Multiprotocol Label Switching (MPLS) Traffic Engineering (TE)
Management Information Base (MIB)

Status of this Memo

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

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Abstract

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

Table of Contents

1. Introduction ........................................... 2
2. Terminology ........................................... 2
3. The Internet-Standard Management Framework ............. 3
4. Feature List ........................................... 3
5. Outline ................................................ 3
   5.1 Summary of Traffic Engineering MIB Module ............ 4
6. Brief Description of MIB Objects ........................ 4
   6.1. mplsTunnelTable .................................. 4
   6.2. mplsTunnelResourceTable .......................... 5
   6.3. mplsTunnelHopTable ............................... 5
   6.4. mplsTunnelARHopTable ............................. 5
   6.5. mplsTunnelCHoptable ............................... 5
   6.6. mplsTunnelPerfTable .............................. 6
   6.7. mplsTunnelCRLDPResTable ......................... 6
7. Use of 32-bit and 64-bit Counters ....................... 6
This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects for modeling a Multiprotocol Label Switching (MPLS) [RFC3031] based traffic engineering. This MIB module should be used in conjunction with the companion document [RFC3813] for MPLS based traffic engineering configuration and management.

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 BCP 14, RFC 2119, reference [RFC2119].

2. Terminology

This document uses terminology from the MPLS architecture document [RFC3031] and MPLS Label Switch Router MIB [RFC3813]. Some frequently used terms are described next.

An explicitly routed LSP (ERLSP) is referred to as an MPLS tunnel. It consists of in-segment(s) and/or out-segment(s) at the egress/ingress LSRs, each segment being associated with one MPLS interface. These are also referred to as tunnel segments. Additionally, at an intermediate LSR, we model a connection as consisting of one or more in-segments and/or one or more out-segments. The binding or interconnection between in-segments and out-segments is performed using a cross-connect. These objects are defined in the MPLS Label Switch Router MIB [RFC3813].
3. The Internet-Standard Management Framework

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

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

4. Feature List

The MPLS traffic engineering MIB module is designed to satisfy the following requirements and constraints:

- The MIB module supports configuration of point-to-point unidirectional tunnels.
- MPLS tunnels need not be interfaces, but it is possible to configure a tunnel as an interface.
- The MIB module supports tunnel establishment via an MPLS signalling protocol wherein the tunnel parameters are specified using this MIB module at the head end of the LSP, and end-to-end tunnel LSP establishment is accomplished via signalling. The MIB module also supports manually configured tunnels, i.e., those for which label associations at each hop of the tunnel LSP are provisioned by the administrator via the LSR MIB [RFC3813].
- The MIB module supports persistent, as well as non-persistent tunnels.

5. Outline

Traffic engineering support for MPLS tunnels requires the following configuration:

- Setting up MPLS tunnels along with appropriate configuration parameters.
- Configuring tunnel for loose and strict source routed hops.
These actions may need to be accompanied by corresponding actions using [RFC3813] to establish and configure tunnel segments, if this is done manually. Also, the in-segment and out-segment performance tables, mplsInSegmentPerfTable, and mplsOutSegmentPerfTable [RFC3813], should be used to determine performance of the tunnels and tunnel segments, in addition to mplsTunnelPerfTable in this MIB module.

5.1. Summary of Traffic Engineering MIB Module

The MIB module objects for performing these actions consist of the following tables:

- Tunnel table (mplsTunnelTable) for setting up MPLS tunnels.
- Resource table (mplsTunnelResourceTable) for setting up the tunnel resources.
- Tunnel specified, actual, and computed hop tables (mplsTunnelHopTable, mplsTunnelARHopTable, and mplsTunnelCHopTable) for strict and loose source routed MPLS tunnel hops.
- Tunnel performance table (mplsTunnelPerfTable) for measuring tunnel performance.
- CRLDP resource table (mplsTunnelCRLDPResTable) for specifying resource objects applicable to tunnels signaled using CRLDP.

These tables are described in the subsequent sections.

6. Brief Description of MIB Objects

The objects described in this section support the functionality described in documents [RFC3209] and [RFC3212]. The tables support both manually configured and signaled tunnels.

6.1. mplsTunnelTable

The mplsTunnelTable allows new MPLS tunnels to be created between an MPLS LSR and a remote endpoint, and existing tunnels to be reconfigured or removed. Note that we only support point-to-point tunnels, although multipoint-to-point and point-to-multipoint connections are supported by an LSR acting as a cross-connect. Each MPLS tunnel can thus have one out-segment originating at an LSR and/or one in-segment terminating at that LSR.
mplsTunnelTable does not define the in and out segments forming the tunnel. Instead, these are defined by creating rows in the in-segment and out-segment tables, defining relationships in the cross-connect table, and referring to these rows in the mplsTunnelTable using a cross-connect index, mplsTunnelXCIndex. These segment and cross-connect related objects are defined in [RFC3813].

6.2. mplsTunnelResourceTable

mplsTunnelResourceTable is used to indicate the resources required for a tunnel. Multiple tunnels may share the same resources by pointing to the same entry in this table. Tunnels that do not share resources must point to separate entries in this table.

6.3. mplsTunnelHopTable

mplsTunnelHopTable is used to indicate the hops, strict or loose, for an MPLS tunnel defined in mplsTunnelTable, when it is established via signalling. Multiple tunnels may share the same hops by pointing to the same entry in this table. Each row also has a secondary index, mplsTunnelHopIndex, corresponding to the next hop of this tunnel. The scalar mplsTunnelMaxHops indicates the maximum number of hops that can be specified on each tunnel supported by this LSR.

At transit LSRs, this table contains the hops, strict or loose, that apply to the downstream part of this tunnel only. This corresponds to the requested path received through the signaling protocol.

6.4. mplsTunnelARHopTable

mplsTunnelARHopTable is used to indicate the actual hops traversed by a tunnel as reported by the MPLS signalling protocol after the tunnel is setup. The support of this table is optional since not all MPLS signalling protocols may support this feature.

At transit LSRs, this table contains the actual hops traversed by the tunnel along its entire length if that information is available. This corresponds to the recorded path reported by the MPLS signalling protocol, possibly derived from multiple signaling messages.

6.5. mplsTunnelCHopTable

mplsTunnelCHopTable lists the actual hops computed by a constraint-based routing algorithm based on the mplsTunnelHopTable for the MPLS signalling protocol in use. The support of this table is optional since not all implementations may support computation of hop lists using a constraint-based routing protocol.
At transit LSRs, this table contains the hops computed to apply to the downstream part of this tunnel. This corresponds to the requested path signaled from this LSR through the signaling protocol.

6.6. mplsTunnelPerfTable

mplsTunnelPerfTable provides several counters to measure the performance of the MPLS tunnels. This table augments mplsTunnelTable.

6.7. mplsTunnelCRLDPResTable

mplsTunnelCRLDPResTable contains resource information for those tunnels that are signaled using CRLDP [RFC3212]. This is a sparse extension to mplsTunnelResourceTable and is also indexed by mplsTunnelResourceIndex. As with mplsTunnelResourceTable, multiple tunnels may share the same resources by pointing to the same entry in this table. Tunnels that do not share resources must point to separate entries in this table. The mplsTunnelCRLDPResTable may be supported only by implementations that support the CR-LDP signaling protocol.

7. Use of 32-bit and 64-bit Counters

64-bit counters are provided in this MIB module for high-speed interfaces where the use of 32-bit counters might be impractical. The requirements on the use of 32-bit and 64-bit counters (copied verbatim from [RFC2863]) are as follows:

For interfaces that operate at 20,000,000 (20 million) bits per second or less, 32-bit byte and packet counters MUST be supported. For interfaces that operate faster than 20,000,000 bits/second, and slower than 650,000,000 bits/second, 32-bit packet counters MUST be supported and 64-bit octet counters MUST be supported. For interfaces that operate at 650,000,000 bits/second or faster, 64-bit packet counters AND 64-bit octet counters MUST be supported.

8. Application of the Interface Group to MPLS Tunnels

The Interfaces Group of MIB II defines generic managed objects for managing interfaces. This memo contains the media-specific extensions to the Interfaces Group for managing MPLS Tunnels as logical interfaces.

This memo assumes the interpretation of the Interfaces Group to be in accordance with [RFC2863] which states that the interfaces table (ifTable) contains information on the managed resource's interfaces and that each sub-layer below the internetwork layer of a network...
interface is considered an interface. Thus, the MPLS interface is represented as an entry in the ifTable. The inter-relation of entries in the ifTable is defined by the Interfaces Stack Group defined in [RFC2863].

When using MPLS Tunnels as interfaces, the interface stack table might appear as follows:

+------------------------------------------------+
| MPLS tunnel interface ifType = mplsTunnel(150) |
+------------------------------------------------+
|                                  +-------------+
|                                  | MPLS interface ifType = mpls(166) |
+------------------------------------------------+
|                                  +-------------+
|                                  | Underlying layer  |
+------------------------------------------------+

In the above diagram, "Underlying Layer" refers to the ifIndex of any interface type for which MPLS internetworking has been defined. Examples include ATM, Frame Relay, and Ethernet.

