtmVpIdentifier,
    mplsLdpEntityAtmDefaultControlVci  MplsAtmVcIdentifier,
    mplsLdpEntityAtmUnlabTrafVpi       AtmVpIdentifier,
    mplsLdpEntityAtmUnlabTrafVci       MplsAtmVcIdentifier,
    mplsLdpEntityAtmStorageType        StorageType,
    mplsLdpEntityAtmRowStatus           RowStatus
}
```

```
mplsLdpEntityAtmIfIndexOrZero OBJECT-TYPE
    SYNTAX      InterfaceIndexOrZero
```

MAX-ACCESS read-create
 STATUS current
 DESCRIPTION

"This value represents either the InterfaceIndex or 0 (zero). The value of zero means that the InterfaceIndex is not known.

However, if the InterfaceIndex is known, then it must be represented by this value.

If an InterfaceIndex becomes known, then the network management entity (e.g., SNMP agent) responsible for this object MUST change the value from 0 (zero) to the value of the InterfaceIndex. If an ATM Label is being used in forwarding data, then the value of this object MUST be the InterfaceIndex."

::= { mplsLdpEntityAtmEntry 1 }

mplsLdpEntityAtmMergeCap OBJECT-TYPE

SYNTAX INTEGER {
 notSupported(0),
 vpMerge(1),
 vcMerge(2),
 vpAndVcMerge(3)
 }

MAX-ACCESS read-create
 STATUS current
 DESCRIPTION

"Denotes the Merge Capability of this Entity. This is the EXACT value for the ATM Session Parameter, field M (for ATM Merge Capabilities). The ATM Session Parameter is an optional parameter in the Initialization Message.

The description from rfc3036.txt is:

'M, ATM Merge Capabilities
 Specifies the merge capabilities of an ATM switch. The following values are supported in this version of the specification:

Value	Meaning
0	Merge not supported
1	VP Merge supported
2	VC Merge supported
3	VP & VC Merge supported

- If the merge capabilities of the LSRs differ, then:
- Non-merge and VC-merge LSRs may freely interoperate.
 - The interoperability of VP-merge-capable switches with non-VP-merge-capable switches is a subject for future study. When the LSRs differ on the use of VP-merge, the session is established, but VP merge is not used.'

Please refer to the following reference for a complete description of this feature."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3
Initialization Message."

::= { mplsLdpEntityAtmEntry 2 }

mplsLdpEntityAtmLRComponents OBJECT-TYPE

SYNTAX Unsigned32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Number of Label Range Components in the Initialization message. This also represents the number of entries in the mplsLdpEntityAtmLRTable which correspond to this entry.

This is the EXACT value for the ATM Session Parameter, field N (for Number of label range components). The ATM Session Parameter is an optional parameter in the Initialization Message.

The description from rfc3036.txt is:

'N, Number of label range components
Specifies the number of ATM Label Range
Components included in the TLV.'

Please refer to the following reference for a complete description of this feature."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3
Initialization Message."

::= { mplsLdpEntityAtmEntry 3 }

mplsLdpEntityAtmVcDirectionality OBJECT-TYPE

SYNTAX INTEGER {
bidirectional(0),

```

                                unidirectional(1)
                                }
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION

```

"If the value of this object is 'bidirectional(0)', a given VCI, within a given VPI, is used as a label for both directions independently.

If the value of this object is 'unidirectional(1)', a given VCI within a VPI designates one direction.

This is the EXACT value for the ATM Session Parameter, field D (for VC Directionality). The ATM Session Parameter is an optional parameter in the Initialization Message.

The description from rfc3036.txt is:

'D, VC Directionality

A value of 0 specifies bidirectional VC capability, meaning the LSR can (within a given VPI) support the use of a given VCI as a label for both link directions independently. A value of 1 specifies unidirectional VC capability, meaning (within a given VPI) a given VCI may appear in a label mapping for one direction on the link only. When either or both of the peers specifies unidirectional VC capability, both LSRs use unidirectional VC label assignment for the link as follows. The LSRs compare their LDP Identifiers as unsigned integers. The LSR with the larger LDP Identifier may assign only odd-numbered VCIs in the VPI/VCI range as labels. The system with the smaller LDP Identifier may assign only even-numbered VCIs in the VPI/VCI range as labels.'

Please refer to the following reference for a complete description of this feature."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3 Initialization Message."

```
 ::= { mplsLdpEntityAtmEntry 4 }
```

```

mplsLdpEntityAtmLsrConnectivity OBJECT-TYPE
SYNTAX      INTEGER {
                                direct(1),

```

```

        indirect(2)
    }
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "The peer LSR may be connected indirectly by means
        of an ATM VP so that the VPI values may be different
        on either endpoint so the label MUST be encoded
        entirely within the VCI field."
    DEFVAL { direct }
    ::= { mplsLdpEntityAtmEntry 5 }

mplsLdpEntityAtmDefaultControlVpi OBJECT-TYPE
    SYNTAX        AtmVpIdentifier
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "The default VPI value for the non-MPLS connection. The
        default value of this is 0 (zero) but other values may
        be configured. This object allows a different value
        to be configured."
    DEFVAL { 0 }
    ::= { mplsLdpEntityAtmEntry 6 }

mplsLdpEntityAtmDefaultControlVci OBJECT-TYPE
    SYNTAX        MplsAtmVcIdentifier
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "The Default VCI value for a non-MPLS connection. The
        default value of this is 32 but other values may be
        configured. This object allows a different value to
        be configured."
    DEFVAL { 32 }
    ::= { mplsLdpEntityAtmEntry 7 }

mplsLdpEntityAtmUnlabTraffVpi OBJECT-TYPE
    SYNTAX        AtmVpIdentifier
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "VPI value of the VCC supporting unlabeled traffic. This
        non-MPLS connection is used to carry unlabeled (IP)
        packets. The default value is the same as the default
        value of the 'mplsLdpEntityAtmDefaultControlVpi', however
        another value may be configured."
    DEFVAL { 0 }
    ::= { mplsLdpEntityAtmEntry 8 }

```

mplsLdpEntityAtmUnlabTrafvci OBJECT-TYPE

SYNTAX MplsAtmVcIdentifier

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"VCI value of the VCC supporting unlabeled traffic. This non-MPLS connection is used to carry unlabeled (IP) packets. The default value is the same as the default value of the 'mplsLdpEntityAtmDefaultControlVci', however another value may be configured."

DEFVAL { 32 }

::= { mplsLdpEntityAtmEntry 9 }

mplsLdpEntityAtmStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The storage type for this conceptual row. Conceptual rows having the value 'permanent(4)' need not allow write-access to any columnar objects in the row."

DEFVAL { nonVolatile }

::= { mplsLdpEntityAtmEntry 10 }

mplsLdpEntityAtmRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this conceptual row. All writable objects in this row may be modified at any time, however, as described in detail in the section entitled, 'Changing Values After Session Establishment', and again described in the DESCRIPTION clause of the mplsLdpEntityAdminStatus object, if a session has been initiated with a Peer, changing objects in this table will wreak havoc with the session and interrupt traffic. To repeat again: the recommended procedure is to set the mplsLdpEntityAdminStatus to down, thereby explicitly causing a session to be torn down. Then, change objects in this entry, then set the mplsLdpEntityAdminStatus to enable which enables a new session to be initiated."

::= { mplsLdpEntityAtmEntry 11 }

--

