Network Working Group
Internet-Draft
Expires February 2002

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August 2001

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

<draft-ietf-mpls-ldp-mib-08.txt>

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).

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1. Introduction

This document defines a MIB for the Label Distribution Protocol (LDP). The Label Distribution Protocol (LDP) [18] is one of the MPLS protocols. This MIB allows a user to configure LDP sessions as well as monitor all LDP sessions on the device. This MIB also supports configuration for LDP using IP, ATM or FrameRelay media.

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 [21].

2. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in RFC 2571 [RFC2571].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIv1 and described in STD 16, RFC 1155 [RFC1155], STD 16, RFC 1212 [RFC1212] and RFC 1215 [RFC1215]. The second version, called SMIv2, is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [RFC1157]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [RFC1901] and RFC 1906 [RFC1906]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [RFC1906], RFC 2572 [RFC2572] and RFC 2574 [RFC2574].
- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [RFC1157]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [RFC1905].
- A set of fundamental applications described in RFC 2573 [RFC2573] and the view-based access control mechanism described in RFC 2575 [RFC2575].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [RFC2570].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIv2. A MIB conforming to the SMIv1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIv2 will be converted into textual descriptions in SMIv1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

3. Structure of the MIB

This section describes the structure of the LDP MIB.

3.1. Overview

The MIB provides objects to configure/set-up potential LDP sessions on a specific LSR. A table is used to configure potential LDP Sessions, where each row in the table initiates a potential LDP Session. This is the mplsLdpEntityTable.

Another table, the mplsLdpPeerTable, is a read-only table which records information learned via discovery or from the session initialization message. Each row in the Peer Table represents an LDP Peer. This table contains information which is specific to the Entity-Peer interactions but is not appropriate for the mplsLdpSessionTable. In other words, the Peer table contains information which is useful but is not strictly part of the Session.

A third table is used to show the actual sessions which have been, or are in the process of being established. Each row represents a specific session between an Entity (on this LSR) and a peer.

3.2. Future Considerations

The LDP Specification [18] does not specify the use of VPNs or multicast for LDP, and thus, objects related to these areas have not been included in the MIB.

This MIB does not include VP merge configuration either. [30] does not yet describe this capability and so it has been excluded from the MIB.

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

3.3. Interface Indexing

Interface Indexes as specified in [27] are used in the MIB. The descriptions of the ifIndexes denote which ifIndex is being used. NOTE: 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 previously mentioned, this MIB is almost

entirely based on the LDP specification. The differences are documented here in the hope to avoid any confusion between the two documents.

The first difference is that the LDP Entity Table contains some DEFVAL clauses which are not specified explicitely 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 MIB. Please note, they can certainly be changed during row creation or a subsequent set request.

A second difference is the mplsLdpEntityConfGenericLabelRangeTable. 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-MIB [36]. This TC was added to restrict vci values to be greater than 31 as described in RFC 3032 [30].

3.5. Discussion of MIB Groups

Currently, there are six groups: the MPLS LDP General Group, the MPLS LDP Generic Group, the MPLS LDP ATM Group, the MPLS LDP Frame Relay Group, the MPLS Mapping Group and the MPLS LDP Notifications Group. The MPLS LDP General Group and the MPLS LDP Notifications Group should always be supported. The MPLS LDP Generic Group is specific to Generic labels and should be supported only if LDP is using Generic Labels. The MPLS LDP ATM Group is specific to ATM and should be supported only if LDP is using ATM. Likewise, the MPLS LDP Frame Relay group is specific to Frame Relay and should be supported only if LDP is using Frame Relay. The MPLS LDP Mapping group should be supported if and only if the tables, mplsInSegmentTable, mplsOutSegmentTable and mplsXCTable from the LSR MIB are supported.

3.6. The MPLS LDP General Group

This group contains information about the specific LDP Entities which are associated with this agent. Each LSR must have at least one LDP Entity.

3.6.1. The LDP Entity Table

The LDP Entity Table provides a way to configure the LSR for using

LDP. There must be at least one LDP Entity for the LSR to support

LDP.

Each entry/row in this table represents a single LDP Entity.

3.6.2. Changing Values After Session Establishment

According to the LDP specification [18] there is no way to manually modify a session once session initialization starts. 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.

For example, assume that a user wishes to change the configuration of a Label Range which is used by a Session that has already been established. The user should change the mplsLdpEntityAdminStatus to "disable(2)". Setting the mplsLdpEntityAdminStatus to "disable(2)" will cause the session to be torn down and all LSPs established due to that session will also be torn down. Also, all information related to that session should be removed from this MIB, and if the LSR MIB 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 MIBs. [For more information please see the section on "The Mapping Tables".] At this point, the user could modify the Label Range. Lastly, the user 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.

3.6.3. mplsLdpEntityAdminStatus and mplsLdpEntityRowStatus

The mplsLdpEntityAdminStatus object could be viewed as having a subset of the functionality of the mplsLdpEntityRowStatus object. For example, the AdminStatus object has states of enable(1) and disable(2). Setting the mplsLdpEntityAdminStatus object to disable(2) and setting the mplsLdpEntityRowStatus object to notInService(2) are functionally the same. The motivation behind keeping the mplsLdpEntityAdminStatus object is that there could be situations where a user would be given write permission to the mplsLdpEntityAdminStatus object, but would not be given write permission to the mplsLdpEntityRowStatus object. Having write permission to the mplsLdpEntityRowStatus object would mean that a

user would be able to destroy a row. This was the motivation for

keeping the two objects.

3.6.4. The LDP Entity Generic Objects

The mplsLdpEntityConfGenericLabelRangeTable is for configuring LDP for using Generic Labels ranges. 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 may be useful for LDP implementations which deploy generic labels.

3.6.5. The LDP Entity ATM Objects

There exists two tables to configure LDP for using ATM. These tables are the mplsLdpEntityAtmParmsTable and the mplsLdpEntityConfAtmLabelRangeTable.

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

The mplsLdpEntityConfAtmLabelRangeTable provides a way to configure information which would be contained in the 'ATM Label Range Components portion of an LDP PDU Intialization Message, see [30] and [18].

3.6.6. The LDP Entity Frame Relay Objects

There exists two tables to configure LDP for using Frame Relay. These tables are the mplsLdpEntityFrameRelayParmsTable and the mplsLdpEntityConfFrLabelRangeTable.

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

The mplsLdpEntityConfFrLabelRangeTable 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 [32] and [18].

3.6.7. 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 is related to a single LDP entity

and 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 mpslLdpSessionRejectedLabelRangeErrors Counter object was increasing, then this would indicate that the label range may need to be adjusted.

3.6.8. The LDP Peer Table

The LDP Peer Table is a read-only table which contains information about LDP Peers known to LDP Entities. 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 relevant to a Peer and may or may not be the same values used in the session. For example, the Peer's PathLimit information is learned from the session initialization phase. The actual value for the PathVectorLimit is the Peer's value and may not be part of 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 PathLimit set by the Entity (and not the Peer).

A separate table allows for a more comprehensive and coherent MIB model.

3.6.9. The LDP Hello Adjacencies Table

This is a table of all adjacencies between all LDP Entities and all LDP Peers. A Session may have one or more adjacencies.

3.6.10. The LDP Session Table

The LDP Session Table is a read-only table. Each entry in this table represents a single session between an LDP Entity and a Peer. The mplsLdpPeerEntry AUGMENTS entries in this table.

3.6.11. The LDP ATM Session Table

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

3.6.12. The LDP Frame Relay Session Table

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

3.6.13. The LDP Session Statistics Table

The MPLS LDP Session Stats Table is a read-only table which contains statistical information on sessions.

3.6.14. The LDP Session Peer Address Table

The MPLS LDP Session Peer Address Table 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.

3.6.15. The Mapping 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 [23]. The LIB is represented by the LSR MIB's mplsXCTable (mpls Cross Connect Table), mplsInSegmentTable (mpls In Segment (ingress label) Table) and the mplsOutSegmentTable (mpls Out Segment (egress label) Table). The mplsXCTable models the cross-connection of the ingress label with a specific egress-label. The mplsInSegmentTable stores the ingress label's information, and the mplsOutSegmentTable stores the egress label's information.

The LDP Session that created the LSP and the LSP's (ingress label, egress label) pair along with other information is contained in the LSR MIB's mplsXCTable, the mplsInSegmentTable and the mplsOutSegmentTable.

In order to utilize the LSR MIB's mplsXCTable, mplsInSegmentTable and mplsOutSegmentTable for LDP sessions, there needed to be a mechanism to associate (or map) LDP sessions with LDP LSPs created as a result of those LDP sessions. The mapping tables in this MIB (mplsLdpSesInLabelMapTable, mplsLdpSesOutLabelMapTable and mplsLdpSesXCMapTable) are used to associate LDP LSP information in this MIB, with the relevant entries in the LSR MIB.

The mplsInSegmentTable, the mplsOutSegmentTable and the mplsXCTable in the LSR MIB could contain rows which were created as a result of an LDP LSPs. Three mapping tables were added to this MIB to map LDP Sessions to these tables in the LSR MIB. These mapping tables are described in the next few subsections. Please note, these mapping tables are optional and need only to be implemented if the mplsInSegmentTable, mplsOutSegmentTable and mplsXCTable from the LSR MIB are implemented.

In order to expedite development, these mapping objects have been

made optional in the conformance section of the MIB.

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.

3.6.15.1. The LDP Session In Label Map Table

The mplsLdpSesInLabelMapTable provides a way to map LDP LSPs in the LSR MIB's mplsInSegmentTable to the LDP session which created them in this MIB's mplsLdpSessionTable. When a session is torn down, the mapping table, mplsLdpSesInLabelMapTable, provides a way to clean up the related LDP entries in the mplsInSegmentTable. If an LSP is terminated on this LSR then there will be an entry in the mapping table which maps the session and the entry in the mplsInSegmentTable. Please note, there may be entries which are also effected by session teardown in the mplsXCTable. (The relationship between the mplsInSegmentTable and the mplsXCTable and cleanup scenarios will need to be handled and are outside of the scope of this MIB.)

This table is optional and only needs to be implemented if the LSR MIB's mplsInSegmentTable and/or mplsXCTable are implemented.

3.6.15.2. The LDP Session Out Label Map Table

The mplsLdpSesOutLabelMapTable provides a way to map a LDP LSPs in the LSR MIB's mplsOutSegmentTable to the LDP session which created them in this MIB's mplsLdpSessionTable. When a session is torn down, the mapping table, mplsLdpSesOutLabelMapTable, provides a way to clean up the related LDP entries in the mplsOutSegmentTable. If an LSP is created by this LSR then there will be an entry in this table which maps the session and the entry in the mplsOutSegmentTable. Please note, there may be entries which are also effected by session teardown in the mplsXCTable. (The relationship between the mplsOutSegmentTable and the mplsXCTable and cleanup scenarios will need to be handled and are outside the scope of this MIB.)

This table is optional and only needs to be implemented if the LSR MIB's mplsOutSegmentTable and/or mplsXCTable are implemented.

3.6.15.3. The LDP Session XC Map Table

The mplsLdpSesXCMapTable provides a way to map LDP LSPs in the LSR MIB's mplsXCTable to the LDP session which created them in this MIB's mplsLdpSessionTable. When a session is torn down, the mapping table,

mplsLdpSesXCMapTable, provides a way to clean up the related LDP

entries in the mplsXCTable. If an LSP is cross-connected on this LSR, then there will be an entry in this mapping table which maps the session and the entry in the mplsXCTable. Please note, only true cross-connects are represented in the mplsLdpSesXCMapTable.

This table is optional and only needs to be implemented if the LSR MIB's mplsXCTable is implemented.

3.6.16. The FEC Table

The FEC Table is a table which contains FEC (Forwarding Equivalence Class) information. Each entry/row represents a single FEC Element. There is also a FEC Mapping table which maps FECs associated with the Cross-connects.