8.1. Support of the MPLS Tunnel Interface by ifTable

Some specific interpretations of the ifTable for those MPLS tunnels represented as interfaces follow:

Object Use for the MPLS tunnel.
ifIndex Each MPLS tunnel is represented by an ifEntry.
ifDescr Description of the MPLS tunnel.
ifType The value that is allocated for the MPLS tunnel is 150.
ifSpeed The total bandwidth in bits per second for use by the MPLS tunnel.
ifPhysAddress Unused.
ifAdminStatus See [RFC2863].
ifOperStatus This value reflects the actual operational status of the MPLS tunnel. Assumes the value down(2) if the MPLS tunnel is down.
ifLastChange See [RFC2863].
ifInOctets             The number of octets received over the
                        MPLS tunnel.

ifOutOctets            The number of octets transmitted over
                        the MPLS tunnel.

ifInErrors             The number of labeled packets dropped
due to uncorrectable errors.

ifInUnknownProtos      The number of received packets
                        discarded during packet header
                        validation, including packets with
                        unrecognized label values.

ifOutErrors            See [RFC2863].

ifName                 Textual name (unique on this system) of
                        the MPLS tunnel or an octet string of
                        zero length.

ifLinkUpDownTrapEnable Default is disabled (2).

ifConnectorPresent     Set to false (2).

ifHighSpeed            See [RFC2863].

ifHCInOctets           The 64-bit version of ifInOctets;
                        supported if required by the compliance
                        statements in [RFC2863].

ifHCOOutOctets         The 64-bit version of ifOutOctets;
                        supported if required by the compliance
                        statements in [RFC2863].

ifAlias                The non-volatile 'alias' name for the
                        MPLS tunnel as specified by a network
                        manager.

9.  Example of Tunnel Setup

This section contains an example of which MIB objects should be
modified if one would like to create a best effort, loosely routed,
unidirectional traffic engineered tunnel, which spans two hops of a
simple network. Note that these objects should be created on the
"head-end" LSR. Those objects relevant to illustrating the
relationships amongst different tables are shown here. Other objects
may be needed before conceptual row activation can happen.
The RowStatus values shown in this section are those to be used in the set request, typically createAndGo(4) which is used to create the conceptual row and have its status immediately set to active. A subsequent retrieval operation on the conceptual row will return a different value, such as active(1). Please see [RFC2579] for a detailed discussion on the use of RowStatus.

In mplsTunnelResourceTable:

```
{  
  mplsTunnelResourceIndex    = 5,  
  mplsTunnelResourceMaxRate  = 0,  
  mplsTunnelResourceMeanRate = 0,  
  mplsTunnelResourceMaxBurstSize = 0,  
  mplsTunnelResourceMeanBurstSize = 0,  
  mplsTunnelResourceExBurstSize = 0,  
  mplsTunnelResourceExBurstSize = unspecified (1),  
  mplsTunnelResourceWeight   = 0,  
  -- Mandatory parameters needed to activate the row go here  
  mplsTunnelResourceRowStatus = createAndGo (4)  
}
```

The next two instances of mplsTunnelHopEntry are used to denote the hops this tunnel will take across the network.

The following denotes the beginning of the tunnel, or the first hop. We have used the fictitious LSR identified by "192.168.100.1" as our example head-end router.

In mplsTunnelHopTable:

```
{  
  mplsTunnelHopListIndex          = 1,  
  mplsTunnelPathOptionIndex       = 1,  
  mplsTunnelHopIndex              = 1,  
  mplsTunnelHopAddrType           = ipv4 (1),  
  mplsTunnelHopIpAddr             = "192.168.100.1",  
  mplsTunnelHopIpPrefixLen        = 32,  
  mplsTunnelHopType               = strict (2),  
  mplsTunnelHopInclude            = true (1),  
  mplsTunnelHopPathOptionName     = "Here to there",  
  mplsTunnelHopEntryPathComp      = explicit (2),  
  -- Mandatory parameters needed to activate the row go here  
  mplsTunnelHopRowStatus          = createAndGo (4)  
}
```
The following denotes the end of the tunnel, or the last hop in our example. We have used the fictitious LSR identified by "192.168.101.1" as our end router.

In mplsTunnelHopTable:

```
{  
    mplsTunnelHopListIndex          = 1,  
    mplsTunnelPathOptionIndex       = 1,  
    mplsTunnelHopIndex              = 2,  
    mplsTunnelHopAddrType           = ipv4 (1),  
    mplsTunnelHopIpAddr             = "192.168.101.1",  
    mplsTunnelHopIpPrefixLen        = 32,  
    mplsTunnelHopType               = loose (2),  
    mplsTunnelHopInclude            = true (1),  
    mplsTunnelHopPathOptionName     = "Here to there",  
    mplsTunnelHopEntryPathComp      = explicit (2),  
    -- Mandatory parameters needed to activate the row go here  
    mplsTunnelHopRowStatus          = createAndGo (4)  
}
```

The following denotes the configured tunnel "head" entry:

In mplsTunnelTable:

```
{  
    mplsTunnelIndex              = 1,  
    mplsTunnelInstance           = 0,  
    mplsTunnelIngressLSRId       = 192.168.100.1,  
    mplsTunnelEgressLSRId        = 192.168.101.1,  
    mplsTunnelName               = "My first tunnel",  
    mplsTunnelDescr              = "Here to there",  
    mplsTunnelIsIf               = true (1),  
    -- RowPointer MUST point to the first accessible column  
    mplsTunnelXCPointer          = 0.0,  
    mplsTunnelSignallingProto    = none (1),  
    mplsTunnelSetupPrio          = 0,  
    mplsTunnelHoldingPrio        = 0,  
    mplsTunnelSessionAttributes  = 0,  
    mplsTunnelLocalProtectInUse  = false (0),  
    -- RowPointer MUST point to the first accessible column  
    mplsTunnelResourcePointer    = mplsTunnelResourceMaxRate.5,  
    mplsTunnelInstancePriority   = 1,  
    mplsTunnelHopTableIndex      = 1,  
    mplsTunnelIncludeAnyAffinity = 0,  
    mplsTunnelIncludeAllAffinity = 0,  
    mplsTunnelExcludeAnyAffinity = 0,  
    mplsTunnelPathInUse          = 1,  
}
```
mplsTunnelRole = head (1),
-- Mandatory parameters needed to activate the row go here
mplsTunnelRowStatus = createAndGo (4)
}

Note that any active or signaled instances of the above tunnel would appear with the same primary mplsTunnelIndex, but would have values greater than 0 for mplsTunnelInstance. They would also have other objects such as the mplsTunnelXCPointer set accordingly.

10. The Use of RowPointer

RowPointer is a textual convention used to identify a conceptual row in a conceptual table in a MIB by pointing to the first accessible object. In this MIB module, in mplsTunnelTable, the objects mplsTunnelXCPointer and mplsTunnelResourcePointer are of type RowPointer. The object mplsTunnelXCPointer points to a specific entry in the mplsXCTable [RFC3813]. This entry in the mplsXCTable is the associated LSP for the given MPLS tunnel entry. The object mplsTunnelResourcePointer points to a specific entry in a traffic parameter table. An example of such a traffic parameter table is mplsTunnelResourceTable. It indicates a specific instance of a traffic parameter entry that is associated with a given MPLS tunnel entry. These RowPointer objects MUST point to the first instance of the first accessible columnar object in the appropriate conceptual row in order to allow the manager to find the appropriate corresponding entry in either MPLS-LSR-STD-MIB [RFC3813] or MPLS-TE-STD-MIB. If object mplsTunnelXCPointer returns zeroDotZero, it implies that there is no LSP associated with that particular instance of tunnel entry. If object mplsTunnelResourcePointer returns zeroDotZero, it implies that there is no QoS resource associated with that particular instance of tunnel entry.