```
-- The MPLS LDP Entity ATM Label Range Table
--
```

```
mplsLdpEntityAtmLRTable OBJECT-TYPE
```

```
    SYNTAX SEQUENCE OF MplsLdpEntityAtmLREntry
```

```
    MAX-ACCESS not-accessible
```

```
    STATUS current
```

```
    DESCRIPTION
```

```
        "The MPLS LDP Entity ATM Label Range (LR) Table.
```

```
        The purpose of this table is to provide a mechanism
        for configuring a contiguous range of vpi's
        with a contiguous range of vci's, or a 'label range'
        for LDP Entities.
```

```
        LDP Entities which use ATM must have at least one
        entry in this table.
```

```
        There must exist at least one entry in this
        table for every LDP Entity that has
        'mplsLdpEntityOptionalParameters' object with
        a value of 'atmSessionParameters'."
```

```
 ::= { mplsLdpEntityAtmObjects 2 }
```

```
mplsLdpEntityAtmLREntry OBJECT-TYPE
```

```
    SYNTAX MplsLdpEntityAtmLREntry
```

```
    MAX-ACCESS not-accessible
```

```
    STATUS current
```

```
    DESCRIPTION
```

```
        "A row in the LDP Entity ATM Label
        Range Table. One entry in this table contains
        information on a single range of labels
        represented by the configured Upper and Lower
        Bounds VPI/VCI pairs. These are the same
        data used in the Initialization Message.
```

```
        NOTE: The ranges for a specific LDP Entity
        are UNIQUE and non-overlapping. For example,
        for a specific LDP Entity index, there could
        be one entry having LowerBound vpi/vci == 0/32, and
        UpperBound vpi/vci == 0/100, and a second entry
        for this same interface with LowerBound
        vpi/vci == 0/101 and UpperBound vpi/vci == 0/200.
        However, there could not be a third entry with
        LowerBound vpi/vci == 0/200 and
        UpperBound vpi/vci == 0/300 because this label
        range overlaps with the second entry (i.e., both
        entries now have 0/200).
```

A row will not become active unless a unique and non-overlapping range is specified.

At least one label range entry for a specific LDP Entity MUST include the default VPI/VCI values denoted in the LDP Entity Table.

A request to create a row with an overlapping range should result in an inconsistentValue error."

```

INDEX      {  mplsLdpEntityLdpId,
               mplsLdpEntityIndex,
               mplsLdpEntityAtmLRMinVpi,
               mplsLdpEntityAtmLRMinVci
             }
 ::= { mplsLdpEntityAtmLRTable 1 }

MplsLdpEntityAtmLREntry ::= SEQUENCE {
    mplsLdpEntityAtmLRMinVpi      AtmVpIdentifier,
    mplsLdpEntityAtmLRMinVci      MplsAtmVcIdentifier,
    mplsLdpEntityAtmLRMaxVpi      AtmVpIdentifier,
    mplsLdpEntityAtmLRMaxVci      MplsAtmVcIdentifier,
    mplsLdpEntityAtmLRStorageType  StorageType,
    mplsLdpEntityAtmLRRowStatus    RowStatus
}

mplsLdpEntityAtmLRMinVpi OBJECT-TYPE
    SYNTAX AtmVpIdentifier
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The minimum VPI number configured for this range.
        The value of zero is a valid value for the VPI portion
        of the label."
    ::= { mplsLdpEntityAtmLREntry 1 }

mplsLdpEntityAtmLRMinVci OBJECT-TYPE
    SYNTAX MplsAtmVcIdentifier
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The minimum VCI number configured for this range."
    ::= { mplsLdpEntityAtmLREntry 2 }

mplsLdpEntityAtmLRMaxVpi OBJECT-TYPE
    SYNTAX AtmVpIdentifier
    MAX-ACCESS read-create

```

```
STATUS current
DESCRIPTION
    "The maximum VPI number configured for this range."
 ::= { mplsLdpEntityAtmLREntry 3 }

mplsLdpEntityAtmLRMaxVci OBJECT-TYPE
    SYNTAX MplsAtmVcIdentifier
    MAX-ACCESS read-create
    STATUS current
    DESCRIPTION
        "The maximum VCI number configured for this range."
 ::= { mplsLdpEntityAtmLREntry 4 }

mplsLdpEntityAtmLRStorageType OBJECT-TYPE
    SYNTAX      StorageType
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The storage type for this conceptual row.
        Conceptual rows having the value 'permanent(4)'
        need not allow write-access to any columnar
        objects in the row."
    DEFVAL { nonVolatile }
 ::= { mplsLdpEntityAtmLREntry 5 }

mplsLdpEntityAtmLRRowStatus OBJECT-TYPE
    SYNTAX RowStatus
    MAX-ACCESS read-create
    STATUS current
    DESCRIPTION
        "The status of this conceptual row. All writable
        objects in this row may be modified at any time,
        however, as described in detail in the section
        entitled, 'Changing Values After Session
        Establishment', and again described in the
        DESCRIPTION clause of the
        mplsLdpEntityAdminStatus object,
        if a session has been initiated with a Peer,
        changing objects in this table will
        wreak havoc with the session and interrupt traffic.
        To repeat again: the recommended procedure
        is to set the mplsLdpEntityAdminStatus to
        down, thereby explicitly causing a session
        to be torn down. Then, change objects in this
        entry, then set the mplsLdpEntityAdminStatus
        to enable which enables a new session
        to be initiated."
 ::= { mplsLdpEntityAtmLREntry 6 }
```

```

--
-- MPLS LDP ATM Session Information
--

mplsLdpAtmSessionObjects OBJECT IDENTIFIER ::=
    { mplsLdpAtmObjects 2 }

mplsLdpAtmSessionTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLdpAtmSessionEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A table which relates sessions in the
        'mplsLdpSessionTable' and their label
        range intersections. There could be one
        or more label range intersections between an
        LDP Entity and LDP Peer using ATM as the
        underlying media. Each row represents
        a single label range intersection.