3.7. The LDP Notifications Group

3.7.1. LDP Notifications

Currently, there are several notifications which are specific for LDP. These are described in this section.

The mplsLdpInitSesThresholdExceeded 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 mplsLdpSesState object. If the value of mplsLdpEntityInitSesThreshold is 0 (zero) then this is equal to specifying the value of inifinity for the threshold, and the mplsLdpInitSesThresholdExceeded Trap will never be sent.

The object, mplsLdpEntityPVLMisTrapEnabled is used to enable or disable the sending of the mplsLdpPVLMismatch trap. If enabled, then this trap is sent when there is a mismatch in the Path Vector Limits between the Entity and Peer during session initialization between that Entity and that Peer. In this situation a session could still be established between that entity and that peer. The session uses the value which is configured as the Entity's Path Vector Limit. However, a trap should be sent to indicate that a mismatch occurred. For further details, please see Section 3.5.3 of the LDP Specification [18].

The object, mplsLdpSesUpDownTrapEnable is used to enable or disable the sending of the mplsLdpSessionUp and mplsLdpSessionDown traps. If

enabled, then these traps are sent when there is an appropriate

change in the mplsLdpSesState object, e.g. when sessions change state (Up to Down for the mplsLdpSessionDown trap, or Down to Up for the mplsLdpSessionUp trap).

4. MPLS Label Distribution Protocol MIB Definitions

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

IMPORTS
    OBJECT-TYPE, MODULE-IDENTITY, NOTIFICATION-TYPE,
    transmission,
    Integer32, Counter32, Unsigned32
        FROM SNMPv2-SMI
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
        FROM SNMPv2-CONF

    RowStatus, TimeInterval, TruthValue,
    TimeStamp, StorageType
        FROM SNMPv2-TC
    InterfaceIndex, InterfaceIndexOrZero
        FROM IF-MIB
    AtmVpIdentifier
        FROM ATM-TC-MIB
    AddressFamilyNumbers
        FROM IANA-ADDRESS-FAMILY-NUMBERS-MIB
    MplsAtmVcIdentifier, MplsLabel,
    MplsLdpGenAddr, MplsLdpIdentifier,
    MplsLdpLabelTypes, MplsLsrIdentifier
        FROM MPLS-TC-MIB
    ;


mplsLdpMIB MODULE-IDENTITY
    LAST-UPDATED "200108161200Z"  -- August 16, 2001
    ORGANIZATION "Multiprotocol Label Switching (mpls)
                  Working Group"
    CONTACT-INFO
        "Joan Cucchiara (jcucchiara@crescentnetworks.com)
         Crescent Networks

         Hans Sjostrand (hans@ipunplugged.com)
         ipUnplugged

         James V. Luciani (jluciani@crescentnetworks.com)
         Crescent Networks

         Working Group Chairs:
         George Swallow,   email: swallow@cisco.com
```

Vijay Srinivasan, email: vijay@cosinecom.com

```
             MPLS Working Group, email: mpls@uu.net
        "
        DESCRIPTION
            "This MIB contains managed object definitions for the
            'Multiprotocol Label Switching, Label Distribution
            Protocol, LDP' document."
        ::= { mplsMIB XXXX} -- to be assigned

    --*****************************************************************


    mplsMIB             OBJECT IDENTIFIER ::= { transmission xxxx }

    mplsLdpObjects      OBJECT IDENTIFIER ::= { mplsLdpMIB 1 }
    mplsLdpNotifications OBJECT IDENTIFIER ::= { mplsLdpMIB 2 }
    mplsLdpConformance  OBJECT IDENTIFIER ::= { mplsLdpMIB 3 }

    --*****************************************************************
    -- MPLS LDP Objects
    --*****************************************************************

    mplsLdpLsrObjects   OBJECT IDENTIFIER ::= { mplsLdpObjects 1 }

    mplsLdpEntityObjects OBJECT IDENTIFIER ::= { mplsLdpObjects 2 }

    --
    -- The MPLS Label Distribution Protocol's
    -- Label Switch Router Objects
    --

    mplsLdpLsrId OBJECT-TYPE
        SYNTAX      MplsLsrIdentifier
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The LSR'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 Switch 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
    --


    mplsLdpEntityIndexNext  OBJECT-TYPE
        SYNTAX      Unsigned32 (0..4294967295)
        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. To obtain the mplsLdpEntityIndex
            value for a new entry, the manager issues a
            management protocol retrieval operation to obtain
            the current value of this object.  After each
            retrieval, the agent should modify the value to
            the next unassigned index."
```

```
        ::= { mplsLdpEntityObjects 1 }
```

```
    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 Switch Router (LSR)."
        ::= { mplsLdpEntityObjects 2 }

    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                      Unsigned32,
        mplsLdpEntityProtocolVersion            Integer32,
        mplsLdpEntityAdminStatus                INTEGER,
        mplsLdpEntityOperStatus                 INTEGER,
        mplsLdpEntityTcpDscPort                 Unsigned32,
        mplsLdpEntityUdpDscPort                 Unsigned32,
        mplsLdpEntityMaxPduLength               Unsigned32,
        mplsLdpEntityKeepAliveHoldTimer         Integer32,
        mplsLdpEntityHelloHoldTimer             Integer32,
        mplsLdpEntityInitSesThreshold           Integer32,
        mplsLdpEntityLabelDistMethod            INTEGER,
        mplsLdpEntityLabelRetentionMode         INTEGER,
        mplsLdpEntityPVLMisTrapEnable           INTEGER,
        mplsLdpEntityPVL                        Integer32,
        mplsLdpEntityHopCountLimit              Integer32,
        mplsLdpEntityTargPeer                   TruthValue,
        mplsLdpEntityTargPeerAddrType           AddressFamilyNumbers,
        mplsLdpEntityTargPeerAddr               MplsLdpGenAddr,
        mplsLdpEntityOptionalParameters         MplsLdpLabelTypes,
        mplsLdpEntityDiscontinuityTime          TimeStamp,
        mplsLdpEntityStorType                   StorageType,
        mplsLdpEntityRowStatus                  RowStatus
    }
```

```
    mplsLdpEntityLdpId OBJECT-TYPE
        SYNTAX      MplsLdpIdentifier
```

```
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The LDP identifier."
        REFERENCE
            "LDP Specification, Section on LDP Identifiers."
        ::= { mplsLdpEntityEntry 1 }

    mplsLdpEntityIndex OBJECT-TYPE
        SYNTAX      Unsigned32 (1..4294967295)
        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
            in an LDP implementation which uses PPP would
            use this index to differentiate PPP sub-links."
        ::= { mplsLdpEntityEntry 2 }

    mplsLdpEntityProtocolVersion OBJECT-TYPE
        SYNTAX      Integer32(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
           "See RFC 3036, 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 (which implies that the
            'mplsLdpEntityRowStatus' object has been set to
            'active'), then all contact with that
            Peer is lost and all information from that Peer
            needs to be removed from the MIB.

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

            When the admin status is set back to 'up', then
            this Entity will attempt to establish new sessions
            with the Peer."
        DEFVAL  { enable }
        ::= { mplsLdpEntityEntry 4 }


    mplsLdpEntityOperStatus OBJECT-TYPE
        SYNTAX      INTEGER {
                      unknown(0),
                      enabled(1),
                      disabled(2)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The operational status of this LDP Entity."
        ::= { mplsLdpEntityEntry 5 }

    mplsLdpEntityTcpDscPort OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The TCP Discovery Port for
            LDP.  The default value is the well-known
            value of this port."
        DEFVAL { 646 }
        ::= { mplsLdpEntityEntry 6 }

    mplsLdpEntityUdpDscPort OBJECT-TYPE
        SYNTAX      Unsigned32
```

```
        MAX-ACCESS  read-create
        STATUS      current
```

```
        DESCRIPTION
            "The UDP Discovery Port for
            LDP.  The default value is the
            well-known value for this port."
        DEFVAL { 646 }
        ::= { mplsLdpEntityEntry 7 }

    mplsLdpEntityMaxPduLength OBJECT-TYPE
        SYNTAX      Unsigned32 (0..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. A value of 255 or less specifies the
           default maximum length of 4096 octets."
        REFERENCE
           "See Section on the 'Initialization Message' in the
           LDP Specification."
        DEFVAL { 4096 }
        ::= { mplsLdpEntityEntry 8 }

    mplsLdpEntityKeepAliveHoldTimer OBJECT-TYPE
        SYNTAX      Integer32 (1..65535)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The two octet value which is the proposed keep alive hold
            timer for this LDP Entity."
        DEFVAL { 40 }
        ::= { mplsLdpEntityEntry 9 }

    mplsLdpEntityHelloHoldTimer OBJECT-TYPE
        SYNTAX      Integer32 (0..65535)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The two octet value which is the proposed Hello hold
            timer for this LDP Entity. A value of 0 means use the
            default, which is 15 seconds for Link Hellos and 45
            seconds for Targeted Hellos.  A value of 65535 means
            infinite."
        DEFVAL { 0 }
        ::= { mplsLdpEntityEntry 10 }
```

```
    mplsLdpEntityInitSesThreshold OBJECT-TYPE
        SYNTAX      Integer32
```

```
        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,
            'mplsLdpInitSesThresholdExceeded', 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 possibily 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.

            A value of 0 (zero) for this object
            indicates that the threshold is infinity, and
            the SNMP notification will never be sent
            when the value of this object is 0 (zero)."
        REFERENCE
            "RFC 3036, Section 2.5.3 Session Initialization."
        DEFVAL { 8 }
        ::= { mplsLdpEntityEntry 11 }


    mplsLdpEntityLabelDistMethod OBJECT-TYPE
        SYNTAX      INTEGER {
                       downstreamOnDemand(1),
                       downstreamUnsolicited(2)
                    }
        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      INTEGER {
                        conservative(1),
                        liberal(2)
                    }
        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 }

    mplsLdpEntityPVLMisTrapEnable OBJECT-TYPE
        SYNTAX      INTEGER {
                               enabled(1),
                               disabled(2)
                             }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Indicates whether the 'mplsLdpPVLMismatch'
            trap should be generated.

            If the value of this object is 'enabled(1)'
            then the trap will generated.  If the value
            of this object is 'disabled(2)' then the
            trap will not be generated.  The DEFVAL
            is set to 'enabled(1)'."
        DEFVAL { enabled }
        ::= { mplsLdpEntityEntry 14 }


    mplsLdpEntityPVL OBJECT-TYPE
        SYNTAX      Integer32 (0..255)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "If the value of this object is 0 (zero) then
            Loop Dection 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)."
        ::= { mplsLdpEntityEntry 15 }


    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)."
        ::= { mplsLdpEntityEntry 16 }

    mplsLdpEntityTargPeer 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 }

    mplsLdpEntityTargPeerAddrType OBJECT-TYPE
        SYNTAX      AddressFamilyNumbers
        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 mplsLdpEntityTargPeerAddr is to
            be interpreted."
        ::= { mplsLdpEntityEntry 18 }

    mplsLdpEntityTargPeerAddr OBJECT-TYPE
        SYNTAX      MplsLdpGenAddr
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The value of the internetwork layer address used for
            the Extended Discovery."
       ::= { mplsLdpEntityEntry 19 }
```

```
     mplsLdpEntityOptionalParameters OBJECT-TYPE
```

```
        SYNTAX      MplsLdpLabelTypes
        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 mplsLdpEntityAtmParms
            Table, which corresponds to this entry.

            If the value is frameRelayParameters(3) then
            a row must be created in the mplsLdpEntityFrameRelayParms
            Table, which corresponds to this entry."
        ::= { 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, or Counter64 object contained
            in the 'mplsLdpEntityStatsTable'.  If no such
            discontinuities have occurred since the last
            re-initialization of the local management
            subsytem, then this object contains a zero
            value."
        ::= { mplsLdpEntityEntry 21 }

    mplsLdpEntityStorType  OBJECT-TYPE
        SYNTAX      StorageType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                 "The storage type for this entry."
        ::= { mplsLdpEntityEntry 22 }

    mplsLdpEntityRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
```

```
        STATUS      current
        DESCRIPTION
```

```
            "An object that allows entries in this table to
             be created and deleted using the
             RowStatus convention.

