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

<draft-ietf-mpls-ldp-mib-02.txt>

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Abstract

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

This 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) [18].

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 [22].

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], RFC 2579 [RFC2579] and 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 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) as defined in [18].

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 an LDP Session. This is the mplsLdpEntityTable.

Another table, the mplsLdpPeerTable, is a read-only table which records information learned via discovery. Each row in the Peer Table represents a peer.

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. The following figure demonstrates these relationships:

Entity                                          Peer
------------                                   ------------
|          |                                   |           |
------------                                   ------------
|          |          --------------           |           |
------------  ----->  |            |  <-----   ------------
--------------

3.2. Interface Indexing

Interface Indexes as specified in [29] 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.

3.3. Future Considerations

The following aspects are not addressed in this document: VPN issues (i.e. potential MIB objects such as the VPN Identifier are not included at this time), and lastly, multicast issues are not discussed.

Some of these issues need further clarification before adding to the
3.4. Discussion of MIB Groups

Currently, there are four groups: the MPLS LDP General Group, the MPLS LDP ATM Group, the MPLS LDP Frame Relay 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 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.

3.5. The MPLS LDP General Group

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

3.5.1. The Label Distribution Protocol’s 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.

3.5.2. The Label Distribution Protocol’s 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 Initialization Message.

3.5.3. The Label Distribution Protocol’s 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 Paramer’ portion of an LDP PDU Initialization Message.

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

3.5.4. The Label Distribution Protocol’s Entity Statistics Table

The LDP Entity Statistics Table will maintain counters related to an LDP Entity. This Table should be a read-only table which contains statistical information.

Each row in this table will be related to a single LDP Entity.

3.5.5. The LDP Peer Table

The LDP Peer Table is a read-only table which contains information about LDP Peers. Each row in this table represents an LDP Peer which is known to an LDP Entity.

3.5.6. 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.

3.5.7. The LDP ATM Session Table

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

3.5.8. 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.

3.5.9. The LDP Session Statistics Table

The MPLS LDP Session Stats Table is a read-only table which contains statistical information on sessions.
3.5.10. 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.

3.5.11. The LDP Adjacencies Table

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

3.5.12. The LDP Label Information Base (LIB) Table

The MPLS LDP LIB Table is a read-only table which contains information stored in the LIB. This table is indexed by a unique number which could be used to represent the LSP segment related to this LIB entry. The Lsp number corresponds to a FEC entry in the FEC Table which is described next.

3.5.13. The LDP FEC Table

The FEC Table is a read-only table which contains FEC (Forwarding Equivalence Class) information. Each entry/row represents a single FEC Element.

3.6. The LDP Notifications Group

3.6.1. LDP Notifications

Currently, there is one notification which will be sent when an LDP attempts to initialize the same session beyond the configured threshold.

4. MPLS Label Distribution Protocol MIB Definitions

MPLS-LDP-MIB DEFINITIONS ::= BEGIN

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

TEXTUAL-CONVENTION, RowStatus, TimeInterval
FROM SNMPv2-TC

InterfaceIndex
FROM IF-MIB
-- AtmInterfaceType,
AtmVcIdentifier, AtmVpIdentifier
FROM ATM-TC-MIB

AddressFamilyNumbers
FROM IANA-ADDRESS-FAMILY-NUMBERS-MIB

mplsLdpMIB MODULE-IDENTITY
LAST-UPDATED "9910071200Z"  -- October 7, 1999
ORGANIZATION "Multiprotocol Label Switching (mpls) Working Group"

CONTACT-INFO
"Joan Cucchiara (joan@ironbridgenetworks.com)
IronBridge Networks

Hans Sjostrand (hans.sjostrand@etx.ericsson.se)
Ericsson

James V. Luciani (luciani@baynetworks.com)
Nortel Networks"

DESCRIPTION
"This MIB contains managed object definitions for the
Multiprotocol Label Switching, Label Distribution
Protocol, LDP, as defined in draft-ietf-mpls-ldp-06.txt."

::= { experimental XXXX } -- to be assigned

--********************************************************************
-- MPLS LDP Textual Conventions
--********************************************************************

-- MplsLsrIdentifier ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION
"The Label Switch Router (LSR) identifier
is the first 4 bytes or the IP Address component
of the Label Distribution Protocol (LDP) identifier."
SYNTAX OCTET STRING (SIZE (4))

-- A similar TC is also used in RFC2677.txt, perhaps
-- this should be made general and not MPLS specific.

MplsLdpGenAddr ::= TEXTUAL-CONVENTION
MplsLdpIdentifier ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION
"The LDP identifier is a six octet quantity
which is used to identify an Label Switch Router
(LSR) label space.