        This table cannot use the 'AUGMENTS'
        clause because there is not necessarily
        a one-to-one mapping between this table
        and the mplsLdpSessionTable."
    ::= { mplsLdpAtmSessionObjects 1 }

mplsLdpAtmSessionEntry OBJECT-TYPE
    SYNTAX      MplsLdpAtmSessionEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An entry in this table represents information on a
        single label range intersection between an LDP Entity
        and LDP Peer.

        The information contained in a row is read-only."
    INDEX      { mplsLdpEntityLdpId,
                  mplsLdpEntityIndex,
                  mplsLdpPeerLdpId,
                  mplsLdpSessionAtmLRLowerBoundVpi,
                  mplsLdpSessionAtmLRLowerBoundVci
                }
    ::= { mplsLdpAtmSessionTable 1 }

MplsLdpAtmSessionEntry ::= SEQUENCE {
    mplsLdpSessionAtmLRLowerBoundVpi      AtmVpIdentifier,
    mplsLdpSessionAtmLRLowerBoundVci      MplsAtmVcIdentifier,
    mplsLdpSessionAtmLRUpperBoundVpi      AtmVpIdentifier,

```



```

    mplsLdpSessionAtmLRUpperBoundVci      MplsAtmVcIdentifier
}

mplsLdpSessionAtmLRLowerBoundVpi OBJECT-TYPE
    SYNTAX AtmVpIdentifier
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The minimum VPI number for this range."
    ::= { mplsLdpAtmSessionEntry 1 }

mplsLdpSessionAtmLRLowerBoundVci OBJECT-TYPE
    SYNTAX MplsAtmVcIdentifier
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The minimum VCI number for this range."
    ::= { mplsLdpAtmSessionEntry 2 }

mplsLdpSessionAtmLRUpperBoundVpi OBJECT-TYPE
    SYNTAX AtmVpIdentifier
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The maximum VPI number for this range."
    ::= { mplsLdpAtmSessionEntry 3 }

mplsLdpSessionAtmLRUpperBoundVci OBJECT-TYPE
    SYNTAX MplsAtmVcIdentifier
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The maximum VCI number for this range."
    ::= { mplsLdpAtmSessionEntry 4 }

--*****
-- Module Conformance Statement
--*****

mplsLdpAtmGroups
    OBJECT IDENTIFIER ::= { mplsLdpAtmConformance 1 }

mplsLdpAtmCompliances
    OBJECT IDENTIFIER ::= { mplsLdpAtmConformance 2 }

--
-- Full Compliance
--

```

```

mplsLdpAtmModuleFullCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The Module is implemented with support for
        read-create and read-write.  In other words,
        both monitoring and configuration
        are available when using this MODULE-COMPLIANCE."
    MODULE -- this module
    MANDATORY-GROUPS {
        mplsLdpAtmGroup
    }

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

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

    ::= { mplsLdpAtmCompliances 1 }

--
-- Read-Only Compliance
--

mplsLdpAtmModuleReadOnlyCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The Module is implemented with support for
        read-only.  In other words, only monitoring
        is available by implementing this MODULE-COMPLIANCE."
    MODULE -- this module
    MANDATORY-GROUPS {
        mplsLdpAtmGroup
    }

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

    OBJECT mplsLdpEntityAtmMergeCap

```

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

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

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

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

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

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

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

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

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

OBJECT mplsLdpEntityAtmLRMaxVpi
MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityAtmLRMaxVci

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityAtmLRStorageType

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityAtmLRRowStatus

SYNTAX RowStatus { active(1) }

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required, and active is the only status that needs to be supported."

::= { mplsLdpAtmCompliances 2 }

--

-- units of conformance

--

mplsLdpAtmGroup OBJECT-GROUP

OBJECTS {

mplsLdpEntityAtmIfIndexOrZero,

mplsLdpEntityAtmMergeCap,

mplsLdpEntityAtmLRComponents,

mplsLdpEntityAtmVcDirectionality,

mplsLdpEntityAtmLsrConnectivity,

mplsLdpEntityAtmDefaultControlVpi,

mplsLdpEntityAtmDefaultControlVci,

mplsLdpEntityAtmUnlabTrafVpi,

mplsLdpEntityAtmUnlabTrafVci,

mplsLdpEntityAtmStorageType,

mplsLdpEntityAtmRowStatus,

mplsLdpEntityAtmLRMaxVpi,

mplsLdpEntityAtmLRMaxVci,

mplsLdpEntityAtmLRStorageType,

mplsLdpEntityAtmLRRowStatus,

mplsLdpSessionAtmLRUpperBoundVpi,

mplsLdpSessionAtmLRUpperBoundVci

}

STATUS current

DESCRIPTION

"Objects that apply to all MPLS LDP implementations using ATM as the Layer 2."
 ::= { mplsLdpAtmGroups 1 }

END

4.2. The MPLS-LDP-FRAME-RELAY-STD-MIB Module

This MIB Module MUST be supported if LDP uses FRAME RELAY as the Layer 2 medium. There are three tables in this MIB Module. Two tables are to configure LDP for using Frame Relay. These tables are the mplsLdpEntityFrameRelayTable and the mplsLdpEntityFrameRelayLRTable. The third table, mplsLdpFrameRelaySessionTable, is a read-only table. This MIB Module IMPORTS the DLCI TEXTUAL-CONVENTION from [RFC2115].

4.2.1. The LDP Entity Frame Relay Table

The mplsLdpEntityFrameRelayTable provides a way to configure information which would be contained in the "Optional Parameter" portion of an LDP PDU Initialization Message.

4.2.2. The LDP Entity Frame Relay Label Range Table

The mplsLdpEntityFrameRelayLRTable provides a way to configure information which would be contained in the "Frame Relay Label Range Components" portion of an LDP PDU Initialization Message, see [RFC3034] and [RFC3036].

4.2.3. The LDP Frame Relay Session Table

The mplsLdpFrameRelaySessionTable is a table which contains session information specific to Frame Relay.

MPLS-LDP-FRAME-RELAY-STD-MIB DEFINITIONS ::= BEGIN

IMPORTS

```

    OBJECT-TYPE,
    MODULE-IDENTITY,
    Unsigned32
        FROM SNMPv2-SMI                -- [RFC2578]
    MODULE-COMPLIANCE,
    OBJECT-GROUP
        FROM SNMPv2-CONF                -- [RFC2580]

    RowStatus,
    StorageType
```

```

FROM SNMPv2-TC -- [RFC2579]

DLCI
FROM FRAME-RELAY-DTE-MIB -- [RFC2115]

InterfaceIndexOrZero
FROM IF-MIB -- [RFC2020]

mplsStdMIB
FROM MPLS-TC-STD-MIB -- [RFC3811]

mplsLdpEntityLdpId,
mplsLdpEntityIndex,
mplsLdpPeerLdpId
FROM MPLS-LDP-STD-MIB -- [RFC3813]
;

mplsLdpFrameRelayStdMIB MODULE-IDENTITY
LAST-UPDATED "200406030000Z" -- June 3, 2004
ORGANIZATION "Multiprotocol Label Switching (mpls)
              Working Group"
CONTACT-INFO
    "Joan Cucchiara (jcucchiara@mindspring.com)
      Marconi Communications, Inc.