11. MPLS Traffic Engineering MIB Definitions

MPLS-TE-STD-MIB DEFINITIONS ::= BEGIN

IMPORTS
   MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
   Integer32, Unsigned32, Counter32, Counter64, TimeTicks,
   zeroDotZero
   FROM SNMPv2-SMI -- [RFC2578]
   MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
   FROM SNMPv2-CONF -- [RFC2580]
   TruthValue, RowStatus, RowPointer, StorageType,
   TimeStamp
   FROM SNMPv2-TC -- [RFC2579]
   InterfaceIndexOrZero, ifGeneralInformationGroup,
ifCounterDiscontinuityGroup
FROM IF-MIB -- [RFC2863]
mplsStdMIB, MplsBitRate, MplsBurstSize, MplsLSPID,
MplsTunnelIndex, MplsTunnelInstanceId,
MplsTunnelAffinity, MplsExtendedTunnelId, MplsPathIndex,
MplsPathIndexOrZero, MplsOwner, TeHopAddressType,
TeHopAddress, TeHopAddressAS, TeHopAddressUnnum
FROM MPLS-TC-STD-MIB -- [RFC3811]
SnmpAdminString
FROM SNMP-FRAMEWORK-MIB -- [RFC3411]
IndexIntegerNextFree
FROM DIFFSERV-MIB -- [RFC3289]
InetAddressPrefixLength
FROM INET-ADDRESS-MIB -- [RFC3291]
;

mplsTeStdMIB MODULE-IDENTITY
LAST-UPDATED "200406030000Z" -- June 3, 2004
ORGANIZATION "Multiprotocol Label Switching (MPLS) Working Group"
CONTACT-INFO
"        Cheenu Srinivasan
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        Comments about this document should be emailed
directly to the MPLS working group mailing list at
mpls@uu.net."

DESCRIPTION
"Copyright (C) The Internet Society (2004). The
initial version of this MIB module was published
in RFC 3812. For full legal notices see the RFC
itself or see: http://www.ietf.org/copyrights/ianamib.html

This MIB module contains managed object definitions
for MPLS Traffic Engineering (TE) as defined in:
1. Extensions to RSVP for LSP Tunnels, Awduche et
   al, RFC 3209, December 2001
2. Constraint-Based LSP Setup using LDP, Jamoussi

-- Revision history.

REVISION
"200406030000Z" -- June 3, 2004
DESCRIPTION
"Initial version issued as part of RFC 3812."

::= { mplsStdMIB 3 }

-- Top level components of this MIB module.

-- traps
mplsTeNotifications OBJECT IDENTIFIER ::= { mplsTeStdMIB 0 }

-- tables, scalars
mplsTeScalars OBJECT IDENTIFIER ::= { mplsTeStdMIB 1 }

mplsTeObjects OBJECT IDENTIFIER ::= { mplsTeStdMIB 2 }

-- conformance
mplsTeConformance OBJECT IDENTIFIER ::= { mplsTeStdMIB 3 }

-- MPLS Tunnel scalars.

mplsTunnelConfigured OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of tunnels configured on this device. A tunnel is considered configured if the mplsTunnelRowStatus is active(1)."

::= { mplsTeScalars 1 }

mplsTunnelActive OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of tunnels active on this device. A tunnel is considered active if the mplsTunnelOperStatus is up(1)."

::= { mplsTeScalars 2 }

mplsTunnelTEDistProto OBJECT-TYPE
SYNTAX        BITS {
          other (0),
          ospf (1),
          isis (2)
        }
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "The traffic engineering distribution protocol(s) used by this LSR. Note that an LSR may support more than one distribution protocol simultaneously."
 ::= { mplsTeScalars 3 }

mplsTunnelMaxHops OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "The maximum number of hops that can be specified for a tunnel on this device."
 ::= { mplsTeScalars 4 }

mplsTunnelNotificationMaxRate OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
  "This variable indicates the maximum number of notifications issued per second. If events occur more rapidly, the implementation may simply fail to emit these notifications during that period, or may queue them until an appropriate time. A value of 0 means no throttling is applied and events may be notified at the rate at which they occur."
DEFVAL       { 0 }
 ::= { mplsTeScalars 5 }

-- End of MPLS Tunnel scalars.

-- MPLS tunnel table.

mplsTunnelIndexNext OBJECT-TYPE
SYNTAX        IndexIntegerNextFree (0..65535)
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "This object contains an unused value for
mplsTunnelIndex, or a zero to indicate that none exist. Negative values are not allowed, as they do not correspond to valid values of mplsTunnelIndex.

Note that this object offers an unused value for an mplsTunnelIndex value at the ingress side of a tunnel. At other LSRs the value of mplsTunnelIndex SHOULD be taken from the value signaled by the MPLS signaling protocol.

::= { mplsTeObjects 1 }

mplsTunnelTable OBJECT-TYPE
SYNTAX        SEQUENCE OF MplsTunnelEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"The mplsTunnelTable allows new MPLS tunnels to be created between an LSR and a remote endpoint, and existing tunnels to be reconfigured or removed. Note that only point-to-point tunnel segments are supported, although multipoint-to-point and point-to-multipoint connections are supported by an LSR acting as a cross-connect. Each MPLS tunnel can thus have one out-segment originating at this LSR and/or one in-segment terminating at this LSR."

::= { mplsTeObjects 2 }

mplsTunnelEntry OBJECT-TYPE
SYNTAX        MplsTunnelEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"An entry in this table represents an MPLS tunnel. An entry can be created by a network administrator or by an SNMP agent as instructed by an MPLS signalling protocol. Whenever a new entry is created with mplsTunnelIsIf set to true(1), then a corresponding entry is created in ifTable as well (see RFC 2863). The ifType of this entry is mplsTunnel(150).

A tunnel entry needs to be uniquely identified across a MPLS network. Indices mplsTunnelIndex and mplsTunnelInstance uniquely identify a tunnel on the LSR originating the tunnel. To uniquely identify a tunnel across an MPLS network requires
index mplsTunnelIngressLSRId. The last index mplsTunnelEgressLSRId is useful in identifying all instances of a tunnel that terminate on the same egress LSR.”

REFERENCE
"1. RFC 2863 - The Interfaces Group MIB, McCloghrie, K., and F. Kastenholtz, June 2000 "

INDEX { mplsTunnelIndex,
    mplsTunnelInstance,
    mplsTunnelIngressLSRId,
    mplsTunnelEgressLSRId }
 ::= { mplsTunnelTable 1 }

MplsTunnelEntry ::= SEQUENCE {
    mplsTunnelIndex              MplsTunnelIndex,
    mplsTunnelInstance           MplsTunnelInstanceIndex,
    mplsTunnelIngressLSRId       MplsExtendedTunnelId,
    mplsTunnelEgressLSRId        MplsExtendedTunnelId,
    mplsTunnelName               SnmpAdminString,
    mplsTunnelDescr              SnmpAdminString,
    mplsTunnelIf                 TruthValue,
    mplsTunnelIfIndex            InterfaceIndexOrZero,
    mplsTunnelOwner              MplsOwner,
    mplsTunnelRole               INTEGER,
    mplsTunnelXCPointer          RowPointer,
    mplsTunnelSignallingProto    INTEGER,
    mplsTunnelSetupPrio          Integer32,
    mplsTunnelHoldingPrio        Integer32,
    mplsTunnelSessionAttributes  BITS,
    mplsTunnelLocalProtectInUse  TruthValue,
    mplsTunnelResourcePointer    RowPointer,
    mplsTunnelPrimaryInstance    MplsTunnelInstanceIndex,
    mplsTunnelInstancePriority   Unsigned32,
    mplsTunnelHopTableIndex      MplsPathIndexOrZero,
    mplsTunnelPathInUse          MplsPathIndexOrZero,
    mplsTunnelARHopTableIndex    MplsPathIndexOrZero,
    mplsTunnelCHopTableIndex     MplsPathIndexOrZero,
    mplsTunnelIncludeAnyAffinity MplsTunnelAffinity,
    mplsTunnelIncludeAllAffinity MplsTunnelAffinity,
    mplsTunnelExcludeAnyAffinity MplsTunnelAffinity,
    mplsTunnelTotalUpTime        TimeTicks,
    mplsTunnelInstanceUpTime     TimeTicks,
    mplsTunnelPrimaryUpTime      TimeTicks,
    mplsTunnelPathChanges        Counter32,
    mplsTunnelLastPathChange     TimeTicks,
    mplsTunnelCreationTime       TimeStamp,
    mplsTunnelStateTransitions   Counter32,
mplsTunnelAdminStatus INTEGER,
mplsTunnelOperStatus INTEGER,
mplsTunnelRowStatus RowStatus,
mplsTunnelStorageType StorageType
}

mplsTunnelIndex OBJECT-TYPE
SYNTAX MplsTunnelIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Uniquely identifies a set of tunnel instances between a pair of ingress and egress LSRs. Managers should obtain new values for row creation in this table by reading mplsTunnelIndexNext. When the MPLS signalling protocol is rsvp(2) this value SHOULD be equal to the value signaled in the Tunnel Id of the Session object. When the MPLS signalling protocol is crldp(3) this value SHOULD be equal to the value signaled in the LSP Id."
::= { mplsTunnelEntry 1 }

mplsTunnelInstance OBJECT-TYPE
SYNTAX MplsTunnelInstanceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Uniquely identifies a particular instance of a tunnel between a pair of ingress and egress LSRs. It is useful to identify multiple instances of tunnels for the purposes of backup and parallel tunnels. When the MPLS signaling protocol is rsvp(2) this value SHOULD be equal to the LSP Id of the Sender Template object. When the signaling protocol is crldp(3) there is no equivalent signaling object."
::= { mplsTunnelEntry 2 }

mplsTunnelIngressLSRId OBJECT-TYPE
SYNTAX MplsExtendedTunnelId
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Identity of the ingress LSR associated with this tunnel instance. When the MPLS signalling protocol is rsvp(2) this value SHOULD be equal to the Tunnel
Sender Address in the Sender Template object and MAY be equal to the Extended Tunnel Id field in the SESSION object. When the MPLS signalling protocol is crldp(3) this value SHOULD be equal to the Ingress LSR Router ID field in the LSPID TLV object.