The first four octets encode an IP address
assigned to the LSR, and the last two octets
identify a specific label space within the LSR."
SYNTAX OCTET STRING (SIZE (6))

MplsLdpLabelTypes ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION
"The Layer 2 label types which are defined for
MPLS LDP are generic(1), atm(2), or frameRelay(3)."
SYNTAX INTEGER(1..3)
SYNTAX       MplsLsrIdentifier
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  "The LSR’s Identifier."
 ::=  { mplsLdpLsrObjects 1 }

mplsLdpLsrLabelRetentionMode OBJECT-TYPE
SYNTAX       INTEGER {
            conservative(1),
            liberal(2)
        }
MAX-ACCESS   read-write
STATUS       current
DESCRIPTION  "The LSR 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."
 ::=  { mplsLdpLsrObjects 2 }

--
-- The MPLS Label Distribution Protocol Entity Table
--

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 1 }

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,
  mplsLdpEntityWellKnownDiscoveryPort        Unsigned32,
  mplsLdpEntityMtu                           Integer32,
  mplsLdpEntityKeepAliveHoldTimer            Integer32,
  mplsLdpEntityFailedInitSessionThreshold    Integer32,
  mplsLdpEntityLabelDistributionMethod       INTEGER,
  mplsLdpEntityOptionalParameters            MplsLdpLabelTypes,
  mplsLdpEntityRowStatus                     RowStatus
}

mplsLdpEntityLdpId OBJECT-TYPE
SYNTAX       MplsLdpIdentifier
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION   "The LDP identifier.

The first four octets encode an IP address
assigned to the LSR, and the last two octets
identify a specific label space within the
LSR."
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 should be unique to differentiate
LDP Identifiers, such that this index along
with the LDP Identifier will uniquely identify
the row."
 ::= { mplsLdpEntityEntry 2 }

mplsLdpEntityWellKnownDiscoveryPort OBJECT-TYPE
SYNTAX       Unsigned32
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION   "The well known LDP Discovery Port."
 ::= { mplsLdpEntityEntry 3 }

Expires April 2000
mplsLdpEntityMtu OBJECT-TYPE
SYNTAX Integer32 (0..65535)
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The maximum transmission unit (MTU) that was configured for this entity."
::= { mplsLdpEntityEntry 4 }

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."
::= { mplsLdpEntityEntry 5 }

mplsLdpEntityFailedInitSessionThreshold 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 a notification when exceeding this threshold. A value of 0 (zero) for this object indicates that the threshold is infinity. In other words, a notification will not be sent if the value of this object is 0 (zero)."
::= { mplsLdpEntityEntry 6 }

mplsLdpEntityLabelDistributionMethod 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 7 }

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 8 }

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."
 ::= { mplsLdpEntityEntry 9 }

-- Ldp Entity Objects for ATM
--

mplsLdpEntityAtmObjects  OBJECT IDENTIFIER ::= { mplsLdpEntityObjects 2 }

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’."
 ::= { mplsLdpEntityAtmObjects 1 }

mplsLdpEntityAtmParmsEntry OBJECT-TYPE
SYNTAX MplsLdpEntityAtmParmsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"An entry in this table represents the ATM parameters
for this LDP entity."

INDEX { mplsLdpEntityLdpId, mplsLdpEntityIndex }
 ::= { mplsLdpEntityAtmParmsTable 1 }

MplsLdpEntityAtmParmsEntry ::= SEQUENCE {
    mplsLdpEntityAtmMergeCap INTEGER,
    mplsLdpEntityAtmLabelRangeComponents Unsigned32,
    mplsLdpEntityAtmVcDirectionality INTEGER,
    mplsLdpEntityAtmRowStatus RowStatus
}

mplsLdpEntityAtmMergeCap OBJECT-TYPE
SYNTAX INTEGER {
    notSupported(0),
    vpMerge(1),
    vcMerge(2),
    vpAndVcMerge(3)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION "Denotes the Merge Capability of this Entity."
 ::= { mplsLdpEntityAtmParmsEntry 1 }

mplsLdpEntityAtmLabelRangeComponents 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 mplsLdpLabelRangeComponentsTable which correspond
to this entry."
 ::= { mplsLdpEntityAtmParmsEntry 2 }

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 3 }

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."
::= { mplsLdpEntityAtmParmsEntry 4 }

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

mplsLdpEntityConfAtmLabelRangeTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsLdpEntityConfAtmLabelRangeEntry
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 }

mplsLdpEntityConfAtmLabelRangeEntry OBJECT-TYPE
SYNTAX MplsLdpEntityConfAtmLabelRangeEntry
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  }  
::= { mplsLdpEntityConfAtmLabelRangeTable 1 }