             Once the 'mplsLdpEntityAdminStatus' object has
             the value of 'up' and this object has the value
             of 'active' then the Entity will atttempt to
             contact an LDP Peer.  If the value of this object
             is changed to 'notInService', then the Entity looses
             contact with the LDP Peer and all information related
             to that Peer must be removed from the MIB.  This has
             the same effect as changing 'mplsLdpEntityAdminStatus'
             from 'enable' to 'disable'.

             When this object is set to 'active' and the value of
             the 'mplsLdpEntityAdminStatus' is 'enable' then
             this Entity will attempt to contact the Peer and
             establish new sessions."
        ::= { mplsLdpEntityEntry 23 }

    --
    -- Ldp Entity Objects for Generic Labels
    --


    mplsLdpEntityGenericObjects  OBJECT IDENTIFIER ::=
                                  { mplsLdpEntityObjects 3 }


    --
    -- The MPLS LDP Entity Configurable Generic Label Range Table
    --

    mplsLdpEntityConfGenLRTable OBJECT-TYPE
        SYNTAX SEQUENCE OF MplsLdpEntityConfGenLREntry
        MAX-ACCESS not-accessible
        STATUS current
        DESCRIPTION
            "The MPLS LDP Entity Configurable Generic Label Range Table.
            The purpose of this table is to provide a mechanism
            for specifying 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."
        ::= { mplsLdpEntityGenericObjects 1 }

    mplsLdpEntityConfGenLREntry OBJECT-TYPE
        SYNTAX MplsLdpEntityConfGenLREntry
```

MAX-ACCESS not-accessible

```
        STATUS current
        DESCRIPTION
            "A row in the LDP Entity Configurable Generic Label
            Range 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,
                       mplsLdpEntityConfGenLRMin,
                       mplsLdpEntityConfGenLRMax
                    }
        ::= { mplsLdpEntityConfGenLRTable 1 }

    MplsLdpEntityConfGenLREntry ::= SEQUENCE {
        mplsLdpEntityConfGenLRMin        Unsigned32,
        mplsLdpEntityConfGenLRMax        Unsigned32,
        mplsLdpEntityConfGenIfIndxOrZero InterfaceIndexOrZero,
        mplsLdpEntityConfGenLRStorType   StorageType,
        mplsLdpEntityConfGenLRRowStatus  RowStatus
    }

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

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

```
    mplsLdpEntityConfGenIfIndxOrZero 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.  For example, if the InterfaceIndex is
           created subsequent to the Generic 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."
        ::= { mplsLdpEntityConfGenLREntry 3 }

    mplsLdpEntityConfGenLRStorType  OBJECT-TYPE
        SYNTAX      StorageType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                 "The storage type for this entry."
        ::= { mplsLdpEntityConfGenLREntry 4 }

    mplsLdpEntityConfGenLRRowStatus OBJECT-TYPE
        SYNTAX RowStatus
        MAX-ACCESS read-create
        STATUS current
        DESCRIPTION
            "An object that allows entries in this
            table to be created and deleted using
            the RowStatus convention.

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

            NOTE:  This RowStatus object should
            have the same value of the 'mplsLdpEntityRowStatus'
            related to this entry."
        ::= { mplsLdpEntityConfGenLREntry 5 }


    --
    -- Ldp Entity Objects for ATM
    --
```

```
    mplsLdpEntityAtmObjects  OBJECT IDENTIFIER ::=
```

```
                                { mplsLdpEntityObjects 4 }

    mplsLdpEntityAtmParmsTable  OBJECT-TYPE
        SYNTAX      SEQUENCE OF MplsLdpEntityAtmParmsEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "This table contains information about the
            ATM specific information which could be used
            in the 'Optional Parameters' and other ATM specific
            information."
        ::= { mplsLdpEntityAtmObjects 1 }

    mplsLdpEntityAtmParmsEntry OBJECT-TYPE
        SYNTAX      MplsLdpEntityAtmParmsEntry
        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
                    }
        ::= { mplsLdpEntityAtmParmsTable 1 }


    MplsLdpEntityAtmParmsEntry ::= SEQUENCE {
        mplsLdpEntityAtmIfIndxOrZero         InterfaceIndexOrZero,
        mplsLdpEntityAtmMergeCap             INTEGER,
        mplsLdpEntityAtmLRComponents         Unsigned32,
        mplsLdpEntityAtmVcDirectionality     INTEGER,
        mplsLdpEntityAtmLsrConnectivity      INTEGER,
        mplsLdpEntityDefaultControlVpi       AtmVpIdentifier,
        mplsLdpEntityDefaultControlVci       MplsAtmVcIdentifier,
        mplsLdpEntityUnlabTrafVpi            AtmVpIdentifier,
        mplsLdpEntityUnlabTrafVci            MplsAtmVcIdentifier,
        mplsLdpEntityAtmStorType             StorageType,
        mplsLdpEntityAtmRowStatus            RowStatus
    }


    mplsLdpEntityAtmIfIndxOrZero  OBJECT-TYPE
        SYNTAX      InterfaceIndexOrZero
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
           "This value represents either the InterfaceIndex of
           the 'ifLayer' where the ATM 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
            ATM 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 ATM Label is
            being used in forwarding data, then the value of this
            object MUST be the InterfaceIndex."
        ::= { mplsLdpEntityAtmParmsEntry 1 }


    mplsLdpEntityAtmMergeCap OBJECT-TYPE
        SYNTAX      INTEGER {
                        notSupported(0),
                        vcMerge(2)
                    }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                 "Denotes the Merge Capability of this Entity."
        ::= { mplsLdpEntityAtmParmsEntry 2 }

    mplsLdpEntityAtmLRComponents OBJECT-TYPE
        SYNTAX      Unsigned32 (1..65535)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Number of Label Range Components in the Initialization
            message.  This also represents the number of entries
            in the mplsLdpEntityConfAtmLRTable which correspond
            to this entry."
        ::= { mplsLdpEntityAtmParmsEntry 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."
```

```
        ::= { mplsLdpEntityAtmParmsEntry 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 }
        ::= { mplsLdpEntityAtmParmsEntry 5 }

    mplsLdpEntityDefaultControlVpi 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 }
        ::= { mplsLdpEntityAtmParmsEntry 6 }

    mplsLdpEntityDefaultControlVci 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 }
        ::= { mplsLdpEntityAtmParmsEntry 7 }

    mplsLdpEntityUnlabTrafVpi OBJECT-TYPE
        SYNTAX      AtmVpIdentifier
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
```

"VPI value of the VCC supporting unlabelled traffic. This
non-MPLS connection is used to carry unlabelled (IP)

```
            packets.  The default value is the same as the default
            value of the 'mplsLdpEntityDefaultControlVpi', however
            another value may be configured."
        DEFVAL  { 0 }
        ::= { mplsLdpEntityAtmParmsEntry 8 }

    mplsLdpEntityUnlabTrafVci OBJECT-TYPE
        SYNTAX      MplsAtmVcIdentifier
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "VCI value of the VCC supporting unlabelled traffic.
            This non-MPLS connection is used to carry unlabelled (IP)
            packets. The default value is the same as the default
            value of the 'mplsLdpEntityDefaultControlVci', however
            another value may be configured."
        DEFVAL  { 32 }
        ::= { mplsLdpEntityAtmParmsEntry 9 }

    mplsLdpEntityAtmStorType  OBJECT-TYPE
        SYNTAX      StorageType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                 "The storage type for this entry."
        ::= { mplsLdpEntityAtmParmsEntry 10 }

    mplsLdpEntityAtmRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "An object that allows entries in this table to
            be created and deleted using the
            RowStatus convention.

            NOTE:  This RowStatus object should
            have the same value of the 'mplsLdpEntityRowStatus'
            related to this entry."
        ::= { mplsLdpEntityAtmParmsEntry 11 }

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

    mplsLdpEntityConfAtmLRTable OBJECT-TYPE
        SYNTAX SEQUENCE OF MplsLdpEntityConfAtmLREntry
        MAX-ACCESS not-accessible
```

```
        STATUS current
        DESCRIPTION
```

```
            "The MPLS LDP Entity Configurable ATM Label Range Table.
            The purpose of this table is to provide a mechanism
            for specifying 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."
        ::= { mplsLdpEntityAtmObjects 2 }

    mplsLdpEntityConfAtmLREntry OBJECT-TYPE
        SYNTAX MplsLdpEntityConfAtmLREntry
        MAX-ACCESS not-accessible
        STATUS current
        DESCRIPTION
            "A row in the LDP Entity Configurable 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 ConfLowerBound vpi/vci == 0/32, and
            ConfUpperBound vpi/vci == 0/100, and a second entry
            for this same interface with ConfLowerBound
            vpi/vci == 0/101 and ConfUpperBound vpi/vci == 0/200.
            However, there could not be a third entry with
            ConfLowerBound vpi/vci == 0/200 and
            ConfUpperBound 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 be created unless a unique and
            non-overlapping range is specified.  Thus, row
            creation implies a one-shot row creation of
            LDP EntityID and ConfLowerBound vpi/vci and
            ConfUpperBound vpi/vci.  At least one label
            range entry for a specific LDP Entity MUST
            include the default VPI/VCI  values denoted
            in the LDP Entity Table."
        INDEX       {  mplsLdpEntityLdpId,
                       mplsLdpEntityIndex,
                       mplsLdpEntityConfAtmLRMinVpi,
                       mplsLdpEntityConfAtmLRMinVci
                    }
```

```
        ::= { mplsLdpEntityConfAtmLRTable 1 }
```

```
    MplsLdpEntityConfAtmLREntry ::= SEQUENCE {
        mplsLdpEntityConfAtmLRMinVpi    AtmVpIdentifier,
        mplsLdpEntityConfAtmLRMinVci    MplsAtmVcIdentifier,
        mplsLdpEntityConfAtmLRMaxVpi    AtmVpIdentifier,
        mplsLdpEntityConfAtmLRMaxVci    MplsAtmVcIdentifier,
        mplsLdpEntityConfAtmLRStorType  StorageType,
        mplsLdpEntityConfAtmLRRowStatus RowStatus
    }

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

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

    mplsLdpEntityConfAtmLRMaxVpi OBJECT-TYPE
        SYNTAX AtmVpIdentifier
        MAX-ACCESS read-create
        STATUS current
        DESCRIPTION
            "The maximum VPI number configured for this range."
        ::= { mplsLdpEntityConfAtmLREntry 3 }

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


    mplsLdpEntityConfAtmLRStorType  OBJECT-TYPE
        SYNTAX      StorageType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                 "The storage type for this entry."
```

```
        ::= { mplsLdpEntityConfAtmLREntry 5 }
```

```
    mplsLdpEntityConfAtmLRRowStatus OBJECT-TYPE
        SYNTAX RowStatus
        MAX-ACCESS read-create
        STATUS current
        DESCRIPTION
            "An object that allows entries in this
            table to be created and deleted using
            the RowStatus convention.

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

            NOTE:  This RowStatus object should
            have the same value of the 'mplsLdpEntityRowStatus'
            related to this entry."
        ::= { mplsLdpEntityConfAtmLREntry 6 }


    --
    -- Ldp Entity Objects for Frame Relay
    --

    mplsLdpEntityFrameRelayObjects OBJECT IDENTIFIER ::=
                                        { mplsLdpEntityObjects 5 }

    mplsLdpEntityFrParmsTable  OBJECT-TYPE
        SYNTAX      SEQUENCE OF MplsLdpEntityFrParmsEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "This table contains information about the
            Optional Parameters to specify what this Entity is
            going to specify for Frame Relay specific
            LDP Intialization Messages."
        ::= { mplsLdpEntityFrameRelayObjects 1 }

    mplsLdpEntityFrParmsEntry OBJECT-TYPE
        SYNTAX      MplsLdpEntityFrParmsEntry
        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
                    }
```

```
        ::= { mplsLdpEntityFrParmsTable 1 }
```

```
    MplsLdpEntityFrParmsEntry ::= SEQUENCE {
        mplsLdpEntityFrIfIndxOrZero         InterfaceIndexOrZero,
        mplsLdpEntityFrMergeCap             INTEGER,
        mplsLdpEntityFrLRComponents         Unsigned32,
        mplsLdpEntityFrLen                  INTEGER,
        mplsLdpEntityFrVcDirectionality     INTEGER,
        mplsLdpEntityFrParmsStorType        StorageType,
        mplsLdpEntityFrParmsRowStatus       RowStatus
    }

    mplsLdpEntityFrIfIndxOrZero 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."
        ::= { mplsLdpEntityFrParmsEntry 1 }

    mplsLdpEntityFrMergeCap OBJECT-TYPE
        SYNTAX      INTEGER {
                        notSupported(0),
                        supported(1)
                    }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "This represents whether or not Frame Relay merge
            capability is supported."
        ::= { mplsLdpEntityFrParmsEntry 2 }

    mplsLdpEntityFrLRComponents OBJECT-TYPE
        SYNTAX      Unsigned32 (1..65535)
        MAX-ACCESS  read-create
        STATUS      current
```

```
        DESCRIPTION
            "Number of LabelRange Components in the Initialization
```

```
            message.  This also represents the number of entries
            in the mplsLdpEntityConfFrLRTable which correspond
            to this entry."
        ::= { mplsLdpEntityFrParmsEntry 3 }

    mplsLdpEntityFrLen OBJECT-TYPE
        SYNTAX      INTEGER {
                        tenDlciBits(0),
                        twentyThreeDlciBits(2)
                    }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "This object specifies the DLCI bits."
        ::= { mplsLdpEntityFrParmsEntry 4 }

    mplsLdpEntityFrVcDirectionality 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."
        ::= { mplsLdpEntityFrParmsEntry 5 }


    mplsLdpEntityFrParmsStorType  OBJECT-TYPE
        SYNTAX      StorageType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                 "The storage type for this entry."
        ::= { mplsLdpEntityFrParmsEntry 6 }


    mplsLdpEntityFrParmsRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "An object that allows entries in this table to
            be created and deleted using the
```