REFERENCE

1. RSVP-TE: Extensions to RSVP for LSP Tunnels, Awduche et al, RFC 3209, December 2001
2. Constraint-Based LSP Setup using LDP, Jamoussi (Editor), RFC 3212, January 2002

::= { mplsTunnelEntry 3 }

mplsTunnelEgressLSRId OBJECT-TYPE
SYNTAX MplsExtendedTunnelId
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Identity of the egress LSR associated with this tunnel instance."
::= { mplsTunnelEntry 4 }

mplsTunnelName OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The canonical name assigned to the tunnel. This name can be used to refer to the tunnel on the LSR’s console port. If mplsTunnelIsIf is set to true then the ifName of the interface corresponding to this tunnel should have a value equal to mplsTunnelName. Also see the description of ifName in RFC 2863."
REFERENCE
"RFC 2863 - The Interfaces Group MIB, McCloghrie, K., and F. Kastenholtz, June 2000"
DEFVAL {""
::= { mplsTunnelEntry 5 }

mplsTunnelDescr OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-create
STATUS current
DESCRIPTION "A textual string containing information about the tunnel. If there is no description this object contains a zero length string. This object is may not be signaled by MPLS signaling protocols,"
consequently the value of this object at transit and egress LSRs MAY be automatically generated or absent."

DEFVAL {""}
::= { mplsTunnelEntry 6 }

mplsTunnelIsIf OBJECT-TYPE
SYNTAX        TruthValue
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION "Denotes whether or not this tunnel corresponds to an interface represented in the interfaces group table. Note that if this variable is set to true then the ifName of the interface corresponding to this tunnel should have a value equal to mplsTunnelName. Also see the description of ifName in RFC 2863. This object is meaningful only at the ingress and egress LSRs."

REFERENCE "RFC 2863 - The Interfaces Group MIB, McCloghrie, K., and F. Kastenholtz, June 2000"

DEFVAL { false }
::= { mplsTunnelEntry 7 }

mplsTunnelIfIndex OBJECT-TYPE
SYNTAX        InterfaceIndexOrZero
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION "If mplsTunnelIsIf is set to true, then this value contains the LSR-assigned ifIndex which corresponds to an entry in the interfaces table. Otherwise this variable should contain the value of zero indicating that a valid ifIndex was not assigned to this tunnel interface."

REFERENCE "RFC 2863 - The Interfaces Group MIB, McCloghrie, K., and F. Kastenholtz, June 2000"

DEFVAL { 0 }
::= { mplsTunnelEntry 8 }

mplsTunnelOwner OBJECT-TYPE
SYNTAX        MplsOwner
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION "Denotes the entity that created and is responsible
for managing this tunnel. This column is automatically filled by the agent on creation of a row.

 ::= { mplsTunnelEntry 9 }

mplsTunnelRole OBJECT-TYPE
SYNTAX INTEGER { head(1),
transit(2),
tail(3),
headTail(4) }
MAX-ACCESS read-create
STATUS current
DESCRIPTION "This value signifies the role that this tunnel entry/instance represents. This value MUST be set to head(1) at the originating point of the tunnel. This value MUST be set to transit(2) at transit points along the tunnel, if transit points are supported. This value MUST be set to tail(3) at the terminating point of the tunnel if tunnel tails are supported.

The value headTail(4) is provided for tunnels that begin and end on the same LSR."
DEFVAL { head }
 ::= { mplsTunnelEntry 10 }

mplsTunnelXCPointer OBJECT-TYPE
SYNTAX RowPointer
MAX-ACCESS read-create
STATUS current
DESCRIPTION "This variable points to a row in the mplsXCTable. This table identifies the segments that compose this tunnel, their characteristics, and relationships to each other. A value of zeroDotZero indicates that no LSP has been associated with this tunnel yet."
DEFVAL { zeroDotZero }
 ::= { mplsTunnelEntry 11 }

mplsTunnelSignallingProto OBJECT-TYPE
SYNTAX INTEGER {
none(1),
rsvp(2),
crldp(3),
other(4)
}
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION   "The signalling protocol, if any, used to setup this tunnel."
DEFVAL        { none }
::= { mplsTunnelEntry 12 }

mplsTunnelSetupPrio OBJECT-TYPE
SYNTAX        Integer32 (0..7)
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION   "Indicates the setup priority of this tunnel."
REFERENCE     "1. RSVP-TE: Extensions to RSVP for LSP Tunnels, Awduche et al, RFC 3209, December 2001
2. Constraint-Based LSP Setup using LDP, Jamoussi (Editor), RFC 3212, January 2002"
DEFVAL { 0 }
::= { mplsTunnelEntry 13 }

mplsTunnelHoldingPrio OBJECT-TYPE
SYNTAX        Integer32 (0..7)
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION   "Indicates the holding priority for this tunnel."
REFERENCE     "1. RSVP-TE: Extensions to RSVP for LSP Tunnels, Awduche et al, RFC 3209, December 2001
2. Constraint-Based LSP Setup using LDP, Jamoussi (Editor), RFC 3212, January 2002"
DEFVAL { 0 }
::= { mplsTunnelEntry 14 }

mplsTunnelSessionAttributes OBJECT-TYPE
SYNTAX        BITS {
   fastReroute (0),
   mergingPermitted (1),
   isPersistent (2),
   isPinned (3),
}
recordRoute(4)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This bit mask indicates optional session values for this tunnel. The following describes these bit fields:

fastRerouteThis flag indicates that the any tunnel hop may choose to reroute this tunnel without tearing it down. This flag permits transit routers to use a local repair mechanism which may result in violation of the explicit routing of this tunnel. When a fault is detected on an adjacent downstream link or node, a transit router can re-route traffic for fast service restoration.

mergingPermitted This flag permits transit routers to merge this session with other RSVP sessions for the purpose of reducing resource overhead on downstream transit routers, thereby providing better network scaling.

isPersistent Indicates whether this tunnel should be restored automatically after a failure occurs.

isPinned This flag indicates whether the loose-routed hops of this tunnel are to be pinned.

recordRoute This flag indicates whether or not the signalling protocol should remember the tunnel path after it has been signaled."

REFERENCE
"1. RSVP-TE: Extensions to RSVP for LSP Tunnels, Awduche et al, RFC 3209, December 2001."

::= { mplsTunnelEntry 15 }

mplsTunnelLocalProtectInUse OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"Indicates that the local repair mechanism is in use to maintain this tunnel (usually in the face of an outage of the link it was previously routed over)."
DEFVAL { false }
::= { mplsTunnelEntry 16 }
mplsTunnelResourcePointer OBJECT-TYPE
SYNTAX        RowPointer
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
  "This variable represents a pointer to the traffic
  parameter specification for this tunnel. This
  value may point at an entry in the
  mplsTunnelResourceEntry to indicate which
  mplsTunnelResourceEntry is to be assigned to this
  LSP instance. This value may optionally point at
  an externally defined traffic parameter
  specification table. A value of zeroDotZero
  indicates best-effort treatment. By having the
  same value of this object, two or more LSPs can
  indicate resource sharing."
DEFVAL        { zeroDotZero }
 ::= { mplsTunnelEntry 17 }

mplsTunnelPrimaryInstance OBJECT-TYPE
SYNTAX        MplsTunnelInstanceIndex
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "Specifies the instance index of the primary instance
  of this tunnel. More details of the definition of
  tunnel instances and the primary tunnel instance
  can be found in the description of the TEXTUAL-CONVENTION
  MplsTunnelInstanceIndex."
DEFVAL { 0 }
 ::= { mplsTunnelEntry 18 }

mplsTunnelInstancePriority OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
  "This value indicates which priority, in descending
  order, with 0 indicating the lowest priority,
  within a group of tunnel instances. A group of
  tunnel instances is defined as a set of LSPs with
  the same mplsTunnelIndex in this table, but with a
different mplsTunnelInstance. Tunnel instance
  priorities are used to denote the priority at which
  a particular tunnel instance will supersede
  another. Instances of tunnels containing the same
  mplsTunnelInstancePriority will be used for load
  sharing."
DEFVAL { 0 }
::= { mplsTunnelEntry 19 }