      Hans Sjostrand (hans@ipunplugged.com)
      ipUnplugged

      James V. Luciani (james_luciani@mindspring.com)
      Marconi Communications, Inc.

      Working Group Chairs:
      George Swallow,    email: swallow@cisco.com
      Loa Andersson,     email: loa@pi.se

      MPLS Working Group, email: mpls@uu.net
    "
DESCRIPTION
    "Copyright (C) The Internet Society (year). The
    initial version of this MIB module was published
    in RFC 3815. For full legal notices see the RFC
    itself or see:
    http://www.ietf.org/copyrights/ianamib.html

    This MIB contains managed object definitions for
    configuring and monitoring the Multiprotocol Label
    Switching (MPLS), Label Distribution Protocol (LDP),
    utilizing Frame Relay as the Layer 2 media."

```

REVISION "200406030000Z" -- June 6, 2004

DESCRIPTION

"Initial version published as part of RFC 3815."

::= { mplsStdMIB 6 }

mplsLdpFrameRelayObjects OBJECT IDENTIFIER

::= { mplsLdpFrameRelayStdMIB 1 }

mplsLdpFrameRelayConformance OBJECT IDENTIFIER

::= { mplsLdpFrameRelayStdMIB 2 }

-- MPLS LDP Frame Relay Objects

--

-- Ldp Entity Objects for Frame Relay

--

mplsLdpEntityFrameRelayObjects OBJECT IDENTIFIER ::=

{ mplsLdpFrameRelayObjects 1 }

mplsLdpEntityFrameRelayTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsLdpEntityFrameRelayEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains Frame Relay specific information which could be used in the 'Optional Parameters' and other Frame Relay specific information.

This table 'sparse augments' the mplsLdpEntityTable when Frame Relay is the Layer 2 medium."

::= { mplsLdpEntityFrameRelayObjects 1 }

mplsLdpEntityFrameRelayEntry OBJECT-TYPE

SYNTAX MplsLdpEntityFrameRelayEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents the Frame Relay optional parameters associated with the LDP entity."

INDEX { mplsLdpEntityLdpId,
mplsLdpEntityIndex

```

    }
    ::= { mplsLdpEntityFrameRelayTable 1 }

MplsLdpEntityFrameRelayEntry ::= SEQUENCE {
    mplsLdpEntityFrameRelayIfIndexOrZero      InterfaceIndexOrZero,
    mplsLdpEntityFrameRelayMergeCap           INTEGER,
    mplsLdpEntityFrameRelayLRComponents       Unsigned32,
    mplsLdpEntityFrameRelayVcDirectionality   INTEGER,
    mplsLdpEntityFrameRelayStorageType        StorageType,
    mplsLdpEntityFrameRelayRowStatus          RowStatus
}

mplsLdpEntityFrameRelayIfIndexOrZero OBJECT-TYPE
    SYNTAX      InterfaceIndexOrZero
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "This value represents either the InterfaceIndex of
        the 'ifLayer' where the Frame Relay Labels 'owned' by this
        entry were created, or 0 (zero). The value of zero
        means that the InterfaceIndex is not known. For example,
        if the InterfaceIndex is created subsequent to the
        Frame Relay Label's creation, then it would not be known.
        However, if the InterfaceIndex is known, then it must
        be represented by this value.

        If an InterfaceIndex becomes known, then the
        network management entity (e.g., SNMP agent) responsible
        for this object MUST change the value from 0 (zero) to the
        value of the InterfaceIndex. If an Frame Relay Label is
        being used in forwarding data, then the value of this
        object MUST be the InterfaceIndex."
    ::= { mplsLdpEntityFrameRelayEntry 1 }

mplsLdpEntityFrameRelayMergeCap OBJECT-TYPE
    SYNTAX      INTEGER {
                    notSupported(0),
                    supported(1)
                }
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "This represents whether or not the Frame Relay merge
        capability is supported. This is the EXACT value for the
        Frame Relay Session Parameter, field M (for Frame Relay
        Merge Capabilities). The Frame Relay Session Parameter
        is an optional parameter in the Initialization Message."

```


The description from rfc3036.txt is:

'M, Frame Relay Merge Capabilities
Specifies the merge capabilities of a Frame
Relay switch. The following values are
supported in this version of the
specification:

Value	Meaning
0	Merge not supported
1	Merge supported

Non-merge and merge Frame Relay LSRs may
freely interoperate.'

Please refer to the following reference for a
complete description of this feature."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3
Initialization Message."

::= { mplsLdpEntityFrameRelayEntry 2 }

mplsLdpEntityFrameRelayLRComponents OBJECT-TYPE

SYNTAX Unsigned32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Number of Label Range Components in the Initialization
message. This also represents the number of entries
in the mplsLdpEntityFrameRelayLRTable which correspond
to this entry.

This is the EXACT value for the Frame Relay Session
Parameter, field N (for Number of label range
components). The Frame Relay Session Parameter
is an optional parameter in the Initialization
Message.

The description from rfc3036.txt is:

'N, Number of label range components
Specifies the number of Frame Relay Label
Range Components included in the TLV.'

Please refer to the following reference for a
complete description of this feature."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3

```

        Initialization Message."
 ::= { mplsLdpEntityFrameRelayEntry 3 }

mplsLdpEntityFrameRelayVcDirectionality OBJECT-TYPE
    SYNTAX      INTEGER {
                                bidirectional(0),
                                unidirectional(1)
                        }
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "If the value of this object is 'bidirectional(0)', then
        the LSR supports the use of a given DLCI as a label for
        both directions independently.  If the value of
        this object is 'unidirectional(1)', then the LSR
        uses the given DLCI as a label in only one direction."

```

This is the EXACT value for the Frame Relay Session Parameter, field D (for VC Directionality). The Frame Relay Session Parameter is an optional parameter in the Initialization Message.

The description from rfc3036.txt is:

```

'D, VC Directionality
  A value of 0 specifies bidirectional VC capability,
  meaning the LSR can support the use of a given
  DLCI as a label for both link directions
  independently.  A value of 1 specifies
  unidirectional VC capability, meaning a given
  DLCI may appear in a label mapping for one
  direction on the link only.  When either or both
  of the peers specifies unidirectional VC
  capability, both LSRs use unidirectional VC
  label assignment for the link as follows.  The
  LSRs compare their LDP Identifiers as unsigned
  integers.  The LSR with the larger LDP
  Identifier may assign only odd-numbered DLCIs
  in the range as labels.  The system with the
  smaller LDP Identifier may assign only
  even-numbered DLCIs in the range as labels.'

```

Please refer to the following reference for a complete description of this feature."

REFERENCE

```

    "RFC3036, LDP Specification, Section 3.5.3
    Initialization Message."
 ::= { mplsLdpEntityFrameRelayEntry 4 }

```

```

mplsLdpEntityFrameRelayStorageType OBJECT-TYPE
    SYNTAX      StorageType
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The storage type for this conceptual row.
        Conceptual rows having the value 'permanent(4)'
        need not allow write-access to any columnar
        objects in the row."
    DEFVAL { nonVolatile }
    ::= { mplsLdpEntityFrameRelayEntry 5 }

mplsLdpEntityFrameRelayRowStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The status of this conceptual row. All writable
        objects in this row may be modified at any time,
        however, as described in detail in the section
        entitled, 'Changing Values After Session
        Establishment', and again described in the
        DESCRIPTION clause of the
        mplsLdpEntityAdminStatus object,
        if a session has been initiated with a Peer,
        changing objects in this table will
        wreak havoc with the session and interrupt
        traffic. To repeat again:
        the recommended procedure is to set the
        mplsLdpEntityAdminStatus to
        down, thereby explicitly causing a
        session to be torn down. Then,
        change objects in this entry, then set
        the mplsLdpEntityAdminStatus
        to enable which enables a new session
        to be initiated."
    ::= { mplsLdpEntityFrameRelayEntry 6 }

--
-- Frame Relay Label Range Components
--

mplsLdpEntityFrameRelayLRTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLdpEntityFrameRelayLREntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "This table contains information about the

```

Optional Parameters for the Frame Relay Session in the LDP Initialization Message, specifically it contains information about the Frame Relay Label Range Components.

If the value of the object 'mplsLdpEntityOptionalParameters' contains the value of 'frameRelaySessionParameters(3)' then there must be at least one corresponding entry in this table."

::= { mplsLdpEntityFrameRelayObjects 2 }

```
mplsLdpEntityFrameRelayLREntry OBJECT-TYPE
    SYNTAX      MplsLdpEntityFrameRelayLREntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An entry in this table represents the Frame Relay
        Label Range Component associated with the LDP entity."
    INDEX       { mplsLdpEntityLdpId,
                  mplsLdpEntityIndex,
                  mplsLdpEntityFrameRelayLRMinDlci
                }
    ::= { mplsLdpEntityFrameRelayLRTable 1 }
```

```
MplsLdpEntityFrameRelayLREntry ::= SEQUENCE {
    mplsLdpEntityFrameRelayLRMinDlci      DLCI,
    mplsLdpEntityFrameRelayLRMaxDlci      DLCI,
    mplsLdpEntityFrameRelayLRLen          INTEGER,
    mplsLdpEntityFrameRelayLRStorageType  StorageType,
    mplsLdpEntityFrameRelayLRRowStatus    RowStatus
}
```

```
mplsLdpEntityFrameRelayLRMinDlci OBJECT-TYPE
    SYNTAX      DLCI
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The lower bound which is supported. This value
        should be the same as that in the Frame Relay Label
        Range Component's Minimum DLCI field. The value
        of zero is valid for the minimum DLCI field of
        the label."
    REFERENCE
        "RFC3034, Use of Label Switching on Frame Relay
        Networks Specification."
    ::= { mplsLdpEntityFrameRelayLREntry 1 }
```

mplsLdpEntityFrameRelayLRMaxDlci OBJECT-TYPE

SYNTAX DLCI

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The upper bound which is supported. This value should be the same as that in the Frame Relay Label Range Component's Maximum DLCI field."

::= { mplsLdpEntityFrameRelayLREntry 2 }

mplsLdpEntityFrameRelayLRLen OBJECT-TYPE

SYNTAX INTEGER {
 tenDlciBits(0),
 twentyThreeDlciBits(2)
 }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the length of the DLCI bits.

This is the EXACT value for the Len field of the Frame Relay Label Range Component.

The description from rfc3036.txt is:

'Len

This field specifies the number of bits of the DLCI. The following values are supported:

Len	DLCI bits
0	10
2	23

Len values 1 and 3 are reserved.'

Please refer to the following reference for a complete description of this feature."

REFERENCE

"RFC3036, LDP Specification, Section 3.5.3 Initialization Message."

::= { mplsLdpEntityFrameRelayLREntry 3 }

mplsLdpEntityFrameRelayLRStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

```

        "The storage type for this conceptual row.
        Conceptual rows having the value 'permanent(4)'
        need not allow write-access to any columnar
        objects in the row."
    DEFVAL { nonVolatile }
    ::= { mplsLdpEntityFrameRelayLREntry 4 }

mplsLdpEntityFrameRelayLRRowStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The status of this conceptual row. All writable
        objects in this row may be modified at any time,
        however, as described in detail in the section
        entitled, 'Changing Values After Session
        Establishment', and again described in the
        DESCRIPTION clause of the
        mplsLdpEntityAdminStatus object,
        if a session has been initiated with a Peer,
        changing objects in this table will
        wreak havoc with the session and interrupt
        traffic. To repeat again:
        the recommended procedure is to set the
        mplsLdpEntityAdminStatus to down, thereby
        explicitly causing a session to be torn down. Then,
        change objects in this entry, then set the
        mplsLdpEntityAdminStatus to enable which enables
        a new session to be initiated."
    ::= { mplsLdpEntityFrameRelayLREntry 5 }

--
-- MPLS LDP Frame Relay Session Information
--

mplsLdpFrameRelaySessionObjects OBJECT IDENTIFIER ::=
    { mplsLdpFrameRelayObjects 2 }

mplsLdpFrameRelaySessionTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLdpFrameRelaySessionEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "A table of Frame Relay label range intersections
        between the LDP Entities and LDP Peers.
        Each row represents a single label range intersection.