MplsLdpEntityConfAtmLabelRangeEntry ::= SEQUENCE {  
  mplsLdpEntityConfAtmLabelRangeMinimumVpi  AtmVpIdentifier,  
  mplsLdpEntityConfAtmLabelRangeMinimumVci  AtmVcIdentifier,  
  mplsLdpEntityConfAtmLabelRangeMaximumVpi  AtmVpIdentifier,  
  mplsLdpEntityConfAtmLabelRangeMaximumVci  AtmVcIdentifier,  
  mplsLdpEntityConfAtmLabelRangeRowStatus   RowStatus  
}

mplsLdpEntityConfAtmLabelRangeMinimumVpi OBJECT-TYPE  
SYNTAX AtmVpIdentifier  
MAX-ACCESS read-create  
STATUS current  
DESCRIPTION  
  "The minimum VPI number configured for this range."
  ::= { mplsLdpEntityConfAtmLabelRangeEntry 1 }

mplsLdpEntityConfAtmLabelRangeMinimumVci OBJECT-TYPE  
SYNTAX AtmVcIdentifier  
MAX-ACCESS read-create  
STATUS current  
DESCRIPTION  
  "The minimum VCI number configured for this range."
  ::= { mplsLdpEntityConfAtmLabelRangeEntry 2 }

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

mplsLdpEntityConfAtmLabelRangeMaximumVci OBJECT-TYPE  
SYNTAX AtmVcIdentifier  
MAX-ACCESS read-create
mplsLdpEntityConfAtmLabelRangeRowStatus 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’."  
::= { mplsLdpEntityConfAtmLabelRangeEntry 5 }

-- Ldp Entity Objects for Frame Relay
--

mplsLdpEntityFrameRelayObjects OBJECT IDENTIFIER ::= 
   { mplsLdpEntityObjects 3 }

mplsLdpEntityFrameRelayParmsTable OBJECT-TYPE
   SYNTAX   SEQUENCE OF MplsLdpEntityFrameRelayParmsEntry
   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 Initialization Messages."
::= { mplsLdpEntityFrameRelayObjects 1 }

mplsLdpEntityFrameRelayParmsEntry OBJECT-TYPE
   SYNTAX   MplsLdpEntityFrameRelayParmsEntry
   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  }
::= { mplsLdpEntityFrameRelayParmsTable 1 }

MplsLdpEntityFrameRelayParmsEntry ::= SEQUENCE {
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."
::= { mplsLdpEntityFrameRelayParmsEntry 1 }

mplsLdpEntityFrLabelRangeComponents 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 mplsLdpEntityConfFRLabelRangeTable which correspond to this entry."
::= { mplsLdpEntityFrameRelayParmsEntry 2 }

mplsLdpEntityFrVcDirectionality OBJECT-TYPE
SYNTAX INTEGER {
    bidirectional(0),
    unidirectional(1)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION "If the value of this object is 'bidirectional(0)', then the LSR supports the use of a given DLCI as a label for both directions independently. If the value of this object is 'unidirectional(1)', then the LSR uses the given DLCI as a label in only one direction."
::= { mplsLdpEntityFrameRelayParmsEntry 3 }

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."
 ::= { mplsLdpEntityFrameRelayParmsEntry 4 }

--
-- Frame Relay Label Range Components
--

mplsLdpEntityConfFrLabelRangeTable OBJECT-TYPE
 SYNTAX    SEQUENCE OF MplsLdpEntityConfFrLabelRangeEntry
 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 Initialization Messages."
 ::= { mplsLdpEntityFrameRelayObjects 2 }

MplsLdpEntityConfFrLabelRangeEntry OBJECT-TYPE
 SYNTAX    MplsLdpEntityConfFrLabelRangeEntry
 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  }
 ::= { mplsLdpEntityConfFrLabelRangeTable 1 }

MplsLdpEntityConfFrLabelRangeEntry ::= SEQUENCE {
 mplsLdpConfFrLen                          INTEGER,
 mplsLdpConfFrMinimumDlci                  Integer32,
 mplsLdpConfFrMaximumDlci                  Integer32,
 mplsLdpConfFrRowStatus                    RowStatus
}

mplsLdpConfFrLen OBJECT-TYPE
 SYNTAX    INTEGER {
   tenDlciBits(0),
   seventeenDlciBits(1),
   twentyThreeDlciBits(2)
 }
 MAX-ACCESS read-create
 STATUS    current
 DESCRIPTION
 "This object specifies the DLCI bits."
 ::= { mplsLdpEntityConfFrLabelRangeEntry 1 }

mplsLdpConfFrMinimumDlci OBJECT-TYPE
mplsLdpConfFrMaximumDlci OBJECT-TYPE
SYNTAX Integer32
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."
 ::= { mplsLdpEntityConfFrLabelRangeEntry 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 'frameReleaySessionParameters(3)' then there must be at least one corresponding entry in this table."
 ::= { mplsLdpEntityConfFrLabelRangeEntry 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 4 }

mplsLdpEntityStatsEntry OBJECT-TYPE
SYNTAX MplsLdpEntityStatsEntry
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 for an LDP Session which contains a fatal 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 mplsLdpSessionStatsEntry.