mplsTunnelHopTableIndex OBJECT-TYPE
SYNTAX MplsPathIndexOrZero
MAX-ACCESS read-create
STATUS current
DESCRIPTION "Index into the mplsTunnelHopTable entry that
specifies the explicit route hops for this tunnel.
This object is meaningful only at the head-end of
the tunnel."
DEFVAL { 0 }
::= { mplsTunnelEntry 20 }

mplsTunnelPathInUse OBJECT-TYPE
SYNTAX MplsPathIndexOrZero
MAX-ACCESS read-create
STATUS current
DESCRIPTION "This value denotes the configured path that was
chosen for this tunnel. This value reflects the
secondary index into mplsTunnelHopTable. This path
may not exactly match the one in
mplsTunnelARHopTable due to the fact that some CSPF
modification may have taken place. See
mplsTunnelARHopTable for the actual path being
taken by the tunnel. A value of zero denotes that
no path is currently in use or available."
DEFVAL { 0 }
::= { mplsTunnelEntry 21 }

mplsTunnelARHopTableIndex OBJECT-TYPE
SYNTAX MplsPathIndexOrZero
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Index into the mplsTunnelARHopTable entry that
specifies the actual hops traversed by the tunnel.
This is automatically updated by the agent when the
actual hops becomes available."
DEFVAL { 0 }
::= { mplsTunnelEntry 22 }

mplsTunnelCHopTableIndex OBJECT-TYPE
SYNTAX MplsPathIndexOrZero
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Index into the mplsTunnelCHopTable entry that specifies the computed hops traversed by the tunnel. This is automatically updated by the agent when computed hops become available or when computed hops get modified."
DEFVAL { 0 }
 ::= { mplsTunnelEntry 23 }

mplsTunnelIncludeAnyAffinity OBJECT-TYPE
SYNTAX        MplsTunnelAffinity
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"A link satisfies the include-any constraint if and only if the constraint is zero, or the link and the constraint have a resource class in common."
REFERENCE
"1. RSVP-TE: Extensions to RSVP for LSP Tunnels, Awduche et al, RFC 3209, December 2001."
 ::= { mplsTunnelEntry 24 }

mplsTunnelIncludeAllAffinity OBJECT-TYPE
SYNTAX        MplsTunnelAffinity
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"A link satisfies the include-all constraint if and only if the link contains all of the administrative groups specified in the constraint."
REFERENCE
"1. RSVP-TE: Extensions to RSVP for LSP Tunnels, Awduche et al, RFC 3209, December 2001."
 ::= { mplsTunnelEntry 25 }

mplsTunnelExcludeAnyAffinity OBJECT-TYPE
SYNTAX        MplsTunnelAffinity
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"A link satisfies the exclude-any constraint if and only if the link contains none of the administrative groups specified in the constraint."
REFERENCE
"1. RSVP-TE: Extensions to RSVP for LSP Tunnels, Awduche et al, RFC 3209, December 2001."
DEFVAL { 0 }
 ::= { mplsTunnelEntry 26 }
mplsTunnelTotalUpTime OBJECT-TYPE
SYNTAX        TimeTicks
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "This value represents the aggregate up time for all instances of this tunnel, if available. If this value is unavailable, it MUST return a value of 0."
 ::= { mplsTunnelEntry 27 }

mplsTunnelInstanceUpTime OBJECT-TYPE
SYNTAX        TimeTicks
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "This value identifies the total time that this tunnel instance’s operStatus has been Up(1)."
 ::= { mplsTunnelEntry 28 }

mplsTunnelPrimaryUpTime OBJECT-TYPE
SYNTAX        TimeTicks
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Specifies the total time the primary instance of this tunnel has been active. The primary instance of this tunnel is defined in mplsTunnelPrimaryInstance."
 ::= { mplsTunnelEntry 29 }

mplsTunnelPathChanges OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Specifies the number of times the actual path for this tunnel instance has changed."
 ::= { mplsTunnelEntry 30 }

mplsTunnelLastPathChange OBJECT-TYPE
SYNTAX        TimeTicks
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
 "Specifies the time since the last change to the actual path for this tunnel instance."
 ::= { mplsTunnelEntry 31 }
mplsTunnelCreationTime OBJECT-TYPE
SYNTAX        TimeStamp
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION    "Specifies the value of SysUpTime when the first
instance of this tunnel came into existence. That is,
when the value of mplsTunnelOperStatus was first set to up(1)."
 ::= { mplsTunnelEntry 32 }

mplsTunnelStateTransitions OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION    "Specifies the number of times the state
(mplsTunnelOperStatus) of this tunnel instance has changed."
 ::= { mplsTunnelEntry 33 }

mplsTunnelAdminStatus OBJECT-TYPE
SYNTAX        INTEGER {
 -- ready to pass packets
   up(1),
   down(2),
 -- in some test mode
   testing(3)
 }
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION    "Indicates the desired operational status of this
tunnel."
 ::= { mplsTunnelEntry 34 }

mplsTunnelOperStatus OBJECT-TYPE
SYNTAX        INTEGER {
 -- ready to pass packets
   up(1),
   down(2),
 -- in some test mode
   testing(3),
 -- status cannot be determined
   unknown(4),
   dormant(5),
 -- some component is missing
   notPresent(6),
-- down due to the state of
-- lower layer interfaces
lowerLayerDown(7)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates the actual operational status of this
tunnel, which is typically but not limited to, a
function of the state of individual segments of
this tunnel."
 ::= { mplsTunnelEntry 35 }

mplsTunnelRowStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This variable is used to create, modify, and/or
delete a row in this table. When a row in this
table is in active(1) state, no objects in that row
can be modified by the agent except
mplsTunnelAdminStatus, mplsTunnelRowStatus and
mplsTunnelStorageType."
 ::= { mplsTunnelEntry 36 }

mplsTunnelStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The storage type for this tunnel entry.
Conceptual rows having the value ‘permanent’
need not allow write-access to any columnar
objects in the row."
DEFVAL { volatile }
 ::= { mplsTunnelEntry 37 }

-- End of mplsTunnelTable

mplsTunnelHopListIndexNext OBJECT-TYPE
SYNTAX MplsPathIndexOrZero
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains an appropriate value to be used
for mplsTunnelHopListIndex when creating entries in
the mplsTunnelHopTable. If the number of
unassigned entries is exhausted, a retrieval
operation will return a value of 0. This object may also return a value of 0 when the LSR is unable to accept conceptual row creation, for example, if the mplsTunnelHopTable is implemented as read-only. To obtain the value of mplsTunnelHopListIndex for a new entry in the mplsTunnelHopTable, the manager issues a management protocol retrieval operation to obtain the current value of mplsTunnelHopIndex.

When the SET is performed to create a row in the mplsTunnelHopTable, the Command Responder (agent) must determine whether the value is indeed still unused; Two Network Management Applications may attempt to create a row (configuration entry) simultaneously and use the same value. If it is currently unused, the SET succeeds and the Command Responder (agent) changes the value of this object, according to an implementation-specific algorithm. If the value is in use, however, the SET fails. The Network Management Application must then re-read this variable to obtain a new usable value."

::= { mplsTeObjects 3 }

mplsTunnelHopTable OBJECT-TYPE
SYNTAX        SEQUENCE OF MplsTunnelHopEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
    "The mplsTunnelHopTable is used to indicate the hops, strict or loose, for an instance of an MPLS tunnel defined in mplsTunnelTable, when it is established via signalling, for the outgoing direction of the tunnel. Thus at a transit LSR, this table contains the desired path of the tunnel from this LSR onwards. Each row in this table is indexed by mplsTunnelHopListIndex which corresponds to a group of hop lists or path options. Each row also has a secondary index mplsTunnelHopIndex, which indicates a group of hops (also known as a path option). Finally, the third index, mplsTunnelHopIndex indicates the specific hop information for a path option. In case we want to specify a particular interface on the originating LSR of an outgoing tunnel by which we want packets to exit the LSR, we specify this as the first hop for this tunnel in mplsTunnelHopTable."

::= { mplsTeObjects 4 }
mplsTunnelHopEntry OBJECT-TYPE
SYNTAX       MplsTunnelHopEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"An entry in this table represents a tunnel hop. An
entry is created by a network administrator for
signaled ERLSP set up by an MPLS signalling
protocol."
INDEX {
    mplsTunnelHopListIndex,
    mplsTunnelHopPathOptionIndex,
    mplsTunnelHopIndex
}
::= { mplsTunnelHopTable 1 }

MplsTunnelHopEntry ::= SEQUENCE {
    mplsTunnelHopListIndex          MplsPathIndex,
    mplsTunnelHopPathOptionIndex    MplsPathIndex,
    mplsTunnelHopIndex              MplsPathIndex,
    mplsTunnelHopAddrType           TeHopAddressType,
    mplsTunnelHopIpAddr             TeHopAddress,
    mplsTunnelHopIpPrefixLen        InetAddressPrefixLength,
    mplsTunnelHopAsNumber           TeHopAddressAS,
    mplsTunnelHopAddrUnnum          TeHopAddressUnnum,
    mplsTunnelHopLspId              MplsLSPID,
    mplsTunnelHopType               INTEGER,
    mplsTunnelHopInclude            TruthValue,
    mplsTunnelHopPathOptionName     SnmpAdminString,
    mplsTunnelHopEntryPathComp      INTEGER,
    mplsTunnelHopRowStatus          RowStatus,
    mplsTunnelHopStorageType        StorageType
}

mplsTunnelHopListIndex OBJECT-TYPE
SYNTAX       MplsPathIndex
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"Primary index into this table identifying a
particular explicit route object."
::= { mplsTunnelHopEntry 1 }

mplsTunnelHopPathOptionIndex OBJECT-TYPE
SYNTAX       MplsPathIndex
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"Secondary index into this table identifying a particular group of hops representing a particular configured path. This is otherwise known as a path option."