        NOTE: this table cannot use the 'AUGMENTS'

```

clause because there is not necessarily a one-to-one mapping between this table and the mplsLdpSessionTable."

```
 ::= { mplsLdpFrameRelaySessionObjects 1 }
```

mplsLdpFrameRelaySessionEntry OBJECT-TYPE

```
SYNTAX      MplsLdpFrameRelaySessionEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "An entry in this table represents information on a
    single label range intersection between an
    LDP Entity and LDP Peer.

    The information contained in a row is read-only."
INDEX       { mplsLdpEntityLdpId,
              mplsLdpEntityIndex,
              mplsLdpPeerLdpId,
              mplsLdpFrameRelaySessionMinDlci
            }
 ::= { mplsLdpFrameRelaySessionTable 1 }
```

MplsLdpFrameRelaySessionEntry ::= SEQUENCE {

```
    mplsLdpFrameRelaySessionMinDlci    DLCI,
    mplsLdpFrameRelaySessionMaxDlci    DLCI,
    mplsLdpFrameRelaySessionLen        INTEGER
}
```

mplsLdpFrameRelaySessionMinDlci OBJECT-TYPE

```
SYNTAX      DLCI
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The lower bound of DLCIs which are supported.
    The value of zero is a valid value for the
    minimum DLCI field of the label."
REFERENCE
    "RFC3034, Use of Label Switching on Frame Relay
    Networks Specification."
 ::= { mplsLdpFrameRelaySessionEntry 1 }
```

mplsLdpFrameRelaySessionMaxDlci OBJECT-TYPE

```
SYNTAX      DLCI
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The upper bound of DLCIs which are supported."
 ::= { mplsLdpFrameRelaySessionEntry 2 }
```

```

mplsLdpFrameRelaySessionLen OBJECT-TYPE
    SYNTAX      INTEGER {
                    tenDlciBits(0),
                    twentyThreeDlciBits(2)
                }
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "This object specifies the DLCI bits."
    ::= { mplsLdpFrameRelaySessionEntry 3 }

--*****
-- Module Conformance Statement
--*****

mplsLdpFrameRelayGroups
    OBJECT IDENTIFIER ::= { mplsLdpFrameRelayConformance 1 }

mplsLdpFrameRelayCompliances
    OBJECT IDENTIFIER ::= { mplsLdpFrameRelayConformance 2 }

--
-- Full Compliance
--

mplsLdpFrameRelayModuleFullCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The Module is implemented with support for
        read-create and read-write.  In other words,
        both monitoring and configuration
        are available when using this MODULE-COMPLIANCE."
    MODULE -- this module
        MANDATORY-GROUPS {
            mplsLdpFrameRelayGroup
        }

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

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

```



```

 ::= { mplsLdpFrameRelayCompliances 1 }

--
-- Read-Only Compliance
--

mplsLdpFrameRelayModuleReadOnlyCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The Module is implemented with support for
        read-only. In other words, only monitoring
        is available by implementing this MODULE-COMPLIANCE."
    MODULE -- this module
        MANDATORY-GROUPS {
            mplsLdpFrameRelayGroup
        }

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

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

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

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

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

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

```

OBJECT mplsLdpEntityFrameRelayLRLen

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityFrameRelayLRStorageType

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsLdpEntityFrameRelayLRRowStatus

SYNTAX RowStatus { active(1) }

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required, and active is the only status that needs to be supported."

::= { mplsLdpFrameRelayCompliances 2 }

--

-- units of conformance

--

mplsLdpFrameRelayGroup OBJECT-GROUP

OBJECTS {

mplsLdpEntityFrameRelayIfIndexOrZero,

mplsLdpEntityFrameRelayMergeCap,

mplsLdpEntityFrameRelayLRComponents,

mplsLdpEntityFrameRelayVcDirectionality,

mplsLdpEntityFrameRelayStorageType,

mplsLdpEntityFrameRelayRowStatus,

mplsLdpEntityFrameRelayLRMaxDlci,

mplsLdpEntityFrameRelayLRLen,

mplsLdpEntityFrameRelayLRStorageType,

mplsLdpEntityFrameRelayLRRowStatus,

mplsLdpFrameRelaySessionMaxDlci,

mplsLdpFrameRelaySessionLen

}

STATUS current

DESCRIPTION

"Objects that apply to all MPLS LDP implementations using Frame Relay as the Layer 2."

::= { mplsLdpFrameRelayGroups 1 }

END

4.3. The MPLS-LDP-GENERIC-STD-MIB Module

This MIB Module MUST be supported if LDP uses a Per Platform Label Space. This MIB Module contains a Label Range (LR) table for configuring MPLS Generic Label Ranges. This table is mplsLdpEntityGenericLRTable. Although the LDP Specification does not provide a way for configuring Label Ranges for Generic Labels, the MIB does provide a way to reserve a range of generic labels because this was thought to be useful by the working group.

MPLS-LDP-GENERIC-STD-MIB DEFINITIONS ::= BEGIN

IMPORTS

 OBJECT-TYPE,
 MODULE-IDENTITY,
 Unsigned32
 FROM SNMPv2-SMI -- [RFC2578]

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

 RowStatus,
 StorageType
 FROM SNMPv2-TC -- [RFC2579]

 InterfaceIndexOrZero
 FROM IF-MIB -- [RFC2020]

 mplsStdMIB
 FROM MPLS-TC-STD-MIB -- [RFC3811]

 mplsLdpEntityLdpId,
 mplsLdpEntityIndex
 FROM MPLS-LDP-STD-MIB -- [RFC3813]
 ;

mplsLdpGenericStdMIB MODULE-IDENTITY

 LAST-UPDATED "200406030000Z" -- June 6, 2004
 ORGANIZATION "Multiprotocol Label Switching (mpls)
 Working Group"

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MPLS Working Group, email: mpls@uu.net

"

DESCRIPTION

"Copyright (C) The Internet Society (year). The initial version of this MIB module was published in RFC 3815. For full legal notices see the RFC itself or see:

<http://www.ietf.org/copyrights/ianamib.html>

This MIB contains managed object definitions for configuring and monitoring the Multiprotocol Label Switching (MPLS), Label Distribution Protocol (LDP), utilizing ethernet as the Layer 2 media."

REVISION "200406030000Z" -- June 6, 2004

DESCRIPTION

"Initial version published as part of RFC 3815."

::= { mplsStdMIB 7 }

--*****

mplsLdpGenericObjects

OBJECT IDENTIFIER ::= { mplsLdpGenericStdMIB 1 }

mplsLdpGenericConformance

OBJECT IDENTIFIER ::= { mplsLdpGenericStdMIB 2 }

--*****

-- MPLS LDP GENERIC Objects

--*****

--

-- Ldp Entity Objects for Generic Labels

--

mplsLdpEntityGenericObjects OBJECT IDENTIFIER ::= { mplsLdpGenericObjects 1 }

--

-- The MPLS LDP Entity Generic Label Range Table

--

```

mplsLdpEntityGenericLRTable OBJECT-TYPE
    SYNTAX SEQUENCE OF MplsLdpEntityGenericLREntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The MPLS LDP Entity Generic Label Range (LR)
        Table.