AUGMENTS { mplsLdpEntityEntry }
::= { mplsLdpEntityStatsTable 1 }

MplsLdpEntityStatsEntry ::= SEQUENCE {
mplsLdpAttemptedSessions                  Counter32,
mplsLdpSessionRejectedNoHelloErrors       Counter32,
mplsLdpSessionRejectedAdvertisementErrors Counter32,
mplsLdpSessionRejectedMaxPduErrors        Counter32,
mplsLdpSessionRejectedLabelRangeErrors    Counter32,
mplsLdpBadLdpIdentifierErrors             Counter32,
mplsLdpBadPduLengthErrors                 Counter32,
mplsLdpBadMessageLengthErrors             Counter32,
mplsLdpBadTlvLengthErrors                 Counter32,
mplsLdpMalformedTlvValueErrors            Counter32,
mplsLdpKeepAliveTimerExpiredErrors        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 }

mplsLdpSessionRejectedNoHelloErrors 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 }

mplsLdpSessionRejectedAdvertisementErrors 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 }

mplsLdpSessionRejectedMaxPduErrors 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 }

mplsLdpSessionRejectedLabelRangeErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A count of the Session Rejected/Parameters Label Range Notification Notifications 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

Expires April 2000
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 }

mplsLdpKeepAliveTimerExpiredErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object counts the number of Session Keep Alive Timer

Expires April 2000
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 Notifications 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 Notifications sent related to session(s) (past and present) associated with this LDP Entity."
::= { mplsLdpEntityStatsEntry 13 }

--
-- The MPLS LDP Peer Table
--

mplsLdpPeerObjects OBJECT IDENTIFIER ::= { mplsLdpObjects 3 }

mplsLdpPeerTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsLdpPeerEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Information about LDP peers which have been discovered by the LDP Entities that are managed by this agent."
::= { mplsLdpPeerObjects 1 }

mplsLdpPeerEntry OBJECT-TYPE
SYNTAX MplsLdpPeerEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Information about a single Peer."
INDEX { mplsLdpPeerLdpId, mplsLdpPeerIndex }
::= { mplsLdpPeerTable 1 }

MplsLdpPeerEntry ::= SEQUENCE {
    mplsLdpPeerLdpId                  MplsLdpIdentifier,
    mplsLdpPeerIndex                Unsigned32,
    mplsLdpPeerInternetworkAddrType AddressFamilyNumbers,
    mplsLdpPeerInternetworkAddr      MplsLdpGenAddr,
    mplsLdpPeerLabelDistributionMethod INTEGER,
    mplsLdpPeerLoopDetectionForPV    INTEGER,
    mplsLdpPeerPathVectorLimit       Integer32
}

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

mplsLdpPeerIndex OBJECT-TYPE
SYNTAX      Unsigned32 (1..4294967295)
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION   "An identifier for the LDP peer that is unique within the
scope of this agent."
::= { mplsLdpPeerEntry 2 }

mplsLdpPeerInternetworkAddrType OBJECT-TYPE
SYNTAX      AddressFamilyNumbers
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION   "The type of the internetwork layer address of this
LDP peer. This object indicates how the value of
mplsLdpPeerInternetworkAddr is to be interpreted."
::= { mplsLdpPeerEntry 3 }

mplsLdpPeerInternetworkAddr OBJECT-TYPE
SYNTAX      MplsLdpGenAddr
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION   "The value of the internetwork layer address of this LDP peer."
::= { mplsLdpPeerEntry 4 }

mplsLdpPeerLabelDistributionMethod 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."
REFERENCE "draft-ietf-mpls-arch-06.txt [20]."
::= { mplsLdpPeerEntry 5 }

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 6 }

mplsLdpPeerPathVectorLimit 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 7 }

--
-- The MPLS LDP Sessions Table
--

mplsLdpSessionObjects OBJECT IDENTIFIER ::= { mplsLdpObjects 4 }

mplsLdpSessionTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsLdpSessionEntry

Expires April 2000
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 1 }

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."
INDEX { mplsLdpEntityLdpId, 
mplsLdpEntityIndex, 
mplsLdpPeerLdpId, 
mplsLdpPeerIndex, 
mplsLdpSessionIndex }
::= { mplsLdpSessionTable 1 }

MplsLdpSessionEntry ::= SEQUENCE {
mplsLdpSessionIndex                          Unsigned32,
mplsLdpSessionState                          INTEGER,
mplsLdpSessionProtocolVersion                Integer32,
mplsLdpSessionKeepAliveHoldTimeRemaining     TimeInterval,
mplsLdpSessionLabelAdvertisement             INTEGER,
mplsLdpSessionLoopDetectionForPV             INTEGER,
mplsLdpSessionPathVectorLimit                Integer32,
mplsLdpSessionMaxPduLength                   Integer32
}

mplsLdpSessionIndex OBJECT-TYPE
SYNTAX    Unsigned32 (1..4294967295)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"An unique identifier for this entry such that it
identifies a specific LDP Session."
::= { mplsLdpSessionEntry 1 }

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

mplsLdpSessionProtocolVersion OBJECT-TYPE
SYNTAX Integer32(1..65535)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The version of the LDP Protocol which
this session is using."
 ::= { mplsLdpSessionEntry 3 }

mplsLdpSessionKeepAliveHoldTimeRemaining OBJECT-TYPE
SYNTAX TimeInterval
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The keep alive hold time remaining for this session."
 ::= { mplsLdpSessionEntry 4 }

mplsLdpSessionLabelAdvertisement OBJECT-TYPE
SYNTAX INTEGER {
   downStreamUnsolicited(0),
   downStreamOnDemand(1)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The label advertisement discipline used for this Session."
 ::= { mplsLdpSessionEntry 5 }

mplsLdpSessionLoopDetectionForPV 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 session.