RowStatus convention.

```
            NOTE:  This RowStatus object should
            have the same value of the 'mplsLdpEntityRowStatus'
            related to this entry."
        ::= { mplsLdpEntityFrParmsEntry 7 }


    --
    -- Frame Relay Label Range Components
    --

    mplsLdpEntityConfFrLRTable  OBJECT-TYPE
        SYNTAX      SEQUENCE OF MplsLdpEntityConfFrLREntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "This table contains information about the
            Optional Parameters to specify what this Entity is
            going to specify for Frame Relay specific
            LDP Intialization Messages."
        ::= { mplsLdpEntityFrameRelayObjects 2 }

    mplsLdpEntityConfFrLREntry OBJECT-TYPE
        SYNTAX      MplsLdpEntityConfFrLREntry
        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,
                       mplsLdpConfFrMinDlci
                    }
        ::= { mplsLdpEntityConfFrLRTable 1 }

    MplsLdpEntityConfFrLREntry ::= SEQUENCE {
        mplsLdpConfFrMinDlci                  Integer32,
        mplsLdpConfFrMaxDlci                  Integer32,
        mplsLdpConfFrStorType                  StorageType,
        mplsLdpConfFrRowStatus                    RowStatus
    }

    mplsLdpConfFrMinDlci OBJECT-TYPE
        SYNTAX      Integer32(0..4194303)
        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."
        ::= { mplsLdpEntityConfFrLREntry 1 }
```

```
    mplsLdpConfFrMaxDlci OBJECT-TYPE
        SYNTAX      Integer32 (0..4194303)
        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."
        ::= { mplsLdpEntityConfFrLREntry 2 }


    mplsLdpConfFrStorType  OBJECT-TYPE
        SYNTAX      StorageType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                 "The storage type for this entry."
        ::= { mplsLdpEntityConfFrLREntry 3 }


    mplsLdpConfFrRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "An object that allows entries in this table to
            be created and deleted using the
            RowStatus convention.

            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.

            NOTE:  This RowStatus object should
            have the same value of the 'mplsLdpEntityRowStatus'
            related to this entry."
        ::= { mplsLdpEntityConfFrLREntry 4 }

    --
    -- 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 6 }

    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. and the Session
            remains), then the error is counted in the
            mplsLdpSesStatsEntry."
        AUGMENTS       {   mplsLdpEntityEntry  }
        ::= { mplsLdpEntityStatsTable 1 }

    MplsLdpEntityStatsEntry ::= SEQUENCE {
        mplsLdpAttemptedSessions            Counter32,
        mplsLdpSesRejectedNoHelloErrors     Counter32,
        mplsLdpSesRejectedAdErrors          Counter32,
        mplsLdpSesRejectedMaxPduErrors      Counter32,
        mplsLdpSesRejectedLRErrors          Counter32,
        mplsLdpBadLdpIdentifierErrors       Counter32,
        mplsLdpBadPduLengthErrors           Counter32,
        mplsLdpBadMessageLengthErrors       Counter32,
        mplsLdpBadTlvLengthErrors           Counter32,
        mplsLdpMalformedTlvValueErrors      Counter32,
        mplsLdpKeepAliveTimerExpErrors      Counter32,
        mplsLdpShutdownNotifReceived        Counter32,
        mplsLdpShutdownNotifSent            Counter32
    }

    mplsLdpAttemptedSessions OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "A count of the total attempted sessions for
```

```
            this LDP Entity."
        ::= { mplsLdpEntityStatsEntry 1 }
```

```
    mplsLdpSesRejectedNoHelloErrors 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."
        ::= { mplsLdpEntityStatsEntry 2 }

    mplsLdpSesRejectedAdErrors 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."
        ::= { mplsLdpEntityStatsEntry 3 }


    mplsLdpSesRejectedMaxPduErrors 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."
        ::= { mplsLdpEntityStatsEntry 4 }

    mplsLdpSesRejectedLRErrors 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."
        ::= { mplsLdpEntityStatsEntry 5 }


    mplsLdpBadLdpIdentifierErrors 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."

```
        REFERENCE
           "LDP Specification, Section 3.5.1.2."
        ::= { mplsLdpEntityStatsEntry 6 }

    mplsLdpBadPduLengthErrors 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."
        REFERENCE
           "LDP Specification, Section 3.5.1.2."
        ::= { mplsLdpEntityStatsEntry 7 }

    mplsLdpBadMessageLengthErrors 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."
        REFERENCE
           "LDP Specification, Section 3.5.1.2."
        ::= { mplsLdpEntityStatsEntry 8 }

    mplsLdpBadTlvLengthErrors 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."
        REFERENCE
           "LDP Specification, Section 3.5.1.2."
        ::= { mplsLdpEntityStatsEntry 9 }

    mplsLdpMalformedTlvValueErrors 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."
        REFERENCE
```

```
            "LDP Specification, Section 3.5.1.2."
        ::= { mplsLdpEntityStatsEntry 10 }

    mplsLdpKeepAliveTimerExpErrors 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."
        REFERENCE
            "LDP Specification, Section 3.5.1.2."
        ::= { mplsLdpEntityStatsEntry 11 }

    mplsLdpShutdownNotifReceived OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object counts the number of Shutdown Notfications
            received related to session(s) (past and present)
            associated with this LDP Entity."
        ::= { mplsLdpEntityStatsEntry 12 }

    mplsLdpShutdownNotifSent 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."
        ::= { mplsLdpEntityStatsEntry 13 }


    --
    -- The MPLS LDP Peer Table
    --

    mplsLdpSessionObjects OBJECT IDENTIFIER ::=
                                            { mplsLdpObjects 3 }

    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 1 }

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

    MplsLdpPeerEntry ::= SEQUENCE {
        mplsLdpPeerLdpId                MplsLdpIdentifier,
        mplsLdpPeerLabelDistMethod      INTEGER,
        mplsLdpPeerLoopDetectionForPV   INTEGER,
        mplsLdpPeerPVL                  Integer32
    }

    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      INTEGER {
                       downstreamOnDemand(1),
                       downstreamUnsolicited(2)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "For any given LDP session, the method of
            label distribution must be specified."
        ::= { mplsLdpPeerEntry 2 }

    mplsLdpPeerLoopDetectionForPV OBJECT-TYPE
        SYNTAX      INTEGER {
```

```
                    disabled(0),
                    enabled(1)
```

```
                }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "An indication of whether loop detection based
            on path vectors is disabled or enabled for this Peer.

            If this object has a value of disabled(0),
            then loop detection is disabled.  Otherwise, if this
            object has a value of enabled(1), then loop detection
            based on path vectors is enabled."
        ::= { mplsLdpPeerEntry 3 }


    mplsLdpPeerPVL OBJECT-TYPE
        SYNTAX      Integer32 (0..255)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "If the value of 'mplsLdpPeerLoopDetectionForPV' for
            this entry is 'enabled(1)', the this object represents
            that Path Vector Limit for this peer.

            If the value of 'mplsLdpPeerLoopDetectionForPV' for
            this entry is 'disabled(0)', then this value should
            be 0 (zero)."
        ::= { mplsLdpPeerEntry 4 }



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

    mplsLdpHelloAdjacencyObjects OBJECT IDENTIFIER ::=
                                { mplsLdpSessionObjects 2 }

    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,
                           mplsLdpHelloAdjIndex }
        ::= { mplsLdpHelloAdjacencyTable 1 }

    MplsLdpHelloAdjacencyEntry ::= SEQUENCE {
        mplsLdpHelloAdjIndex         Unsigned32,
        mplsLdpHelloAdjHoldTimeRem   TimeInterval,
        mplsLdpHelloAdjType          INTEGER
    }

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

    mplsLdpHelloAdjHoldTimeRem OBJECT-TYPE
        SYNTAX      TimeInterval
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The time remaining for this Hello Adjacency.
            This interval will change when the 'next'
            Hello message which corresponds to this
            Hello Adjacency is received."
        ::= { mplsLdpHelloAdjacencyEntry 2 }

    mplsLdpHelloAdjType 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 3 }
```

```
    --
    -- The MPLS LDP Sessions Table
```

```
    --

    mplsLdpSesUpDownTrapEnable OBJECT-TYPE
        SYNTAX      INTEGER {
                               enabled(1),
                               disabled(2)
                             }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "Indicates whether the traps, 'mplsLdpSesUp' and
            'mplsLdpSesDown' will be generated or not.

            If the value of this object is 'enabled(1)'
            then the traps will generated.  If the value
            of this object is 'disabled(2)' then the
            traps will not be generated.  The DEFVAL
            is set to 'disabled(2)'."
        DEFVAL { disabled }
        ::= { mplsLdpSessionObjects 3 }


    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.  Each row represents a single session."
        ::= { mplsLdpSessionObjects 4 }

    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 noted 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 {
        mplsLdpSesState                 INTEGER,
        mplsLdpSesProtocolVersion       Integer32,
        mplsLdpSesKeepAliveHoldTimeRem  TimeInterval,
        mplsLdpSesMaxPduLen             Unsigned32,
        mplsLdpSesDiscontinuityTime     TimeStamp
    }


    mplsLdpSesState 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 - 5 are based on the state machine for
            session negotiation behavior."
        ::= { mplsLdpSessionEntry 1 }

    mplsLdpSesProtocolVersion OBJECT-TYPE
        SYNTAX      Integer32(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
           "RFC 3036, LDP Specification, Section 3.5.3 Initialization
           Message."
        ::= { mplsLdpSessionEntry 2 }

    mplsLdpSesKeepAliveHoldTimeRem OBJECT-TYPE
```

```
        SYNTAX      TimeInterval
        MAX-ACCESS  read-only
```

```
        STATUS      current
        DESCRIPTION
            "The keep alive hold time remaining for this session."
        ::= { mplsLdpSessionEntry 3 }

    mplsLdpSesMaxPduLen OBJECT-TYPE
        SYNTAX      Unsigned32 (1..65535)
        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."
        ::= { mplsLdpSessionEntry 4 }

    mplsLdpSesDiscontinuityTime 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 or Counter64 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, an NMS can distinguish when a session
            between a given Entity and Peer goes away and then is
            're-established'.  This value would change and
            thus indicate to the NMS that this is a
            different session."
        ::= { mplsLdpSessionEntry 5 }


    --
    -- MPLS LDP ATM Session Information
    --

    mplsLdpAtmSesTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF MplsLdpAtmSesEntry
        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.