        The purpose of this table is to provide a mechanism
        for configuring a contiguous range of generic labels,
        or a 'label range' for LDP Entities.

        LDP Entities which use Generic Labels must have at least
        one entry in this table.  In other words, this table
        'extends' the mplsLdpEntityTable for Generic Labels."
    ::= { mplsLdpEntityGenericObjects 1 }

mplsLdpEntityGenericLREntry OBJECT-TYPE
    SYNTAX MplsLdpEntityGenericLREntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "A row in the LDP Entity Generic Label
        Range (LR) Table.  One entry in this table contains
        information on a single range of labels
        represented by the configured Upper and Lower
        Bounds pairs.  NOTE: there is NO corresponding
        LDP message which relates to the information
        in this table, however, this table does provide
        a way for a user to 'reserve' a generic label
        range.

        NOTE: The ranges for a specific LDP Entity
        are UNIQUE and non-overlapping.

        A row will not be created unless a unique and
        non-overlapping range is specified."
    INDEX      { mplsLdpEntityLdpId,
                  mplsLdpEntityIndex,
                  mplsLdpEntityGenericLRMin,
                  mplsLdpEntityGenericLRMax
                }
    ::= { mplsLdpEntityGenericLRTable 1 }

MplsLdpEntityGenericLREntry ::= SEQUENCE {
    mplsLdpEntityGenericLRMin      Unsigned32,
    mplsLdpEntityGenericLRMax      Unsigned32,
    mplsLdpEntityGenericLabelSpace INTEGER,

```

```

    mplsLdpEntityGenericIfIndexOrZero    InterfaceIndexOrZero,
    mplsLdpEntityGenericLRStorageType    StorageType,
    mplsLdpEntityGenericLRRowStatus      RowStatus
}

mplsLdpEntityGenericLRMin OBJECT-TYPE
    SYNTAX      Unsigned32(0..1048575)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The minimum label configured for this range."
    ::= { mplsLdpEntityGenericLREntry 1 }

mplsLdpEntityGenericLRMax OBJECT-TYPE
    SYNTAX      Unsigned32(0..1048575)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The maximum label configured for this range."
    ::= { mplsLdpEntityGenericLREntry 2 }

mplsLdpEntityGenericLabelSpace OBJECT-TYPE
    SYNTAX      INTEGER {
                                perPlatform(1),
                                perInterface(2)
                            }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This value of this object is perPlatform(1), then
        this means that the label space type is
        per platform.

        If this object is perInterface(2), then this
        means that the label space type is per Interface."
    REFERENCE
        "RFC3036, LDP Specification, Section 2.2.1,
        Label Spaces."
    DEFVAL { perPlatform }
    ::= { mplsLdpEntityGenericLREntry 3 }

mplsLdpEntityGenericIfIndexOrZero OBJECT-TYPE
    SYNTAX      InterfaceIndexOrZero
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This value represents either the InterfaceIndex of
        the 'ifLayer' where these Generic Label would be created,
```

or 0 (zero). The value of zero means that the InterfaceIndex is not known.

However, if the InterfaceIndex is known, then it must be represented by this value.

If an InterfaceIndex becomes known, then the network management entity (e.g., SNMP agent) responsible for this object MUST change the value from 0 (zero) to the value of the InterfaceIndex."

```
::= { mplsLdpEntityGenericLREntry 4 }
```

```
mplsLdpEntityGenericLRStorageType OBJECT-TYPE
```

```
SYNTAX StorageType
```

```
MAX-ACCESS read-create
```

```
STATUS current
```

```
DESCRIPTION
```

"The storage type for this conceptual row. Conceptual rows having the value 'permanent(4)' need not allow write-access to any columnar objects in the row."

```
DEFVAL { nonVolatile }
```

```
::= { mplsLdpEntityGenericLREntry 5 }
```

```
mplsLdpEntityGenericLRRowStatus OBJECT-TYPE
```

```
SYNTAX RowStatus
```

```
MAX-ACCESS read-create
```

```
STATUS current
```

```
DESCRIPTION
```

"The status of this conceptual row. All writable objects in this row may be modified at any time, however, as described in detail in the section entitled, 'Changing Values After Session Establishment', and again described in the DESCRIPTION clause of the mplsLdpEntityAdminStatus object, if a session has been initiated with a Peer, changing objects in this table will wreak havoc with the session and interrupt traffic. To repeat again: the recommended procedure is to set the mplsLdpEntityAdminStatus to down, thereby explicitly causing a session to be torn down. Then, change objects in this entry, then set the mplsLdpEntityAdminStatus to enable which enables a new session to be initiated.

There must exist at least one entry in this table for every LDP Entity that has a generic label configured."

```

 ::= { mplsLdpEntityGenericLREntry 6 }

--*****
-- Module Conformance Statement
--*****

mplsLdpGenericGroups
    OBJECT IDENTIFIER ::= { mplsLdpGenericConformance 1 }

mplsLdpGenericCompliances
    OBJECT IDENTIFIER ::= { mplsLdpGenericConformance 2 }

--
-- Full Compliance
--

mplsLdpGenericModuleFullCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The Module is implemented with support for
        read-create and read-write. In other words,
        both monitoring and configuration
        are available when using this MODULE-COMPLIANCE."
    MODULE -- this module
        MANDATORY-GROUPS {
            mplsLdpGenericGroup
        }

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

    ::= { mplsLdpGenericCompliances 1 }

--
-- Read-Only Compliance
--

mplsLdpGenericModuleReadOnlyCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The Module is implemented with support for
        read-only. In other words, only monitoring
        is available by implementing this MODULE-COMPLIANCE."
    MODULE -- this module
        MANDATORY-GROUPS {

```