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."

::= { mplsLdpSessionEntry 6 }

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

If the value of 'mplsLdpSessionLoopDetectionForPV' for this entry is 'disabled(0)', then this value should be 0 (zero)."

::= { mplsLdpSessionEntry 7 }

mplsLdpSessionMaxPduLength OBJECT-TYPE
SYNTAX Integer32 (0..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 8 }

--
-- MPLS LDP ATM Session Information
--

mplsLdpAtmSessionTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsLdpAtmSessionEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A table of Sessions between the LDP Entities and LDP Peers using ATM as the underlying media.
Each row represents a single session.

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 2 }

mplsLdpAtmSessionEntry OBJECT-TYPE
MplsLdpAtmSessionEntry ::= SEQUENCE {
    mplsLdpSessionAtmLabelRangeLowerBoundVpi     AtmVpIdentifier,
    mplsLdpSessionAtmLabelRangeLowerBoundVci     AtmVcIdentifier,
    mplsLdpSessionAtmLabelRangeUpperBoundVpi     AtmVpIdentifier,
    mplsLdpSessionAtmLabelRangeUpperBoundVci     AtmVcIdentifier
}

mplsLdpSessionAtmLabelRangeLowerBoundVpi OBJECT-TYPE
SYNTAX AtmVpIdentifier
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "The minimum VPI number for this range."
 ::= { mplsLdpAtmSessionEntry 1 }

mplsLdpSessionAtmLabelRangeLowerBoundVci OBJECT-TYPE
SYNTAX AtmVcIdentifier
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "The minimum VCI number for this range."
 ::= { mplsLdpAtmSessionEntry 2 }

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

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

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

mplsLdpFrameRelaySessionTable OBJECT-TYPE
SYNTAX      SEQUENCE OF MplsLdpFrameRelaySessionEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A table of Sessions between the LDP Entities and LDP Peers using Frame Relay as the underlying media.
Each row represents a single session.
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 3 }

MplsLdpFrameRelaySessionEntry OBJECT-TYPE
SYNTAX      MplsLdpFrameRelaySessionEntry
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,
           mplsLdpPeerIndex,
           mplsLdpSessionIndex
           }
::= { mplsLdpFrameRelaySessionTable 1 }

MplsLdpFrameRelaySessionEntry ::= SEQUENCE {
  mplsLdpFrSessionLen     INTEGER,
  mplsLdpFrSessionMinDlci Integer32,
  mplsLdpFrSessionMaxDlci Integer32
}

mplsLdpFrSessionLen OBJECT-TYPE
SYNTAX      INTEGER {
  tenDlciBits(0),
  seventeenDlciBits(1),
  twentyThreeDlciBits(2)
mplsLdpFrSessionMinDlci OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The lower bound of DLCIs which are supported."
::= { mplsLdpFrameRelaySessionEntry 2 }

mplsLdpFrSessionMaxDlci OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The upper bound of DLCIs which are supported."
::= { mplsLdpFrameRelaySessionEntry 3 }

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

mplsLdpSessionStatsTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsLdpSessionStatsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "A table of Sessions between the LDP Entities and LDP Peers."
::= { mplsLdpSessionObjects 4 }

mplsLdpSessionStatsEntry OBJECT-TYPE
SYNTAX MplsLdpSessionStatsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry in this table represents statistical information on a single session between an LDP Entity and LDP Peer."
AUGMENTS { mplsLdpSessionEntry }
::= { mplsLdpSessionStatsTable 1 }

MplsLdpSessionStatsEntry ::= SEQUENCE {
  mplsLdpSessionStatsUnknownMessageTypeErrors Counter32,
  mplsLdpSessionStatsUnknownTlvErrors Counter32
}
mplsLdpSessionStatsUnknownMessageTypeErrors 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."
::= { mplsLdpSessionStatsEntry 1 }

mplsLdpSessionStatsUnknownTlvErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object counts the number of Unknown TLV Errors detected during this session."
::= { mplsLdpSessionStatsEntry 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.
--

mplsLdpSessionPeerAddressTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsLdpSessionPeerAddressEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table 'extends' the mplsLdpSessionTable. This table is used to store Label Address Information from Label Address Message received by this LSR from Peers. This table is read-only and should be updated when Label Withdraw Address Messages are received, i.e. Rows should be deleted as appropriate.