            NOTE:  this table cannot use the 'AUGMENTS'
            clause because there is not necessarily a one-to-one
            mapping between this table and the mplsLdpSessionTable."
        ::= { mplsLdpSessionObjects 5 }

    mplsLdpAtmSesEntry OBJECT-TYPE
        SYNTAX      MplsLdpAtmSesEntry
        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,
                      mplsLdpSesAtmLRLowerBoundVpi,
                      mplsLdpSesAtmLRLowerBoundVci

                    }
        ::= { mplsLdpAtmSesTable 1 }

    MplsLdpAtmSesEntry ::= SEQUENCE {
        mplsLdpSesAtmLRLowerBoundVpi     AtmVpIdentifier,
        mplsLdpSesAtmLRLowerBoundVci     MplsAtmVcIdentifier,
        mplsLdpSesAtmLRUpperBoundVpi     AtmVpIdentifier,
        mplsLdpSesAtmLRUpperBoundVci     MplsAtmVcIdentifier
    }

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

    mplsLdpSesAtmLRLowerBoundVci OBJECT-TYPE
        SYNTAX MplsAtmVcIdentifier
        MAX-ACCESS not-accessible
        STATUS current
```

```
        DESCRIPTION
            "The minimum VCI number for this range."
```

```
        ::= { mplsLdpAtmSesEntry 2 }

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

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


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

    mplsLdpFrameRelaySesTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF MplsLdpFrameRelaySesEntry
        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."
        ::= { mplsLdpSessionObjects 6 }

    mplsLdpFrameRelaySesEntry OBJECT-TYPE
        SYNTAX      MplsLdpFrameRelaySesEntry
        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,
```

```
                    mplsLdpFrSesMinDlci
                }
    ::= { mplsLdpFrameRelaySesTable 1 }

MplsLdpFrameRelaySesEntry ::= SEQUENCE {
    mplsLdpFrSesMinDlci    Integer32,
    mplsLdpFrSesMaxDlci    Integer32,
    mplsLdpFrSesLen        INTEGER
}


mplsLdpFrSesMinDlci OBJECT-TYPE
    SYNTAX      Integer32(0..4194303)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The lower bound of DLCIs which are supported."
    ::= { mplsLdpFrameRelaySesEntry 1 }

mplsLdpFrSesMaxDlci OBJECT-TYPE
    SYNTAX      Integer32 (0..4194303)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The upper bound of DLCIs which are supported."
    ::= { mplsLdpFrameRelaySesEntry 2 }

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


--
-- The MPLS LDP Session Statistics Table
--


mplsLdpSesStatsTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MplsLdpSesStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
```

"A table of statistics for Sessions between

```
            LDP Entities and LDP Peers."
        ::= { mplsLdpSessionObjects 7 }

    mplsLdpSesStatsEntry OBJECT-TYPE
        SYNTAX      MplsLdpSesStatsEntry
        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 }
        ::= { mplsLdpSesStatsTable 1 }

    MplsLdpSesStatsEntry ::= SEQUENCE {
        mplsLdpSesStatsUnkMesTypeErrors Counter32,
        mplsLdpSesStatsUnkTlvErrors         Counter32
    }

    mplsLdpSesStatsUnkMesTypeErrors OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object counts the number of Unknown Message Type
            Errors detected 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
            mplsLdpSesDiscontinuityTime."
        ::= { mplsLdpSesStatsEntry 1 }

    mplsLdpSesStatsUnkTlvErrors OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object counts the number of Unknown TLV Errors
            detected 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."
        ::= { mplsLdpSesStatsEntry 2 }
```

```
    --
    -- Mpls FEC Table
    --

    mplsFecObjects OBJECT IDENTIFIER ::=
                                        { mplsLdpSessionObjects 8 }

    mplsFecIndexNext  OBJECT-TYPE
        SYNTAX      Unsigned32 (0..4294967295)
        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. To obtain the mplsFecIndex
            value for a new entry, the manager issues a
            management protocol retrieval operation to obtain
            the current value of this object.  After each
            retrieval, the agent should modify the value to
            the next unassigned index."
       ::= { mplsFecObjects 1 }


    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 2 }

    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      Unsigned32,
        mplsFecType       INTEGER,
        mplsFecAddrLength Integer32,
```

```
        mplsFecAddrFamily AddressFamilyNumbers,
        mplsFecAddr       MplsLdpGenAddr,
```

```
        mplsFecStorType   StorageType,
        mplsFecRowStatus  RowStatus
    }

    mplsFecIndex OBJECT-TYPE
        SYNTAX      Unsigned32(1..4294967295)
        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 for address prefixes.

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

    mplsFecAddrLength  OBJECT-TYPE
        SYNTAX      Integer32(0..255)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "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 if the length is zero then
            this is a special value which indicates that the
            prefix matches all addresses.  In this case the
            prefix is also zero (i.e. 'mplsFecAddr' will
            have the value of zero.)"
        ::= { mplsFecEntry 3 }

    mplsFecAddrFamily  OBJECT-TYPE
        SYNTAX      AddressFamilyNumbers
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
```

"The value of this object is from the Address Family
Numbers."

```
        ::= { mplsFecEntry 4 }


    mplsFecAddr     OBJECT-TYPE
        SYNTAX      MplsLdpGenAddr
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "If the value of 'mplsFecType' is 'prefix(1)'
            then the value of this object is the address prefix.
            If the value of the 'mplsFecAddrLength'
            is object is zero, then this object should also be
            zero.

            If the value of the 'mplsFecType' is 'host(2)'
            then this is the host address."
        ::= { mplsFecEntry 5 }

    mplsFecStorType  OBJECT-TYPE
        SYNTAX      StorageType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
                 "The storage type for this entry."
        ::= { mplsFecEntry 6 }

    mplsFecRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "An object that allows entries in this table to
             be created and deleted using the
             RowStatus convention."
        ::= { mplsFecEntry 7 }


    --
    --  Mapping Tables between Sessions and the LSR MIB.
    --



    --
    --  SessionInLabels and InSegment
    --

    mplsLdpSesInLabelMapTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF MplsLdpSesInLabelMapEntry
        MAX-ACCESS  not-accessible
```

```
        STATUS      current
```

```
        DESCRIPTION
            "A table of Session's Ingress Labels which
            are Mapped to the LSR MIB's mplsInSegmentTable.
            Each row represents a single Ingress Label."
        ::= { mplsLdpSessionObjects 9 }

    mplsLdpSesInLabelMapEntry OBJECT-TYPE
        SYNTAX      MplsLdpSesInLabelMapEntry
        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 tuple (mplsLdpSessionInLabel, mplsInSegmentIfIndex)
            from the LSR MIB's mplsInSegmentTable.
            The information contained in a row is read-only."
        INDEX       { mplsLdpEntityLdpId,
                      mplsLdpEntityIndex,
                      mplsLdpPeerLdpId,
                      mplsLdpSesInLabelIfIndex,
                      mplsLdpSesInLabel
                    }
        ::= { mplsLdpSesInLabelMapTable 1 }

    MplsLdpSesInLabelMapEntry ::= SEQUENCE {
        mplsLdpSesInLabelIfIndex      InterfaceIndex,
        mplsLdpSesInLabel             MplsLabel,
        mplsLdpSesInLabelType         MplsLdpLabelTypes,
        mplsLdpSesInLabelConnType     INTEGER
    }

    mplsLdpSesInLabelIfIndex OBJECT-TYPE
        SYNTAX       InterfaceIndex
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
            "The ifIndex of the 'mplsLdpSesInLabel' which should
            have the same value as the 'mplsInSegmentIfIndex' in
            the LSR MIB."
        ::= { mplsLdpSesInLabelMapEntry 1 }

    mplsLdpSesInLabel OBJECT-TYPE
        SYNTAX        MplsLabel
        MAX-ACCESS    not-accessible
        STATUS        current
        DESCRIPTION
```

"The incoming label of this LSP. This has the same value
as the 'mplsInSegmentLabel' in the LSR MIB."

```
        ::= { mplsLdpSesInLabelMapEntry 2 }

    mplsLdpSesInLabelType  OBJECT-TYPE
        SYNTAX        MplsLdpLabelTypes
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The Layer 2 Label Type for 'mplsLdpInLabel'."
        ::= { mplsLdpSesInLabelMapEntry 3 }

    mplsLdpSesInLabelConnType OBJECT-TYPE
        SYNTAX         INTEGER {
                          unknown(1),
                          xconnect(2),
                          terminates(3)
                       }
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The type of LSP connection.
            The possible values are:

            unknown(1) --    this may be the value if the LSP
                             is in a state of flux.  It is
                             considered to be a temporary
                             situation.
            xconnect(2) --   if the mapping between the
                             session and the insegment
                             is associated with an LSP which
                             is a true cross-connection.
            terminates(3) -- if the mapping between the
                             session and the insegment
                             is associated with an LSP which
                             terminates on this LSR and is
                             not a cross-connection."
        ::= { mplsLdpSesInLabelMapEntry 4 }


    --
    --  SessionOutLabels and OutSegment
    --

    mplsLdpSesOutLabelMapTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF MplsLdpSesOutLabelMapEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "A table of Session's Egress Labels which
```

```
            are Mapped to the LSR MIB.
            Each row represents a single Egress Label."
```

```
        ::= { mplsLdpSessionObjects 10 }

    mplsLdpSesOutLabelMapEntry OBJECT-TYPE
        SYNTAX      MplsLdpSesOutLabelMapEntry
        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."
        INDEX       { mplsLdpEntityLdpId,
                      mplsLdpEntityIndex,
                      mplsLdpPeerLdpId,
                      mplsLdpSesOutLabelIfIndex,
                      mplsLdpSesOutLabel
                    }
        ::= { mplsLdpSesOutLabelMapTable 1 }

    MplsLdpSesOutLabelMapEntry ::= SEQUENCE {
        mplsLdpSesOutLabelIfIndex  InterfaceIndex,
        mplsLdpSesOutLabel         MplsLabel,
        mplsLdpSesOutLabelType     MplsLdpLabelTypes,
        mplsLdpSesOutLabelConnType INTEGER,
        mplsLdpSesOutSegmentIndex  Integer32
    }

    mplsLdpSesOutLabelIfIndex OBJECT-TYPE
        SYNTAX       InterfaceIndex
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
            "The ifIndex of the 'mplsLdpSesOutLabel'."
        ::= { mplsLdpSesOutLabelMapEntry 1 }

    mplsLdpSesOutLabel OBJECT-TYPE
        SYNTAX        MplsLabel
        MAX-ACCESS    not-accessible
        STATUS        current
        DESCRIPTION
            "The outgoing label of this LSP."
        ::= { mplsLdpSesOutLabelMapEntry 2 }


    mplsLdpSesOutLabelType  OBJECT-TYPE
        SYNTAX        MplsLdpLabelTypes
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
```

```
            "The Layer 2 Label Type for 'mplsLdpOutLabel'."
        ::= { mplsLdpSesOutLabelMapEntry 3 }
```

```
    mplsLdpSesOutLabelConnType OBJECT-TYPE
        SYNTAX         INTEGER {
                          unknown(1),
                          xconnect(2),
                          starts(3)
                       }
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The type of LSP connection.
            The possible values are:

            unknown(1) --  this may be the value if the LSP
                           is in a state of flux.  It is
                           considered to be a temporary
                           situation.
            xconnect(2) -- if the mapping between the
                           session and the outsegment
                           is associated with an LSP which
                           is a true cross-connection.
            starts(3) -- if the mapping between the
                          session and the insegment
                          is associated with an LSP which
                          starts on this LSR and is
                          considered an ingress to the LSP."
        ::= { mplsLdpSesOutLabelMapEntry 4 }

    mplsLdpSesOutSegmentIndex  OBJECT-TYPE
       SYNTAX        Integer32(1..2147483647)
       MAX-ACCESS    read-only
       STATUS        current
       DESCRIPTION
           "This value should contain the same value as
           the 'mplsOutSegmentIndex' in the LSR MIB.