::= { mplsTunnelHopEntry 2 }

mplsTunnelHopIndex OBJECT-TYPE
SYNTAX         MplsPathIndex
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION  "Tertiary index into this table identifying a particular hop."

::= { mplsTunnelHopEntry 3 }

mplsTunnelHopAddrType OBJECT-TYPE
SYNTAX         TeHopAddressType
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION  "The Hop Address Type of this tunnel hop.

The value of this object cannot be changed if the value of the corresponding mplsTunnelHopRowStatus object is ‘active’.

Note that lspid(5) is a valid option only for tunnels signaled via CRLDP.

DEFVAL        { ipv4 }

::= { mplsTunnelHopEntry 4 }

mplsTunnelHopIpAddr OBJECT-TYPE
SYNTAX         TeHopAddress
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION  "The Tunnel Hop Address for this tunnel hop.

The type of this address is determined by the value of the corresponding mplsTunnelHopAddrType.

The value of this object cannot be changed if the value of the corresponding mplsTunnelHopRowStatus object is ‘active’.

DEFVAL       { ’00000000’h }  -- IPv4 address 0.0.0.0

::= { mplsTunnelHopEntry 5 }

mplsTunnelHopIpPrefixLen OBJECT-TYPE
SYNTAX        InetAddressPrefixLength
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION  "If mplsTunnelHopAddrType is set to ipv4(1) or
ipv6(2), then this value will contain an
appropriate prefix length for the IP address in
object mplsTunnelHopIpAddr. Otherwise this value
is irrelevant and should be ignored."
DEFVAL         { 32 }
::= { mplsTunnelHopEntry 6 }

mplsTunnelHopAsNumber OBJECT-TYPE
SYNTAX        TeHopAddressAS
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION  "If mplsTunnelHopAddrType is set to asnumber(3), then
this value will contain the AS number of this hop.
Otherwise the agent should set this object to zero-
length string and the manager should ignore this."
::= { mplsTunnelHopEntry 7 }

mplsTunnelHopAddrUnnum OBJECT-TYPE
SYNTAX        TeHopAddressUnnum
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION  "If mplsTunnelHopAddrType is set to unnum(4), then
this value will contain the interface identifier of
the unnumbered interface for this hop. This object
should be used in conjunction with
mplsTunnelHopIpAddress which would contain the LSR
Router ID in this case. Otherwise the agent should
set this object to zero-length string and the
manager should ignore this."
::= { mplsTunnelHopEntry 8 }

mplsTunnelHopLspId OBJECT-TYPE
SYNTAX        MplsLSPID
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION  "If mplsTunnelHopAddrType is set to lspid(5), then
this value will contain the LSPID of a tunnel of
this hop. The present tunnel being configured is
tunneled through this hop (using label stacking).
This object is otherwise insignificant and should
mplsTunnelHopEntryPathComp OBJECT-TYPE
SYNTAX INTEGER {

::= { mplsTunnelHopEntry 12 }

Srinivasan, et al.          Standards Track                    [Page 33]
If this value is set to dynamic, then the user should only specify the source and destination of the path and expect that the CSPF will calculate the remainder of the path. If this value is set to explicit, the user should specify the entire path for the tunnel to take. This path may contain strict or loose hops. Each hop along a specific path SHOULD have this object set to the same value.

::= { mplsTunnelHopEntry 13 }

mplsTunnelHopRowStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This variable is used to create, modify, and/or delete a row in this table. When a row in this table is in active(1) state, no objects in that row can be modified by the agent except mplsTunnelHopRowStatus and mplsTunnelHopStorageType."
::= { mplsTunnelHopEntry 14 }

mplsTunnelHopStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The storage type for this Hop entry. Conceptual rows having the value ‘permanent’ need not allow write-access to any columnar objects in the row."
DEFVAL { volatile }
::= { mplsTunnelHopEntry 15 }

-- End of mplsTunnelHopTable

-- Begin of mplsTunnelResourceTable

mplsTunnelResourceIndexNext OBJECT-TYPE
SYNTAX Unsigned32 (0.. 2147483647)
MAX-ACCESS read-only
STATUS    current
DESCRIPTION
"This object contains the next appropriate value to be used for mplsTunnelResourceIndex when creating entries in the mplsTunnelResourceTable. If the number of unassigned entries is exhausted, a retrieval operation will return a value of 0. This object may also return a value of 0 when the LSR is unable to accept conceptual row creation, for example, if the mplsTunnelTable is implemented as read-only. To obtain the mplsTunnelResourceIndex value for a new entry, the manager must first issue a management protocol retrieval operation to obtain the current value of this object.

When the SET is performed to create a row in the mplsTunnelResourceTable, the Command Responder (agent) must determine whether the value is indeed still unused; Two Network Management Applications may attempt to create a row (configuration entry) simultaneously and use the same value. If it is currently unused, the SET succeeds and the Command Responder (agent) changes the value of this object, according to an implementation-specific algorithm. If the value is in use, however, the SET fails. The Network Management Application must then re-read this variable to obtain a new usable value."

::= { mplsTeObjects 5 }

mplsTunnelResourceTable OBJECT-TYPE
SYNTAX      SEQUENCE OF MplsTunnelResourceEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"The mplsTunnelResourceTable allows a manager to specify which resources are desired for an MPLS tunnel. This table also allows several tunnels to point to a single entry in this table, implying that these tunnels should share resources."

::= { mplsTeObjects 6 }

mplsTunnelResourceEntry OBJECT-TYPE
SYNTAX      MplsTunnelResourceEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"An entry in this table represents a set of resources for an MPLS tunnel. An entry can be created by a
network administrator or by an SNMP agent as instructed by any MPLS signaling protocol. An entry in this table referenced by a tunnel instance with zero mplsTunnelInstance value indicates a configured set of resource parameter. An entry referenced by a tunnel instance with a non-zero mplsTunnelInstance reflects the in-use resource parameters for the tunnel instance which may have been negotiated or modified by the MPLS signaling protocols."

INDEX

{ mplsTunnelResourceIndex }

::= { mplsTunnelResourceTable 1 }

MplsTunnelResourceEntry ::= SEQUENCE {

mplsTunnelResourceIndex                Unsigned32,
mplsTunnelResourceMaxRate              MplsBitRate,
mplsTunnelResourceMeanRate             MplsBitRate,
mplsTunnelResourceMaxBurstSize         MplsBurstSize,
mplsTunnelResourceMeanBurstSize        MplsBurstSize,
mplsTunnelResourceExBurstSize          MplsBurstSize,
mplsTunnelResourceFrequency            INTEGER,
mplsTunnelResourceWeight               Unsigned32,
mplsTunnelResourceRowStatus            RowStatus,
mplsTunnelResourceStorageType          StorageType

}

mplsTunnelResourceIndex OBJECT-TYPE
SYNTAX        Unsigned32 (1..2147483647)
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"Uniquely identifies this row."

::= { mplsTunnelResourceEntry 1 }

mplsTunnelResourceMaxRate OBJECT-TYPE
SYNTAX        MplsBitRate
UNITS         "kilobits per second"
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The maximum rate in bits/second. Note that setting mplsTunnelResourceMaxRate, mplsTunnelResourceMeanRate, and mplsTunnelResourceMaxBurstSize to 0 indicates best-effort treatment."