NOTE: since more than one address may be contained in a Label Address Message, this table 'extends', rather than 'AUGMENTS' the mplsLdpSessionTable's information."
::= { mplsLdpSessionObjects 5 }

mplsLdpSessionPeerAddressEntry OBJECT-TYPE
SYNTAX MplsLdpSessionPeerAddressEntry
MAX-ACCESS not-accessible
An entry in this table represents information on a 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, mplsLdpPeerIndex, mplsLdpSessionIndex }

::= { mplsLdpSessionPeerAddressTable 1 }

MplsLdpSessionPeerAddressEntry ::= SEQUENCE {
  mplsLdpSessionPeerNextHopAddressType     AddressFamilyNumbers,
  mplsLdpSessionPeerNextHopAddress         MplsLdpGenAddr
}

mplsLdpSessionPeerNextHopAddressType 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."
::= { mplsLdpSessionPeerAddressEntry 1 }

mplsLdpSessionPeerNextHopAddress 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."
::= { mplsLdpSessionPeerAddressEntry 2 }

-- The MPLS LDP Hello Adjacency Table
--

mplsLdpHelloAdjacencyObjects OBJECT IDENTIFIER ::= { mplsLdpObjects 5 }

mplsLdpHelloAdjacencyTable OBJECT-TYPE
SYNTAX      SEQUENCE OF MplsLdpHelloAdjacencyEntry
MAX-ACCESS  not-accessible
A table of Hello Adjacencies for Sessions.

Each row represents a single LDP Hello Adjacency. An LDP Session can have one or more Hello adjacencies.

An identifier for this specific adjacency.

The time remaining for this Hello Adjacency. This interval will change when the 'next' Hello message which corresponds to this Hello Adjacency is received.
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 }

--
-- MPLS LDP LIB Table
--

mplsLdpLibObjects OBJECT IDENTIFIER ::= { mplsLdpObjects 6 }

mplsLdpLibTable OBJECT-TYPE
SYNTAX      SEQUENCE OF MplsLdpLibEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"This table represents LIB (Label Information Base)
Information. The table is read-only."
::= { mplsLdpLibObjects 1 }

mplsLdpLibEntry OBJECT-TYPE
SYNTAX      MplsLdpLibEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"Each row represents a single LDP LIB entry."
INDEX       { mplsLdpLibLspId }
::= { mplsLdpLibTable 1 }

MplsLdpLibEntry ::= SEQUENCE {
    mplsLdpLibLspId                             Unsigned32,
    mplsLdpLibLabelInIfIndex                    InterfaceIndex,
    mplsLdpLibLabelOutIfIndex                   InterfaceIndex,
    mplsLdpLibLabelType                         MplsLdpLabelTypes,
    mplsLdpLibInLabel                           MplsLdpGenAddr,
    mplsLdpLibOutLabel                          MplsLdpGenAddr
}

mplsLdpLibLspId OBJECT-TYPE
SYNTAX       Unsigned32 (1..4294967295)
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"This number is used to uniquely identify this row, since this
row is associated with a specific LSP, it may also be used
to describe a unique number for an LSP. This number is used
in the mplsLdpFecTable to identify which FECs or FEC is
associated with this LIB entry.
::= { mplsLdpLibEntry 1 }

mplsLdpLibLabelInIfIndex OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The ifIndex of the 'mplsLdpInLabel'."
::= { mplsLdpLibEntry 2 }

mplsLdpLibLabelOutIfIndex OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The ifIndex of the 'mplsLdpOutLabel'."
::= { mplsLdpLibEntry 3 }

mplsLdpLibLabelType OBJECT-TYPE
SYNTAX MplsLdpLabelTypes
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The Layer 2 Label Type for 'mplsLdpInLabel' and 'mplsLdpOutLabel'."
::= { mplsLdpLibEntry 4 }

mplsLdpLibInLabel OBJECT-TYPE
SYNTAX MplsLdpGenAddr
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The incoming label of this LSP."
::= { mplsLdpLibEntry 5 }

mplsLdpLibOutLabel OBJECT-TYPE
SYNTAX MplsLdpGenAddr
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The outgoing label of this LSP."
::= { mplsLdpLibEntry 6 }

--
-- Mpls Ldp FEC Table
--

mplsLdpFecTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsLdpFecEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table represents the FEC
(Forwarding Equivalence Class)
Information associated with an LSP.
The table is read-only."
::= { mplsLdpLibObjects 2 }

mplsLdpFecEntry OBJECT-TYPE
SYNTAX MplsLdpFecEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Each row represents a single FEC Element."
INDEX { mplsLdpFecType,
mplsLdpFecAddressFamily,
mplsLdpFecAddressLength,
mplsLdpFecAddress }
::= { mplsLdpFecTable 1 }