           NOTE: this value will never be zero, because
           this table only maps from Sessions to true
           outsegments."
       ::= { mplsLdpSesOutLabelMapEntry 5 }


    --
    --  Sessions and XConnects  (LIB Information)
    --

    mplsLdpSesXCMapTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF MplsLdpSesXCMapEntry
        MAX-ACCESS  not-accessible
```

```
        STATUS      current
        DESCRIPTION
```

```
            "A table of Session's Labels which
            are Mapped to the LSR MIB 's XConnect table.
            Each row represents a single cross connect."
        ::= { mplsLdpSessionObjects 11 }

    mplsLdpSesXCMapEntry OBJECT-TYPE
        SYNTAX      MplsLdpSesXCMapEntry
        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."
        INDEX       { mplsLdpEntityLdpId,
                      mplsLdpEntityIndex,
                      mplsLdpPeerLdpId,
                      mplsLdpSesInLabelIfIndex,
                      mplsLdpSesInLabel,
                      mplsLdpSesOutLabelIfIndex,
                      mplsLdpSesOutLabel
                    }
        ::= { mplsLdpSesXCMapTable 1 }

    MplsLdpSesXCMapEntry ::= SEQUENCE {
        mplsLdpSesXCIndex                Integer32
    }

    mplsLdpSesXCIndex  OBJECT-TYPE
       SYNTAX        Integer32(1..2147483647)
       MAX-ACCESS    read-only
       STATUS        current
       DESCRIPTION
           "This value should contain the same value as
           the 'mplsXCIndex' in the LSR MIB.

           NOTE: this value will never be zero, because
           this table only maps from Sessions to true
           cross connects."
       ::= { mplsLdpSesXCMapEntry 1 }



    --
    --  XcrossConnectsFECs Table
    --

    mplsXCsFecsTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF MplsXCsFecsEntry
       MAX-ACCESS  not-accessible
```

```
        STATUS      current
```

```
        DESCRIPTION
           "A table which shows the relationship between
           cross-connects and FECs.  Each row represents
           a single cross connect to FEC association.
           This table is read-only."
        ::= { mplsLdpSessionObjects 13 }

     mplsXCsFecsEntry OBJECT-TYPE
        SYNTAX     MplsXCsFecsEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
           "An entry represents a single cross connect
           to FEC association."
        INDEX       { mplsLdpEntityLdpId,
                      mplsLdpEntityIndex,
                      mplsLdpPeerLdpId,
                      mplsLdpSesInLabelIfIndex,
                      mplsLdpSesInLabel,
                      mplsLdpSesOutLabelIfIndex,
                      mplsLdpSesOutLabel,
                      mplsFecIndex
        }
        ::= { mplsXCsFecsTable 1 }

     MplsXCsFecsEntry ::= SEQUENCE {
        mplsXCFecOperStatus           INTEGER,
        mplsXCFecOperStatusLastChange TimeStamp

     }

     mplsXCFecOperStatus  OBJECT-TYPE
        SYNTAX      INTEGER {
                              unknown(1),
                              inUse(2),
                              notInUse(3)
                            }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
           "An indication of the operational status of
           the FEC associated with this cross connect.

           unknown(1) - this is a temporary state which
                        may indicate the LSP-FEC association
                        is in a state of transition.

           inUse(2) - the FEC associated with the XC is
```

currently being applied.

```
          notInUse(3) - the FEC associated with the XC is
                        not being applied.  Eventually, this
                        entry may be aged out."
      ::= { mplsXCsFecsEntry 1 }

   mplsXCFecOperStatusLastChange  OBJECT-TYPE
      SYNTAX     TimeStamp
      MAX-ACCESS read-only
      STATUS     current
      DESCRIPTION
         "This value of sysUpTime when the
         mplsXCFecOperStatus last changed state."
      ::= { mplsXCsFecsEntry 2 }


   --
   -- 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.
   --

   mplsLdpSesPeerAddrTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF MplsLdpSesPeerAddrEntry
       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 apropriate.

           NOTE:  since more than one address may be contained
           in a Label Address Message, this table 'extends',
           rather than 'AUGMENTS' the mplsLdpSessionTable's
           information."
       ::= { mplsLdpSessionObjects 12 }

   mplsLdpSesPeerAddrEntry OBJECT-TYPE
       SYNTAX      MplsLdpSesPeerAddrEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "An entry in this table represents information on
           session's for a 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,
                      mplsLdpSesPeerAddrIndex
                    }
        ::= { mplsLdpSesPeerAddrTable 1 }

    MplsLdpSesPeerAddrEntry ::= SEQUENCE {
        mplsLdpSesPeerAddrIndex       Unsigned32,
        mplsLdpSesPeerNextHopAddrType AddressFamilyNumbers,
        mplsLdpSesPeerNextHopAddr     MplsLdpGenAddr
    }

    mplsLdpSesPeerAddrIndex OBJECT-TYPE
        SYNTAX      Unsigned32 (1..4294967295)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "An index which uniquely identifies this entry within
            a given session."
        ::= { mplsLdpSesPeerAddrEntry 1 }

    mplsLdpSesPeerNextHopAddrType OBJECT-TYPE
        SYNTAX      AddressFamilyNumbers
        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
            mplsLdpSessionPeerNextHopAddress."
        ::= { mplsLdpSesPeerAddrEntry 2 }

    mplsLdpSesPeerNextHopAddr OBJECT-TYPE
        SYNTAX      MplsLdpGenAddr
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The value of the next hop address."
        REFERENCE
            "LDP Specification [18] defines only IPv4 for LDP Protocol
            Version 1, see section 3.4.3."
        ::= { mplsLdpSesPeerAddrEntry 3 }


    ---
    --- Notifications
```

```
     mplsLdpNotificationPrefix   OBJECT IDENTIFIER ::=
                                      { mplsLdpNotifications 0 }

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

     mplsLdpPVLMismatch NOTIFICATION-TYPE
          OBJECTS     {
                        mplsLdpEntityPVL,
                        mplsLdpPeerPVL
                      }
          STATUS      current
          DESCRIPTION
             "This notification is generated when the value
             of the value of the
             'mplsLdpEntityPVLMisTrapEnable'
             object is 'enabled(1)' and the
             'mplsLdpEntityPVL' does NOT match
             the value of the 'mplsLdpPeerPVL' for
             a specific Entity."
          REFERENCE
             "LDP Specification, Section 3.5.3."
          ::= { mplsLdpNotificationPrefix 2 }

     mplsLdpSessionUp NOTIFICATION-TYPE
          OBJECTS     {
                         mplsLdpSesState,
                         mplsLdpSesDiscontinuityTime,
                         mplsLdpSesStatsUnkMesTypeErrors,
                         mplsLdpSesStatsUnkTlvErrors
                      }
          STATUS      current
          DESCRIPTION
             "Generation of this trap occurs when the
             'mplsLdpSesUpDownTrapEnable' object is 'enabled(1)'
             and the value of 'mplsLdpSesState' enters
             the 'operational(5)' state."
          ::= { mplsLdpNotificationPrefix 3 }
```

```
     mplsLdpSessionDown NOTIFICATION-TYPE
```

```
          OBJECTS     {
                         mplsLdpSesState,
                         mplsLdpSesDiscontinuityTime,
                         mplsLdpSesStatsUnkMesTypeErrors,
                         mplsLdpSesStatsUnkTlvErrors

                      }
          STATUS      current
          DESCRIPTION
             "Generation of this trap occurs when the
             'mplsLdpSesUpDownTrapEnable' object is
             'enabled(1)' and the value of
             'mplsLdpSesState' leaves the 'operational(5)'
             state."
          ::= { mplsLdpNotificationPrefix 4 }


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


     mplsLdpGroups
         OBJECT IDENTIFIER ::= { mplsLdpConformance 1 }

     mplsLdpCompliances
         OBJECT IDENTIFIER ::= { mplsLdpConformance 2 }

     --
     -- Compliance Statements
     --

     mplsLdpModuleCompliance MODULE-COMPLIANCE
         STATUS current
         DESCRIPTION
             "The basic implementation requirements for agents that
             support the MPLS LDP MIB."
         MODULE -- this module
             MANDATORY-GROUPS    { mplsLdpGeneralGroup,
                                   mplsLdpNotificationsGroup
                                 }

         GROUP mplsLdpGenericGroup
         DESCRIPTION
             "This group must be supported if Generic Labels
             are used in the MPLS LDP implementation."

         GROUP mplsLdpAtmGroup
         DESCRIPTION
```

"This group must be supported if ATM is used in the

```
            MPLS LDP implementation."

        GROUP mplsLdpFrameRelayGroup
        DESCRIPTION
            "This group must be supported if Frame Relay is used
            in the MPLS LDP implementation."

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

        ::= { mplsLdpCompliances 1 }



    -- units of conformance

    mplsLdpGeneralGroup OBJECT-GROUP
        OBJECTS {
        mplsLdpLsrId,
        mplsLdpLsrLoopDetectionCapable,
        mplsLdpEntityIndexNext,
        mplsLdpEntityProtocolVersion,
        mplsLdpEntityAdminStatus,
        mplsLdpEntityOperStatus,
        mplsLdpEntityTcpDscPort,
        mplsLdpEntityUdpDscPort,
        mplsLdpEntityMaxPduLength,
        mplsLdpEntityKeepAliveHoldTimer,
        mplsLdpEntityHelloHoldTimer,
        mplsLdpEntityInitSesThreshold,
        mplsLdpEntityLabelDistMethod,
        mplsLdpEntityLabelRetentionMode,
        mplsLdpEntityPVLMisTrapEnable,
        mplsLdpEntityPVL,
        mplsLdpEntityHopCountLimit,
        mplsLdpEntityTargPeer,
        mplsLdpEntityTargPeerAddrType,
        mplsLdpEntityTargPeerAddr,
        mplsLdpEntityOptionalParameters,
        mplsLdpEntityDiscontinuityTime,
        mplsLdpEntityStorType,
        mplsLdpEntityRowStatus,
        mplsLdpAttemptedSessions,
        mplsLdpSesRejectedNoHelloErrors,
        mplsLdpSesRejectedAdErrors,
```

```
        mplsLdpSesRejectedMaxPduErrors,
        mplsLdpSesRejectedLRErrors,
```