::= { mplsTunnelResourceEntry 2 }

mplsTunnelResourceMeanRate OBJECT-TYPE
SYNTAX         MplsBitRate
UNITS         "kilobits per second"
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION   "This object is copied into an instance of
               mplsTrafficParamMeanRate in the
               mplsTrafficParamTable. The OID of this table entry
               is then copied into the corresponding
               mplsInSegmentTrafficParamPtr."
 ::= { mplsTunnelResourceEntry 3 }

mplsTunnelResourceMaxBurstSize OBJECT-TYPE
SYNTAX         MplsBurstSize
UNITS         "bytes"
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION   "The maximum burst size in bytes."
 ::= { mplsTunnelResourceEntry 4 }

mplsTunnelResourceMeanBurstSize OBJECT-TYPE
SYNTAX         MplsBurstSize
UNITS         "bytes"
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION   "The mean burst size in bytes. The implementations
               which do not implement this variable must return
               a noSuchObject exception for this object and must
               not allow a user to set this object."
 ::= { mplsTunnelResourceEntry 5 }

mplsTunnelResourceExBurstSize OBJECT-TYPE
SYNTAX         MplsBurstSize
UNITS         "bytes"
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION   "The Excess burst size in bytes. The implementations
               which do not implement this variable must return
               a noSuchObject exception for this object and must
               not allow a user to set this value."
REFERENCE      "CR-LDP Specification, Section 4.3."
 ::= { mplsTunnelResourceEntry 6 }

mplsTunnelResourceFrequency  OBJECT-TYPE

Srinivasan, et al.          Standards Track                    [Page 37]
SYNTAX INTEGER { unspecified(1),
    frequent(2),
    veryFrequent(3)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The granularity of the availability of committed
rate. The implementations which do not implement
this variable must return unspecified(1) for this
value and must not allow a user to set this value."
REFERENCE
"CR-LDP Specification, Section 4.3."
 ::= { mplsTunnelResourceEntry 7 }

mplsTunnelResourceWeight OBJECT-TYPE
SYNTAX Unsigned32(0..255)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The relative weight for using excess bandwidth above
its committed rate. The value of 0 means that
weight is not applicable for the CR-LSP."
REFERENCE
"CR-LDP Specification, Section 4.3."
 ::= { mplsTunnelResourceEntry 8 }

mplsTunnelResourceRowStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This variable is used to create, modify, and/or
delete a row in this table. When a row in this
table is in active(1) state, no objects in that row
can be modified by the agent except
mplsTunnelResourceRowStatus and
mplsTunnelResourceStorageType."
 ::= { mplsTunnelResourceEntry 9 }

mplsTunnelResourceStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The storage type for this Hop entry. Conceptual
rows having the value ‘permanent’ need not
allow write-access to any columnar objects"
in the row.
DEFVAL { volatile }

::= { mplsTunnelResourceEntry 10 }

-- End mplsTunnelResourceTable
-- Tunnel Actual Route Hop table.

mplsTunnelARHopTable OBJECT-TYPE
SYNTAX        SEQUENCE OF MplsTunnelARHopEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"The mplsTunnelARHopTable is used to indicate the
hops for an MPLS tunnel defined in mplsTunnelTable,
as reported by the MPLS signalling protocol. Thus at
a transit LSR, this table (if the table is supported
and if the signaling protocol is recording actual
route information) contains the actual route of the
whole tunnel. If the signaling protocol is not
recording the actual route, this table MAY report
the information from the mplsTunnelHopTable or the
mplsTunnelCHopTable.

Each row in this table is indexed by
mplsTunnelARHopListIndex. Each row also has a
secondary index mplsTunnelARHopIndex, corresponding
to the next hop that this row corresponds to.

Please note that since the information necessary to
build entries within this table is not provided by
some MPLS signalling protocols, implementation of
this table is optional. Furthermore, since the
information in this table is actually provided by
the MPLS signalling protocol after the path has
been set-up, the entries in this table are provided
only for observation, and hence, all variables in
this table are accessible exclusively as read-
only.

Note also that the contents of this table may change
while it is being read because of re-routing
activities. A network administrator may verify that
the actual route read is consistent by reference to
the mplsTunnelLastPathChange object."

::= { mplsTeObjects 7 }
mplsTunnelARHopEntry OBJECT-TYPE
SYNTAX MplsTunnelARHopEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry in this table represents a tunnel hop. An
entry is created by the agent for signaled ERLSP
set up by an MPLS signalling protocol."
INDEX { mplsTunnelARHopListIndex, mplsTunnelARHopIndex }
 ::= { mplsTunnelARHopTable 1 }

MplsTunnelARHopEntry ::= SEQUENCE {
  mplsTunnelARHopListIndex MplsPathIndex,
  mplsTunnelARHopIndex MplsPathIndex,
  mplsTunnelARHopAddrType TeHopAddressType,
  mplsTunnelARHopIpAddr TeHopAddress,
  mplsTunnelARHopAddrUnnum TeHopAddressUnnum,
  mplsTunnelARHopLspId MplsLSPID
}

mplsTunnelARHopListIndex OBJECT-TYPE
SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Primary index into this table identifying a
particular recorded hop list."
 ::= { mplsTunnelARHopEntry 1 }

mplsTunnelARHopIndex OBJECT-TYPE
SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Secondary index into this table identifying the
particular hop."
 ::= { mplsTunnelARHopEntry 2 }

mplsTunnelARHopAddrType OBJECT-TYPE
SYNTAX TeHopAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The Hop Address Type of this tunnel hop.

Note that lspid(5) is a valid option only
for tunnels signaled via CRLDP."
DEFVAL { ipv4 }
::= { mplsTunnelARHopEntry 3 }  

mplsTunnelARHopIpAddr OBJECT-TYPE  
SYNTAX        TeHopAddress  
MAX-ACCESS    read-only  
STATUS        current  
DESCRIPTION  
"The Tunnel Hop Address for this tunnel hop. The type of this address is determined by the value of the corresponding mplsTunnelARHopAddrType. If mplsTunnelARHopAddrType is set to unnum(4), then this value contains the LSR Router ID of the unnumbered interface. Otherwise the agent SHOULD set this object to the zero-length string and the manager should ignore this object."  
DEFVAL       { '00000000'h }  -- IPv4 address 0.0.0.0  
::= { mplsTunnelARHopEntry 4 }  

mplsTunnelARHopAddrUnnum OBJECT-TYPE  
SYNTAX        TeHopAddressUnnum  
MAX-ACCESS    read-only  
STATUS        current  
DESCRIPTION  
"If mplsTunnelARHopAddrType is set to unnum(4), then this value will contain the interface identifier of the unnumbered interface for this hop. This object should be used in conjunction with mplsTunnelARHopIpAddr which would contain the LSR Router ID in this case. Otherwise the agent should set this object to zero-length string and the manager should ignore this."  
::= { mplsTunnelARHopEntry 5 }  

mplsTunnelARHopLspId OBJECT-TYPE  
SYNTAX        MplsLSPID  
MAX-ACCESS    read-only  
STATUS        current  
DESCRIPTION  
"If mplsTunnelARHopAddrType is set to lspid(5), then this value will contain the LSP ID of this hop. This object is otherwise insignificant and should contain a value of 0 to indicate this fact."  
::= { mplsTunnelARHopEntry 6 }  

-- End of mplsTunnelARHopTable
-- Tunnel Computed Hop table.

mplsTunnelCHopTable  OBJECT-TYPE
SYNTAX        SEQUENCE OF MplsTunnelCHopEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"The mplsTunnelCHopTable is used to indicate the
hops, strict or loose, for an MPLS tunnel defined
in mplsTunnelTable, as computed by a constraint-
based routing protocol, based on the
mplsTunnelHopTable for the outgoing direction of
the tunnel. Thus at a transit LSR, this table (if
the table is supported) MAY contain the path
computed by the CSPF engine on (or on behalf of)
this LSR. Each row in this table is indexed by
mplsTunnelCHopListIndex. Each row also has a
secondary index mplsTunnelCHopIndex, corresponding
to the next hop that this row corresponds to. In
case we want to specify a particular interface on
the originating LSR of an outgoing tunnel by which
we want packets to exit the LSR, we specify this as
the first hop for this tunnel in
mplsTunnelCHopTable.

Please note that since the information necessary to
build entries within this table may not be
supported by some LSRs, implementation of this
table is optional. Furthermore, since the
information in this table describes the path
computed by the CSPF engine the entries in this
table are read-only."
 ::= { mplsTeObjects 8 }

mplsTunnelCHopEntry  OBJECT-TYPE
SYNTAX        MplsTunnelCHopEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"An entry in this table represents a tunnel hop. An
entry in this table is created by a path
computation engine using CSPF techniques applied to
the information collected by routing protocols and
the hops specified in the corresponding
mplsTunnelHopTable."
INDEX { mplsTunnelCHopListIndex, mplsTunnelCHopIndex }
 ::= { mplsTunnelCHopTable 1 }
MplsTunnelCHopEntry ::= SEQUENCE {
  mplsTunnelCHopListIndex MplsPathIndex,
  mplsTunnelCHopIndex MplsPathIndex,
  mplsTunnelCHopAddrType TeHopAddressType,
  mplsTunnelCHopIpAddr TeHopAddress,
  mplsTunnelCHopIpPrefixLen InetAddressPrefixLength,
  mplsTunnelCHopAsNumber TeHopAddressAS,
  mplsTunnelCHopAddrUnnum TeHopAddressUnnum,
  mplsTunnelCHopLspId MplsLSPID,
  mplsTunnelCHopType INTEGER
}

mplsTunnelCHopListIndex OBJECT-TYPE
SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Primary index into this table identifying a particular computed hop list."
::= { mplsTunnelCHopEntry 1 }

mplsTunnelCHopIndex OBJECT-TYPE
SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Secondary index into this table identifying the particular hop."
::= { mplsTunnelCHopEntry 2 }

mplsTunnelCHopAddrType OBJECT-TYPE
SYNTAX TeHopAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The Hop Address Type of this tunnel hop. Note that lspid(5) is a valid option only for tunnels signaled via CRLDP."
DEFVAL { ipv4 }
::= { mplsTunnelCHopEntry 3 }

mplsTunnelCHopIpAddr OBJECT-TYPE
SYNTAX TeHopAddress
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The Tunnel Hop Address for this tunnel hop."
The type of this address is determined by the value of the corresponding mplsTunnelCHopAddrType.

