Network Working Group
Request for Comments: 3815
Category: Standards Track

J. Cucchiara
Marconi Communications, Inc.
H. Sjostrand
ipUnplugged
J. Luciani
Marconi Communications, Inc.

June 2004

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

Status of this Memo

Copyright Notice

Abstract

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

Table of Contents

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 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 intialization, 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 mplsLpdEntityStatsTable 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 intialization.

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

            "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 (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
            interpretted 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 Dection 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 Dection,
           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 Notfications
            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/mplsLdpSessionTable."
        ::= { 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 UPD 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 mplsLdpFectTable 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 interpretted 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 interpretted 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 Intialization 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"
       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 (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 }

    mplsLdpEntityAtmUnlabTrafVpi 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 Intialization 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),
                              unidirection(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"
    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 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 configurating 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 mpldLdpEntityTable 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

This document is a product of the MPLS Working Group. The authors would like to thank Mike MacFadden and Adrian Farrel for their helpful comments on several reviews. Also, the authors would like to give a special acknowledgement to Bert Wijnen for his many detailed reviews. Bert's assistance and guidance is greatly appreciated.

We would also like to thank Cheenu Srinivasan, Arun Viswanathan and Thomas D. Nadeau, the authors of the MPLS-LSR-STD-MIB [RFC3813], for their assistance.

Additionally, there have been other members of the working group that have been very helpful: Alan Kullberg from NetPlane Systems gave input on earlier versions of this document, and more recently, Riza Cetin of Alcatel and Neil Jerram of Data Connection who both provided MIB objects.

Early versions of this document were also reviewed by colleagues at Nortel Networks and Ericsson. The authors would like to thank the following people: Leigh McLellan, Geetha Brown, Geping Chen and Charlan Zhou from Nortel Networks, and Zoltan Takacs and Bo Augustsson from Ericsson.

6. References

6.1. Normative References

[RFC2115] Brown, C. and F. Baker, "Management Information Base for Frame Relay DTEs Using SMIv2", RFC 2115, September 1997.

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

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

[RFC2514] Noto, M., Spiegel, E., and K. Tesink, editors, "Definition of Textual Conventions and OBJECT-IDENTITIES for ATM Management", RFC 2514, February 1999.

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

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

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

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

[RFC3031] Rosen, E., Viswananthan, A., and R. Callon, "Multiprotocol Label Switching Architecture", RFC 3031, January 2001.

[RFC3032] Rosen, E., Tappan, D., Fedorkow, G., Rekhter, Y., Farinacci, D., Li, T., and A. Conta, "MPLS Label Stack Encoding", RFC 3032, January 2001.

[RFC3034] Conta, A., Doolan, P., and A. Malis, "Use of Label Switching on Frame Relay Networks Specification", RFC 3034, January 2001.

[RFC3035] Davie, B., Lawrence, J., McCloghrie, K., Rosen, E., Swallow, G., Rekhter, Y., and P. Doolan, "MPLS using LDP and ATM VC Switching", RFC 3035, January 2001.

[RFC3036] Andersson, L., Doolan, P., Feldman, N., Fredette, A., and B. Thomas, "LDP Specification", RFC 3036, January 2001.

[RFC3037] Thomas, B. and E. Gray, "LDP Applicability", RFC 3037, January 2001.

[RFC3215] Boscher, C., Cheval, P., Wu, L., and E. Gray, "LDP State Machine", RFC 3215, January 2002.

[RFC3289] Baker, F., Chan, K., and A. Smith, "Management Information Base for the Differentiated Services Architecture", RFC 3289, May 2002.

[RFC3291] Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "Textual Coventions for Internet Network Addresses", RFC 3291, May 2002.

[RFC3413] Levi, D., Meyers, P. and B. Stewart, "Simple Network Management Protocol (SNMP) Applications", STD 62, RFC 3413, December 2002.

[RFC3811] Nadeau, T. and J. Cucchiara, Editors "Definitions of Textual Conventions (TCs) for Multiprotocol Label Switching (MPLS) Management", RFC 3811, June 2004.

[RFC3813] Srinivansan, C., Viswanathan, A., and T. Nadeau, "Multiprotocol Label Switching (MPLS) Label Switching Router (LSR) Management Information Base (MIB)", RFC 3813, June 2004

6.2. Informative References

[MPLSMGMT] Nadeau, T., Srinivasan, C., and A. Farrel, "Multiprotocol Label Switching (MPLS) Management Overview", Work in Progress, September 2003.

[RFC2684] Grossman, D. and J. Heinanen, "Multiprotocol Encapsulation over ATM Adaptation Layer 5", RFC 2684, September 1999.

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

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:

- 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:

- 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:

- 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:

- the mplsLdpEntityAtmTable and mplsLdpEntityAtmLRTable 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:

- the mplsLdpEntityFrameRelayTable and mplsLdpEntityFrameRelayLRTable 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:

- the mplsLdpEntityFrameRelayTable and mplsLdpEntityFrameRelayLRTable 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:

- 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:

- 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.

9. Authors' Addresses

James V. Luciani
Marconi Communications, Inc.
900 Chelmsford Street
Lowell, MA 01851

EMail: james_luciani@mindspring.com

Hans Sjostrand
ipUnplugged
P.O. Box 101 60
S-121 28 Stockholm, Sweden

Phone: +46 8 725 5900
EMail: hans@ipunplugged.com

Joan E. Cucchiara
Marconi Communications, Inc.
900 Chelmsford Street
Lowell, MA 01851

Phone: +1 978 275 7400
EMail: jcucchiara@mindspring.com

10. Full Copyright Statement

Intellectual Property

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.