```
        mplsLdpBadLdpIdentifierErrors,
        mplsLdpBadPduLengthErrors,
        mplsLdpBadMessageLengthErrors,
        mplsLdpBadTlvLengthErrors,
        mplsLdpMalformedTlvValueErrors,
        mplsLdpKeepAliveTimerExpErrors,
        mplsLdpShutdownNotifReceived,
        mplsLdpShutdownNotifSent,
        mplsLdpPeerLabelDistMethod,
        mplsLdpPeerLoopDetectionForPV,
        mplsLdpPeerPVL,
        mplsLdpHelloAdjHoldTimeRem,
        mplsLdpHelloAdjType,
        mplsLdpSesUpDownTrapEnable,
        mplsLdpSesState,
        mplsLdpSesProtocolVersion,
        mplsLdpSesKeepAliveHoldTimeRem,
        mplsLdpSesMaxPduLen,
        mplsLdpSesDiscontinuityTime,
        mplsLdpSesStatsUnkMesTypeErrors,
        mplsLdpSesStatsUnkTlvErrors,
        mplsLdpSesPeerNextHopAddrType,
        mplsLdpSesPeerNextHopAddr,
        mplsFecIndexNext,
        mplsFecType,
        mplsFecAddrFamily,
        mplsFecAddrLength,
        mplsFecAddr,
        mplsFecStorType,
        mplsFecRowStatus
        }
        STATUS    current
        DESCRIPTION
            "Objects that apply to all MPLS LDP implementations."
        ::= { mplsLdpGroups 1 }


    mplsLdpGenericGroup OBJECT-GROUP
        OBJECTS {
        mplsLdpEntityConfGenIfIndxOrZero,
        mplsLdpEntityConfGenLRStorType,
        mplsLdpEntityConfGenLRRowStatus
        }
        STATUS    current
        DESCRIPTION
            "Objects that apply to all MPLS LDP implementations
            using Generic Lables."
        ::= { mplsLdpGroups 2 }
```

```
    mplsLdpAtmGroup OBJECT-GROUP
        OBJECTS {
        mplsLdpEntityAtmIfIndxOrZero,
        mplsLdpEntityAtmMergeCap,
        mplsLdpEntityAtmLRComponents,
        mplsLdpEntityAtmVcDirectionality,
        mplsLdpEntityAtmLsrConnectivity,
        mplsLdpEntityDefaultControlVpi,
        mplsLdpEntityDefaultControlVci,
        mplsLdpEntityUnlabTrafVpi,
        mplsLdpEntityUnlabTrafVci,
        mplsLdpEntityAtmStorType,
        mplsLdpEntityAtmRowStatus,
        mplsLdpEntityConfAtmLRMaxVpi,
        mplsLdpEntityConfAtmLRMaxVci,
        mplsLdpEntityConfAtmLRStorType,
        mplsLdpEntityConfAtmLRRowStatus,
        mplsLdpSesAtmLRUpperBoundVpi,
        mplsLdpSesAtmLRUpperBoundVci

        }
        STATUS    current
        DESCRIPTION
            "Objects that apply to all MPLS LDP implementations
            over ATM."
        ::= { mplsLdpGroups 3 }

    mplsLdpFrameRelayGroup OBJECT-GROUP
        OBJECTS {
        mplsLdpEntityFrIfIndxOrZero,
        mplsLdpEntityFrMergeCap,
        mplsLdpEntityFrLRComponents,
        mplsLdpEntityFrLen,
        mplsLdpEntityFrVcDirectionality,
        mplsLdpEntityFrParmsStorType,
        mplsLdpEntityFrParmsRowStatus,
        mplsLdpConfFrMaxDlci,
        mplsLdpConfFrStorType,
        mplsLdpConfFrRowStatus,
        mplsLdpFrSesMaxDlci,
        mplsLdpFrSesLen
        }
        STATUS    current
        DESCRIPTION
            "Objects that apply to all MPLS LDP implementations over
            Frame Relay."
        ::= { mplsLdpGroups 4 }
```

```
    mplsLdpMappingGroup OBJECT-GROUP
```

```
        OBJECTS {
        mplsLdpSesInLabelType,
        mplsLdpSesInLabelConnType,
        mplsLdpSesOutLabelType,
        mplsLdpSesOutLabelConnType,
        mplsLdpSesOutSegmentIndex,
        mplsLdpSesXCIndex,
        mplsXCFecOperStatus,
        mplsXCFecOperStatusLastChange
        }
        STATUS    current
        DESCRIPTION
            "These objects are optional and only need to be supported
            for LDP implementations which support the
            tables, mplsInSegmentTable, mplsOutSegmentTable
            and mplsXCTable, in the LSR MIB."
        ::= { mplsLdpGroups 5 }


    mplsLdpNotificationsGroup NOTIFICATION-GROUP
        NOTIFICATIONS { mplsLdpInitSesThresholdExceeded,
                        mplsLdpPVLMismatch,
                        mplsLdpSessionUp,
                        mplsLdpSessionDown
                           }
        STATUS   current
        DESCRIPTION
            "The notification(s) which an MPLS LDP implemention
             is required to implement."
        ::= { mplsLdpGroups 6 }