```

        mplsLdpGenericGroup
    }

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

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

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

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

::= { mplsLdpGenericCompliances 2 }

--
-- units of conformance
--

mplsLdpGenericGroup OBJECT-GROUP
    OBJECTS {
        mplsLdpEntityGenericLabelSpace,
        mplsLdpEntityGenericIfIndexOrZero,
        mplsLdpEntityGenericLRStorageType,
        mplsLdpEntityGenericLRRowStatus
    }
    STATUS      current
    DESCRIPTION
        "Objects that apply to all MPLS LDP implementations
        using Generic Labels as the Layer 2."
    ::= { mplsLdpGenericGroups 1 }

END

```

5. Acknowledgments

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7. Security Considerations

This Security Considerations section consists of 4 subsections, one for each of the MIB Modules in this document.

7.1. Security Considerations for MPLS-LDP-STD-MIB

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:

- o the mplsLdpEntityTable contains objects to provision potential LDP sessions on the Label Switching Router (LSR) or Label Edge Router (LER). The mplsLdpLspFecTable contains objects which associate an LSP with a FEC. Unauthorized access to objects in these tables, could result in disruption of traffic on the network. This is especially true if an LDP session has been established. The use of stronger mechanisms such as SNMPv3 security should be considered where possible. Specifically, SNMPv3 VACM and USM MUST be used with any v3 agent which implements this MIB. Administrators should consider whether

read access to these objects should be allowed, since read access may be undesirable under certain circumstances.

Some of the readable objects in this MIB module i.e., (objects with a MAX-ACCESS other than not-accessible), may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

- o the `mplsLdpEntityTable`, `mplsLdpPeerTable`, `mplsLdpSessionTable` and `mplsLdpSessionStatsTable` collectively show the LDP LSP network topology. If an Administrator does not want to reveal the LDP LSP topology of the network, then these tables should be considered sensitive/vulnerable.

7.2. Security Considerations for MPLS-LDP-ATM-STD-MIB

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:

- o the `mplsLdpEntityAtmTable` and `mplsLdpEntityAtmLRTable` contain objects to provision potential LDP sessions on the Label Switching Router (LSR) or Label Edge Router (LER) over Layer 2 of ATM. These tables extend the `mplsLdpEntityTable` in the MPLS-LDP-MIB. Unauthorized access to objects in these tables, could result in disruption of traffic on the network. This is especially true if an LDP session has been established. The use of stronger mechanisms such as SNMPv3 security should be considered where possible. Specifically, SNMPv3 VACM and USM MUST be used with any v3 agent which implements this MIB. Administrators should consider whether read access to these objects should be allowed, since read access may be undesirable under certain circumstances.

Some of the readable objects in this MIB module i.e., (objects with a MAX-ACCESS other than not-accessible), may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

- o the `mplsLdpEntityAtmTable` and `mplsLdpEntityAtmLRTTable` show the Label Ranges for ATM. If an Administrator does not want to reveal this information then these tables should be considered sensitive/vulnerable and treated accordingly.

7.3. Security Considerations for MPLS-LDP-FRAME-RELAY-STD-MIB

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:

- o the `mplsLdpEntityFrameRelayTable` and `mplsLdpEntityFrameRelayLRTTable` contain objects to provision potential LDP sessions on the Label Switching Router (LSR) or Label Edge Router (LER) over Layer 2 of Frame Relay. These tables extend the `mplsLdpEntityTable` in the MPLS-LDP-MIB. Unauthorized access to objects in these tables, could result in disruption of traffic on the network. This is especially true if an LDP session has been established. The use of stronger mechanisms such as SNMPv3 security should be considered where possible. Specifically, SNMPv3 VACM and USM MUST be used with any v3 agent which implements this MIB. Administrators should consider whether read access to these objects should be allowed, since read access may be undesirable under certain circumstances.

Some of the readable objects in this MIB module i.e., (objects with a MAX-ACCESS other than not-accessible), may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

- o the `mplsLdpEntityFrameRelayTable` and `mplsLdpEntityFrameRelayLRTTable` show the Label Ranges for Frame Relay. If an Administrator does not want to reveal this information then these tables should be considered sensitive/vulnerable and treated accordingly.

7.4. Security Considerations for MPLS-LDP-GENERIC-STD-MIB

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:

- o the `mplsLdpEntityGenericLRTable` contains objects to provision potential LDP sessions on the Label Switching Router (LSR) or Label Edge Router (LER) over Layer 2 of Ethernet. This table extends the `mplsLdpEntityTable` in the MPLS-LDP-MIB. Unauthorized access to objects in these tables, could result in disruption of traffic on the network. This is especially true if an LDP session has been established. The use of stronger mechanisms such as SNMPv3 security should be considered where possible. Specifically, SNMPv3 VACM and USM MUST be used with any v3 agent which implements this MIB. Administrators should consider whether read access to these objects should be allowed, since read access may be undesirable under certain circumstances.

Some of the readable objects in this MIB module i.e., (objects with a MAX-ACCESS other than not-accessible), may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

- o the `mplsLdpEntityGenericLRTable` shows the Label Ranges for ethernet. If an Administrator does not want to reveal this information then these tables should be considered sensitive/vulnerable and treated accordingly.

7.5. Additional Security Considerations

The following paragraphs describe additional security considerations which are applicable to all 4 of the MIB Modules in this document.

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.

8. IANA Considerations

As described in [MPLSMGMT] and as requested in the MPLS-TC-STD-MIB [MPLSTCMIB], MPLS related standards track MIB modules should be rooted under the mplsStdMIB subtree. There are 4 MPLS MIB Modules contained in this document, each of the following "IANA Considerations" subsections lists new IANA assignments under the mplsStdMIB subtree. New assignments can only be made via a Standards Action as specified in [RFC2434].

8.1. IANA Considerations for MPLS-LDP-STD-MIB

The IANA has assigned { mplsStdMIB 4 } to the MPLS-LDP-STD-MIB module specified in this document.

8.2. IANA Considerations for MPLS-LDP-ATM-STD-MIB

The IANA has assigned { mplsStdMIB 5 } to the MPLS-LDP-ATM-STD-MIB module specified in this document.

8.3. IANA Considerations for MPLS-LDP-FRAME-RELAY-STD-MIB

The IANA has assigned { mplsStdMIB 6 } to the MPLS-LDP-FRAME-RELAY-STD-MIB module specified in this document.

8.4. IANA Considerations for MPLS-LDP-GENERIC-STD-MIB

The IANA has assigned { mplsStdMIB 7 } to the MPLS-LDP-GENERIC-STD-MIB module specified in this document.

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