MplsLdpFecEntry ::= SEQUENCE {
mplsLdpFecType INTEGER,
mplsLdpFecAddressFamily AddressFamilyNumbers,
mplsLdpFecAddressLength Integer32(0..255),
mplsLdpFecAddress MplsLdpGenAddr,
mplsLdpFecLspId Unsigned32
}

mplsLdpFecType OBJECT-TYPE
SYNTAX INTEGER {
prefix(1),
hostAddress(2)
}
MAX-ACCESS not-accessible
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."
::= { mplsLdpFecEntry 1 }

mplsLdpFecAddressFamily OBJECT-TYPE
SYNTAX AddressFamilyNumbers
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The value of this object is from the Address Family Numbers."
::= { mplsLdpFecEntry 2 }

mplsLdpFecAddressLength OBJECT-TYPE
SYNTAX      Integer32(0..255)
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"If the value of ‘mplsLdpFecType’ is ‘prefix(1)’ then the value of this object is the length in bits of the address prefix represented by ‘mplsLdpFecAddress’, 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. ‘mplsLdpFecAddress’ will have the value of zero.)"
::= { mplsLdpFecEntry 3 }

mplsLdpFecAddress OBJECT-TYPE
SYNTAX      MplsLdpGenAddr
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"If the value of ‘mplsLdpFecType’ is ‘prefix(1)’ then the value of this object is the address prefix. If the value of the ‘mplsLdpFecAddressLength’ object is zero, then this object should also be zero."
::= { mplsLdpFecEntry 4 }

mplsLdpFecLspId OBJECT-TYPE
SYNTAX      Unsigned32 (1..4294967295)
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"This number represents the LSP which is related to this FEC. The value of this object should correspond to an entry in the MplsLdpLibTable, as denoted by the ‘mplsLdpLibLspId’ object. In other words, this object and the ‘mplsLdpLibLspId’ should have the same value."
::= { mplsLdpFecEntry 5 }
--- Notifications ---

mplsLdpNotificationPrefix  OBJECT IDENTIFIER ::=  
{ mplsLdpNotifications 0 }

mplsLdpFailedInitSessionThresholdExceeded NOTIFICATION-TYPE
OBJECTS  
{ mplsLdpEntityFailedInitSessionThreshold }
STATUS current
DESCRIPTION
"This notification is generated whenever the value of mplsLdpEntityFailedInitSessionThreshold is exceeded."
::= { mplsLdpNotificationPrefix 1 }

mplsLdpPathVectorLimitMismatch NOTIFICATION-TYPE
OBJECTS  
{ mplsLdpPeerPathVectorLimit, mplsLdpSessionPathVectorLimit }
STATUS current
DESCRIPTION
"This notification is generated when the value of mplsLdpSessionPathVectorLimit does NOT match the value of the mplsLdpPeerPathVectorLimit for the corresponding mplsLdpPeerEntry."
REFERENCE
"LDP Specification, Section 3.5.3."
::= { mplsLdpNotificationPrefix 2 }

--***************************************************************
-- 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 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."
::= { mplsLdpCompliances 1 }

-- units of conformance

mplsLdpGeneralGroup OBJECT-GROUP
OBJECTS {
mplsLdpLsrId,
mplsLdpLsrLabelRetentionMode,
mplsLdpEntityWellKnownDiscoveryPort,
mplsLdpEntityMtu,
mplsLdpEntityKeepAliveHoldTimer,
mplsLdpEntityFailedInitSessionThreshold,
mplsLdpEntityLabelDistributionMethod,
mplsLdpEntityOptionalParameters,
mplsLdpEntityRowStatus,
mplsLdpAttemptedSessions,
mplsLdpSessionRejectedNoHelloErrors,
mplsLdpSessionRejectedAdvertisementErrors,
mplsLdpSessionRejectedMaxPduErrors,
mplsLdpSessionRejectedLabelRangeErrors,
mplsLdpBadLdpIdentifierErrors,
mplsLdpBadPduLengthErrors,
mplsLdpBadMessageLengthErrors,
mplsLdpBadTlvLengthErrors,
mplsLdpMalformedTlvValueErrors,
mplsLdpKeepAliveTimerExpiredErrors,
mplsLdpShutdownNotifReceived,
mplsLdpShutdownNotifSent,
mplsLdpPeerInternetworkAddrType,
mplsLdpPeerInternetworkAddr,
mplsLdpPeerLabelDistributionMethod,
mplsLdpPeerLoopDetectionForPv,
mplsLdpPeerPathVectorLimit,
mplsLdpSessionState,
mplsLdpSessionProtocolVersion,
mplsLdpSessionKeepAliveHoldTimeRemaining,
mplsLdpSessionLabelAdvertisement,
mplsLdpSessionLoopDetectionForPV,
mplsLdpSessionPathVectorLimit,
mplsLdpSessionMaxPduLength,
mplsLdpSessionStatsUnknownMessageTypeErrors,
mplsLdpSessionStatsUnknownTlvErrors,
mplsLdpSessionPeerNextHopAddressType,
mplsLdpSessionPeerNextHopAddress,
mplsLdpHelloAdjacencyHoldTimeRemaining,
mplsLdpHelloAdjacencyType,
mplsLdpLibLabelInIfIndex,
mplsLdpLibLabelOutIfIndex,
mplsLdpLibLabelType,
mplsLdpLibInLabel,
mplsLdpLibOutLabel,
mplsLdpFecLspId