    END
```

5. Revision History

This section should be removed when this document is published as an RFC.

5.1. Changes from <draft-ietf-mpls-ldp-mib-07.txt>

There were three types of changes: the first change was that all the MPLS Textual Conventions from this MIB, the LSR and MPLS-TE MIBs were moved into a new document [36], "draft-ietf-mpls-tc-mib-00.txt". The Textual Conventions are now IMPORTED from [36]. The second type of change was updates based on comments from the IESG. These changes will be discussed below. The third type of changes were based on minor editorial changes from the co-authors.

The "Introduction" and "Structure of the MIB" sections were reworded since they were repetitive.

The "Overview" was rearranged.

References were added to "The LDP Entity ATM Objects" and "The LDP Entity Frame Relay Objects" Sections.

The Working Group mailing list and Chairs were added to the CONTACT-INFO.

Updated the DESCRIPTION clause for the "mplsLdpEntityLdpId" object.

Updated the mplsLdpEntityProtocolVersion to include a range (1..65535).

Updated the "References" Section.

Running the MIB through the smilint MIB compiler showed that some object names were longer than 32 characters, these were shortened to 32 characters or fewer.

The following changes were from the co-authors.

Other minor editorial changes such as fixing typographical errors, and removing MIB comments which are no longer meaningful.

Page 17 (also page 46) the description was enhanced to describe the version field in the LDP header from RFC3036.

Removed WellKnown from the tcp and upd port names. It's the ports that get set, and the default value is the well known (actually the registered) port number.

mplsLdpEntityInitSesTrapEnable object is useless and was removed since setting mplsLdpEntityInitSesThreshold=0 acheives the same thing. Also removed it from the descriptive text in section 3.

Page 47, mplsLdpSessionDiscontinuityTime The initial value of this was changed to be sysUpTime instead of zero. sysUpTime for when the session starts is more meaningful and was added to the Session Up/Down Traps also. Also, added the Session specific stats to the up/down traps.

5.2. Changes from <draft-ietf-mpls-ldp-mib-06.txt>

All changes were from the second last call which took place Thursday, July 20th, until Thursday, July 27th, 2000 and are described in the remainder of this section.

Remove the reference to the MPLS framework document.

Add an mplsFecIndexNext type of object.

Change the conformance of the FEC table objects to be part of the mplsLdpGeneralGroup.

The mplsLdpEntityConfGenericTable is no longer needed because the functionality has been absorbed by the mplsLdpEntityConfGenericLabelRangeTable. The mplsLdpEntityConfGenericTable has been removed and the front section was updated accordingly.

Other editorial issues, updating references, typos and so forth.

5.3. Changes from <draft-ietf-mpls-ldp-mib-05.txt>

The majority of changes in this revision are based on Last Call comments which were received during the last call from Thursday, March 9, 2000 to Friday, March 17, 2000, or slightly thereafter. Also, changes were made to agree with the latest specifications. These changes are described in this section.

Changes due to draft-ietf-mpls-ldp-07.txt and draft-ietf-mpls-ldp-08.txt. Specifically, removing references to IPv4/IP and using router id, as appropriate.

Removed vpMerge and vpAndVcMerge choices from the object, mplsLdpEntityAtmMergeCap. VP Merge is not described in [30].

The LIB Table was removed and replaced by mapping tables to map LDP

LSPs created by LDP sessions to the mplsInSegment, mplsOutSegment and

mplsXC tables in the LSR MIB. The conformance section was updated to include a Mapping Group which is to be implemented iff these LSR MIB tables (mplsInSegmentTable, mplsOutSegmentTable and mplsXCTable) are implemented.

The front section was updated to include information on the Generic label table.

Added more in the front section on on Row Creation/adminStatus/OperStatus in the LDP Entity and related tables.

Added a generic label range table. 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.

A new TEXTUAL-CONVENTION, MplsAtmVcIdentifier was added. This TC has the same upper bounds as AtmVcIdentifier (from rfc2514) except that the lower bound is 32 (and not 0). The lower bound is 32 since this value is specified by [30].

Removed the scalar object mplsLsrLabelRetentionMode and added mplsLdpEntityLabelRetentionMode. The change was made to allow configuring the retention mode on a per LDP Entity basis, as opposed for the entire LSR.

Typo in section 3.5.2 was fixed.

Typo in the mplsLdpSessionUp notification description was fixed.

Section 'LDP Notifications' was expanded to cover both the 'mplsLdpSessionUp' and 'mplsLdpSessionDown' traps. Also, the objects which enable and disable these traps have been described in this Section:

The 'mplsLdpEntityHopCountLoopDetection' object and the 'mplsLdpEntityHopCount' object have been combined into the new object, 'mplsLdpEntityHopCountLimit'.

MplsLabel has been updated to reflect the VPI value of 12 bits and not 8.

Added DEFVAL clause to the 'mplsLdpEntityWellKnownDiscoveryPort' object. The default value is 646.

Added UNITS and DEFVAL clauses to the 'mplsLdpEntityMaxPduLength' object. The default value is 4096 and the units is octets.

Added DEFVAL clause to 'mplsLdpEntityProtocolVersion' object. The

default value is 1.

Added DEFVAL clause to 'mplsLdpEntityKeepAliveHoldTimer' of 40 seconds.

Added DEFVAL clause to 'mplsLdpEntityInitSesThreshold' object. The default value is 8.

The mplsLdpEntityWellKnownDiscoveryPort was changed into two objects, one for TCP and one for UDP. The names are

Typo in the description for the

The mplsLdpEntityPeerTable was (re-)named mplsLdpPeerTable. The mplsLdpSessionTable now AUGMENTs the mplsLdpPeerTable in order to show that these two tables are related. There has been wording added to the mplsLdpSessionEntry description and to the description for the mplsLdpPeerTable.

5.4. Changes from <draft-ietf-mpls-ldp-mib-04.txt>

Editorial changes, fixing typo's, fixing wrapping lines, etc.

Updated references for latest drafts, and added [31] and [32] to Reference Section.

Added to the Acknowledgements Section.

Changed the SYNTAX and DESCRIPTION of the 'mplsLdpLsrLoopDetectionCapable' object, so that it will also support the loop detection by hop count.

Combined the 'mplsLdpEntityLoopDetectionForPV' and 'mplsLdpEntityPVL' objects. The functionality of the 'mplsLdpEntityLoopDectionForPV' is now denoted by the value of 0 (zero) in the 'mplsLdpEntityPVL' object. This results in one less object 'mplsLdpEntityLoopDectionForPV' but does not sacrifice functionality.

Changed 'mplsLdpLibLabelType' into two objects: 'mplsLdpLibInLabelType' and differ from the egress label type. The MIB now reflects this.

The following items were changed as a result of the Frame Relay Forum dropping support for 17-bit DLCIs: the MplsLabel TC description has been modified, and other Frame Relay Object descriptions were also modified (as specified in this section).

The MplsLabel TC was also modified and reference 3. was added to the REFERENCE Clause.

MplsLdpLabelTypes TC was modified to use an enum.

InterfaceIndex support was added to the Entity information. This was specifically requested by several members of the working group. An additional table, mplsLdpEntityConfGenericTable as a way to configure Generic Labels, and an object, 'mplsLdpConfGenericIfIndexOrZero was added to map the InterfaceIndex used by Generic Labels. Objects were also added to the 'mplsLdpEntityAtmParmsTable' and the and 'mplsLdpEntityFrIfIndex', respectively.

Changed the name of the 'mplsLdpEntityMtu' object to be 'mplsLdpEntityMaxPduLength' which is more consistent with the LDP Specification. Also, the description and SYNTAX were changed.

Changed the SYNTAX of the 'mplsLdpSessionMaxPduLength' to unsigned32 and changed the Range from (0..65535) to (1..65535).

Added and improved the front section discussion on SNMP Notifications.

Also, modified the DESCRIPTION clause of the

Added objects to enable/disable the sending of traps:

Added an object to enable/disable sending traps for Sessions changing from Up to Down, or Down to Up.

Added notifications to generate traps from session changing from Up to Down, or Down to up.

Added a StorageType object to the Entity and associated tables which are configurable.

Added a Discontinuity Time object to the Entity Table,

Added discussion on row creation in the Entity and other associated Entity tables. This is a new Section in the Front part of the document called:

Removed the 'mplsLdpEntityControlMethod'.

Made 'mplsLdpFecLspId' as part of the INDEX for the FEC table. This is to allow FECs to map to multiple LSPs. Also add a RowPointer to a row in the Session Table.

Added an operation status object, 'mplsLdpLspOperStatus' and a last Change object, 'mplsLdpLspLastChangeto the LIB Table. This will be used to detect whether an LSP has changed its status.

Changed the name of the mplsLdpPeerTable to the mplsLdpEntityPeerTable. This table contains information relevant to

Peers which are known to specific Entities. The indexing of this

table has also changed to include the Row in the Entity Table that this Peer is known by. The mplsLdpHelloAdjacencyTable and the mplsLdpSessionTable have been moved under this table. Since Hello Adjacencies are related to Entity-Peer information and Sessions are related to Entity-Peer information this was seen as a comprehensive and coherent modelling. Associated descriptions in the front section and in the tables have been changed to reflect this change.

Moved the 'mplsLdpConfFrLen' object from the 'mplsLdpEntityConfFrLabelRangeTable' to the 'mplsLdpEntityFrameRelayParmsTable' since the Frame Relay interface/port can only use one header length at a time, i.e. a specific FR interface supports one address length for all VCs on that interface. Also, changed the object so that it only supports 10 and 23 bit DLCI lengths. (The 17 bit length was dropped by the Frame Relay Forum and thus, is no longer required.) The name of this object was changed from 'mplsLdpConfFrLen' to 'mplsLdpEntityFrLen' to fit in with the 'mplsLdpEntityFrameRelayParmsTable'.

Removed the seventeenDlciBits(1) value from the mplsLdpFrSessionLen object. (The 17 bit length was dropped by the Frame Relay Forum and thus, is no longer required.)

Corrected the range of the 'mplsLdpEntityIndexNext' object to include 0 (zero).

5.5. Changes from <draft-ietf-mpls-ldp-mib-03.txt>

Reworded the description of the mplsLdpAtmSessionTable to clarify that one or MORE label range intersection(s) is/are represented in this table.

Reworded the description of the mplsLdpFrameRelaySessionTable to clarify that one or MORE label range intersection(s) is/are represented in this table.

Added a new index, mplsLdpSessionPeerIndex, to the mplsLdpSessionPeerAddressTable. This new index uniquely identifies the entry within a given session. (Since adding mplsLdpSessionPeerNextHopAddressType, mplsLdpSessionPeerNextHopAddress to the INDEX clause of the mplsLdpSessionPeerAddressTable leaves a table with only indices and no objects, the work around was to add a new index which uniquely differentiates an entry within a given session.)

Quite a few changes to the mplsLdpPeerTable. First, removed the mplsLdpPeerIndex from the mplsLdpPeerTable and other tables. This index served no purpose, so was removed. Second, removed the

objects: mplsLdpPeerInternetworkAddrType, and

mplsLdpPeerInternetworkAddr. Third, reworded the description of this table to include information which is known during Session Intialization attempts, the specific information has to do with Loop Dection based on Path Vectors. Since Section 3.5.3 of the LDP Spec when describing the PVLim says: "Although knowledge of a peer's path vector limit will not change an LSR's behavior, it does enable the LSR to alert an operator to a possible misconfiguration." and the object mplsLdpPeerPVL is sent as a varbind in the mplsLdpPVLMismatch notification.

Removed the mplsLdpPeerIndex from the mplsLdpHelloAdjacencyTable.

Removed the "IANA Address Family Numbers" MIB section.

Updated the boiler.me from the ops web page dated Weds., Dec 22, 1999.

Updated the Security Section from the ops web page.

Added the following objects to the mplsLdpEntityTable: mplsLdpEntityControlMethod, mplsLdpEntityLoopDectionForPV, and mplsLdpEntityPathVectorLimit.

Removed mplsLdpSessionLabelAdvertisement, mplsLdpSessionLoopDetectionForPV, and mplsLdpSessionPathVectorLimit from the mplsLdpSessionTable.

Changed the mplsLdpPathVectorLimitMismatch Notification to send mplsLdpEntityPathVectorLimit (instead of mplsLdpSessionPathVectorLimit).

Copied the MplsLabel TC from draft-ietf-mpls-lsr-mib-00.txt and replaced the MplsLdpGenAddr for mplsLdpLibInLabel and mpslLdpLibOutLabel with MplsLabel.

The mplsLdpSessionIndex was removed throughout the MIB. This was replaced by the object mplsLdpSessionDiscontinuityTime. The motivation was to reduce the number of indices.

The descriptions for the objects in the mplsLdpSessionStatsTable, mplsLdpSessionStatsUnknownMessageTypeErrors and mplsLdpSessionStatsUnknownTlvErrors, have been updated to include a reference to the mplsLdpSessionDiscontinuityTime object.

5.6. Changes from <draft-ietf-mpls-ldp-mib-02.txt>

Added Scalar Objects: mplsLdpLsrLoopDetectionPresent, and mplsLdpEntityIndexNext.

Added the following objects to the mplsLdpEntityTable: mplsLdpEntityProtocolVersion, mplsLdpEntityAdminStatus, mplsLdpEntityOperStatus, mplsLdpEntityTargetedPeer, mplsLdpEntityTargetedPeerAddrType, mplsLdpEntityTargetedPeerAddr, and mplsLdpEntityHelloHoldTimer.

Changed the description of the mplsLdpEntityAtmParmsTable and added the following objects to this table: mplsLdpEntityAtmLsrConnectivity, mplsLdpEntityDefaultControlVpi, mplsLdpEntityDefaultControlVci, mplsLdpEntityUnlabTrafVpi, and mplsLdpEntityUnlabTrafVci. NOTE: the last four objects were in Version 01 of the MIB but were mistakenly omitted from Version 02. Now, they are back.

Changed the indexing of the mplsLdpEntityConfAtmLabelRangeTable to include the minimum VPI/VCI. This is to ensure that indices in this table are unique.

Changed the indexing of the mplsLdpEntityConfFrLabelRangeTable, to include the minimum DLCI value. This is to ensure that indices in this table are unique.

Added [30] to Reference Section.

5.7. Changes from <draft-ietf-mpls-ldp-mib-01.txt>

The MIB was updated to correspond to draft-ietf-mpls-ldp-06.txt of the LDP Specification [18].

The front section was updated.

The MIB was made to be less ATM-centric. Essentially, the ATM specific objects where removed from the tables and placed in ATM specific Tables. A type was added to the base tables and a row is to be created in the ATM/FR/etc. type table. Apropos compliance statements were added to reflect the separation of ATM and Frame Relay objects into their respective tables.

Objects for Loop Detection were removed from describing the LDP implementation (i.e. the scalars were removed) and Loop Dection objects were added to the Session Table. (Although as the LDP Specification indicates loop detection should be for an LSR within a domain.)

The following tables were added: mplsLdpEntityAtmParmsTable, mplsLdpEntityConfAtmLabelRangeTable, mplsLdpFrameRelayParmsTable, mplsLdpConfFrLabelRangeTable, mplsLdpAtmSessionTable, mpslLdpFrameRelaySessionTable, mplsLdpSessionPeerAddressTable,

mplsLdpLibTable, and the mplsLdpFecTable.

The following notifications were added: notification for Session removal.

The following objects were removed from the Session Table: mplsLdpSessionRole was removed (this can be determined by comparing LSR Ids and does not need to be explicitely in the MIB.) ATM specific objects (mplsLdpSessionAtmLabelRangeLowerBoundVpi mplsLdpSessionAtmLabelRangeLowerBoundVci, mplsLdpSessionAtmLabelRangeUpperBoundVpi mplsLdpSessionAtmLabelRangeUpperBoundVci) were removed and put into a separate table. Frame Relay objects were added in a separate table.

Hello Adjacency Table was updated.

The objects, mplsLdpSessionRejectedParamErrors, mplsLdpSessionRejectedNoHelloErrors, mplsLdpBadLdpIdentifierErrors, mplsLdpBadPduLengthErrors, mplsLdpBadMessageLengthErrors, mplsLdpBadTlvLengthErrors, mplsLdpMalformedTlvValueErrors, mplsLdpKeepAliveTimerExpiredErrors, mplsLdpShutdownNotifReceived, and mplsLdpShutdownNotifSent were added to the mplsLdpEntityStatsTable.

The mplsLdpSessionStatsTable was added to count statics based on a per Session basis.

The mplLdpPeerConfAtmLabelRangeTable has been removed. There is no need to configure information for a Peer. All information for a peer is learned, thus peer information is read-only.

(Editorial) References were updated to reflect the documents which this version was based on.

5.8. Changes from <draft-ietf-mpls-ldp-mib-00.txt>

Textual conventions were added for the LSR Identifier and the LDP Identifier.

Top-level mib structure was added. The LDP MIB falls under a proposed hierarchy of mpls.mplsProtocols.

The mib hierarchy within the LDP MIB was also changed. A new branch, under mpls.mplsProtocols.mplsLdpMIB.mplsLdpObjects was added. This branch is mplsLdpLsrObjects. Currently, this contains several new scalar objects: mplsLdpLsrID, mplsLdpLsrLoopDetectionPresent, mplsLdpLsrLoopDetectinAdminStatus, mplsLdpLsrPathVectorLimit, mplsLdpLsrHopCountLimit, mplsLdpLsrLoopPreventionPresent, mplsLdpLsrLoopPreventionAdminStatus, and mplsLdpLsrLabelRetentionMode.

mplsLdpEntityTable is now indexed by mplsLdpEntityIdentifier, which

is the LDP Identifier used in Session establishment. mplsLdpEntityLoopDetection and mplsLdpEntityLoopPrevention objects were removed from this table.

The following objects were added to the mplsLdpEntityTable: mplsLdpEntityLabelSpaceType, mplsLdpEntityUnlabTrafVpi, mplsLdpEntityUnlabTrafVci, mplsLdpEntityMergeCapability, mplsLdpEntityVcDirectionality, and mplsLdpEntityLabelDistributionMethod.

The following objects were added to the mplsLdpPeerEntityTable: mplsLdpPeerLabelDistributionMethod.

The following object was removed from the mplsLdpEntityStatsTable: mplsLdpEntityEstablishedSessions.

References were added and revised.

6. Acknowledgments

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. Also, some members of the working group were very helpful with comments and corrections to the MIB; the authors would like to thank Adrian Farrel of Movaz Networks, and Alan Kullberg from NetPlane Systems.

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8. Security Considerations

There are a number of management objects defined in this MIB that have 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.

There are a number of managed objects in this MIB that may contain sensitive information. These are contained in the mplsLdpEntityTable.

The objects contained in this table are responsible for setting up or

tearing down LSPs.

It is thus important to control even GET access to these objects and possibly to even encrypt the values of these object when sending them over the network via SNMP. Not all versions of SNMP provide features for such a secure environment.

SNMPv1 by itself is not a secure environment. 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.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [RFC2574] and the View-based Access Control Model RFC 2575 [RFC2575] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, 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.

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