}  
STATUS      current
DESCRIPTION
"Objects that apply to all MPLS LDP implementations."
::= { mplsLdpGroups 1 }

mplsLdpAtmGroup OBJECT-GROUP
OBJECTS {
  mplsLdpEntityAtmMergeCap,
  mplsLdpEntityAtmLabelRangeComponents,
  mplsLdpEntityAtmVcDirectionality,
  mplsLdpEntityAtmRowStatus,
  mplsLdpEntityConfAtmLabelRangeMinimumVpi,
  mplsLdpEntityConfAtmLabelRangeMinimumVci,
  mplsLdpEntityConfAtmLabelRangeMaximumVpi,
  mplsLdpEntityConfAtmLabelRangeMaximumVci,
  mplsLdpEntityConfAtmLabelRangeRowStatus,
  mplsLdpSessionAtmLabelRangeLowerBoundVpi,
  mplsLdpSessionAtmLabelRangeLowerBoundVci,
  mplsLdpSessionAtmLabelRangeUpperBoundVpi,
  mplsLdpSessionAtmLabelRangeUpperBoundVci
}
STATUS      current
DESCRIPTION
"Objects that apply to all MPLS LDP implementations over ATM."
::= { mplsLdpGroups 2 }

Expires April 2000
mplsLdpFrameRelayGroup OBJECT-GROUP
  OBJECTS {
    mplsLdpEntityFrMergeCap,
    mplsLdpEntityFrLabelRangeComponents,
    mplsLdpEntityFrVcDirectionality,
    mplsLdpEntityFrParmRowStatus, 
    mplsLdpConfFrLen, 
    mplsLdpConfFrMinimumDlci, 
    mplsLdpConfFrMaximumDlci, 
    mplsLdpConfFrRowStatus, 
    mplsLdpFrSessionLen, 
    mplsLdpFrSessionMinDlci, 
    mplsLdpFrSessionMaxDlci 
  }
  STATUS current
  DESCRIPTION
  "Objects that apply to all MPLS LDP implementations over Frame Relay."
  ::= { mplsLdpGroups 3 }

mplsLdpNotificationsGroup NOTIFICATION-GROUP
  NOTIFICATIONS { mplsLdpFailedInitSessionThresholdExceeded, 
    mplsLdpPathVectorLimitMismatch 
  }
  STATUS current
  DESCRIPTION
  "The notification(s) which an MPLS LDP implementation is required to implement."
  ::= { mplsLdpGroups 4 }

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-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, mplsLdpFrameRelaySessionTable, 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.

5.2. 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, mplsLdpLsrLoopDetectionAdminStatus, 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. TO DO List

This section should be removed when this document is published as an RFC. This section outlines the next areas the authors intend to address in subsequent revisions.

- Remove the following sections prior to final publication: IANA Considerations Section, Revisions Section and this (TO DO List) Section.

- Updates as suggested by review of working group.

7. 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.
8. References


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


9. Security Considerations

Assuming that secure network management (such as SNMP v3) is implemented, the objects represented in this MIB do not pose a threat to the security of the network.

10. Authors' Addresses

James V. Luciani
Nortel Networks
3 Federal Street
Mail Stop: BL3-03
Billerica, MA 01821
Phone: (978) 288-4734
Email: luciani@baynetworks.com

Hans Sjostrand
Ericsson
Business Unit Datacom Networks and IP Services
S-126 25 Stockholm, Sweden
Phone: +46 8 719 9960
Email: hans.sjostrand@etx.ericsson.se

Joan Cucchiara
IronBridge Networks
55 Hayden Ave., Suite 1000
Lexington, MA 02421
Phone: (781) 372-8236
Email: joan@ironbridgenetworks.com
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12. IANA Address Family Numbers MIB

This section is copied verbatim from the RFC2677 [26]. This section
will be removed in future versions of this draft. This section was
copied here for convenience, as it is IMPORTED into the LDP MIB.

The Internet Assigned Numbers Authority (IANA) has been and continues
to be responsible for maintaining the ADDRESS FAMILY NUMBERS
(http://www.isi.edu/in-notes/iana/assignments/address-family-numbers)
name space assignments. The IANA has placed this list in a MIB
module, such that it may be imported into other MIBs. The motivation
for doing this is to allow MIBs to not have to change when a new
assignment is made to the ADDRESS FAMILY NUMBERS. This is very
similar to the motivation behind the IANAifType-MIB.

Any additions or changes to the list of ADDRESS FAMILY NUMBERS
registered via IANA will be done as they have in the past and this
document does not propose any changes to the ADDRESS FAMILY NUMBERS
other than to place them into a MIB, which can be found via anonymous