If mplsTunnelCHopAddrType is set to unnum(4), then this value will contain the LSR Router ID of the unnumbered interface. Otherwise the agent should set this object to the zero-length string and the manager SHOULD ignore this object.

DEFVAL { '00000000'h } -- IPv4 address 0.0.0.0
::= { mplsTunnelCHopEntry 4 }

mplsTunnelCHopIpPrefixLen OBJECT-TYPE
SYNTAX InetAddressPrefixLength
MAX-ACCESS read-only
STATUS current
DESCRIPTION "If mplsTunnelCHopAddrType is set to ipv4(1) or ipv6(2), then this value will contain an appropriate prefix length for the IP address in object mplsTunnelCHopIpAddr. Otherwise this value is irrelevant and should be ignored."

DEFVAL { 32 }
::= { mplsTunnelCHopEntry 5 }

mplsTunnelCHopAsNumber OBJECT-TYPE
SYNTAX TeHopAddressAS
MAX-ACCESS read-only
STATUS current
DESCRIPTION "If mplsTunnelCHopAddrType is set to asnumber(3), then this value will contain the AS number of this hop. Otherwise the agent should set this object to zero-length string and the manager should ignore this."
::= { mplsTunnelCHopEntry 6 }

mplsTunnelCHopAddrUnnum OBJECT-TYPE
SYNTAX TeHopAddressUnnum
MAX-ACCESS read-only
STATUS current
DESCRIPTION "If mplsTunnelCHopAddrType is set to unnum(4), then this value will contain the unnumbered interface identifier of this hop. This object should be used in conjunction with mplsTunnelCHopIpAddr which would contain the LSR Router ID in this case."
Otherwise the agent should set this object to zero-length string and the manager should ignore this.

::= { mplsTunnelCHopEntry 7 }

mplsTunnelCHopLspId OBJECT-TYPE
SYNTAX        MplsLSPID
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "If mplsTunnelCHopAddrType is set to lspid(5), then this value will contain the LSP ID of this hop. This object is otherwise insignificant and should contain a value of 0 to indicate this fact."
::= { mplsTunnelCHopEntry 8 }

mplsTunnelCHopType OBJECT-TYPE
SYNTAX        INTEGER { strict(1),
                          loose(2) }
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "Denotes whether this is tunnel hop is routed in a strict or loose fashion."
::= { mplsTunnelCHopEntry 9 }

-- End of mplsTunnelCHopTable

-- MPLS Tunnel Performance Table.

mplsTunnelPerfTable  OBJECT-TYPE
SYNTAX        SEQUENCE OF MplsTunnelPerfEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
  "This table provides per-tunnel instance MPLS performance information."
::= { mplsTeObjects 9 }

mplsTunnelPerfEntry OBJECT-TYPE
SYNTAX        MplsTunnelPerfEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
  "An entry in this table is created by the LSR for every tunnel. Its is an extension to mplsTunnelEntry."
AUGMENTS { mplsTunnelEntry }
 ::= { mplsTunnelPerfTable 1 }

MplsTunnelPerfEntry ::= SEQUENCE {
    mplsTunnelPerfPackets Counter32,
    mplsTunnelPerfHCPackets Counter64,
    mplsTunnelPerfErrors Counter32,
    mplsTunnelPerfBytes Counter32,
    mplsTunnelPerfHCBYtes Counter64
}

mplsTunnelPerfPackets OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of packets forwarded by the tunnel. This object should represent the 32-bit value of the least significant part of the 64-bit value if both mplsTunnelPerfHCPackets is returned."
 ::= { mplsTunnelPerfEntry 1 }

mplsTunnelPerfHCPackets OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION "High capacity counter for number of packets forwarded by the tunnel."
 ::= { mplsTunnelPerfEntry 2 }

mplsTunnelPerfErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of packets dropped because of errors or for other reasons."
 ::= { mplsTunnelPerfEntry 3 }

mplsTunnelPerfBytes OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Number of bytes forwarded by the tunnel. This object should represent the 32-bit
value of the least significant part of the 64-bit value if both mplsTunnelPerfHCBytes is returned."
 ::= { mplsTunnelPerfEntry 4 }

mplsTunnelPerfHCBytes OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION "High capacity counter for number of bytes forwarded by the tunnel."
 ::= { mplsTunnelPerfEntry 5 }

-- End of mplsTunnelPerfTable

-- CR-LDP Tunnel Resource Table

mplsTunnelCRLDPResTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsTunnelCRLDPResEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The mplsTunnelCRLDPResTable allows a manager to specify which CR-LDP-specific resources are desired for an MPLS tunnel if that tunnel is signaled using CR-LDP. Note that these attributes are in addition to those specified in mplsTunnelResourceTable. This table also allows several tunnels to point to a single entry in this table, implying that these tunnels should share resources."
 ::= { mplsTeObjects 10 }

mplsTunnelCRLDPResEntry OBJECT-TYPE
SYNTAX MplsTunnelCRLDPResEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry in this table represents a set of resources for an MPLS tunnel established using CRLDP (mplsTunnelSignallingProto equal to crldp (3)). An entry can be created by a network administrator or by an SNMP agent as instructed by any MPLS signalling protocol."
INDEX { mplsTunnelResourceIndex }
 ::= { mplsTunnelCRLDPResTable 1 }
MplsTunnelCRLDPResEntry ::= SEQUENCE {
    mplsTunnelCRLDPResMeanBurstSize MplsBurstSize,
    mplsTunnelCRLDPResExBurstSize MplsBurstSize,
    mplsTunnelCRLDPResFrequency INTEGER,
    mplsTunnelCRLDPResWeight Unsigned32,
    mplsTunnelCRLDPResFlags Unsigned32,
    mplsTunnelCRLDPResRowStatus RowStatus,
    mplsTunnelCRLDPResStorageType StorageType
}

mplsTunnelCRLDPResMeanBurstSize OBJECT-TYPE
SYNTAX  MplsBurstSize
UNITS   "bytes"
MAX-ACCESS read-create
STATUS   current
DESCRIPTION
   "The mean burst size in bytes."
::= { mplsTunnelCRLDPResEntry 1 }

mplsTunnelCRLDPResExBurstSize OBJECT-TYPE
SYNTAX  MplsBurstSize
UNITS   "bytes"
MAX-ACCESS read-create
STATUS   current
DESCRIPTION
   "The Excess burst size in bytes."
REFERENCE
   "CR-LDP Specification, Section 4.3."
::= { mplsTunnelCRLDPResEntry 2 }

mplsTunnelCRLDPResFrequency OBJECT-TYPE
SYNTAX  INTEGER {
        unspecified(1),
        frequent(2),
        veryFrequent(3)
    }
MAX-ACCESS read-create
STATUS   current
DESCRIPTION
   "The granularity of the availability of committed rate."
REFERENCE
   "CR-LDP Specification, Section 4.3."
::= { mplsTunnelCRLDPResEntry 3 }

mplsTunnelCRLDPResWeight OBJECT-TYPE
SYNTAX  Unsigned32(0..255)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The relative weight for using excess bandwidth above its committed rate. The value of 0 means that weight is not applicable for the CR-LSP."
REFERENCE "CR-LDP Specification, Section 4.3."
DEFVAL { 0 }
::= { mplsTunnelCRLDPResEntry 4 }

mplsTunnelCRLDPResFlags OBJECT-TYPE
SYNTAX Unsigned32 (0..63)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The value of the 1 byte Flags conveyed as part of the traffic parameters during the establishment of the CRLSP. The bits in this object are to be interpreted as follows.

+--+--+--+--+--+--+--+--+
| Res |F6|F5|F4|F3|F2|F1|
+--+--+--+--+--+--+--+--+
Res - These bits are reserved. Zero on transmission. Ignored on receipt.
F1 - Corresponds to the PDR.
F2 - Corresponds to the PBS.
F3 - Corresponds to the CDR.
F4 - Corresponds to the CBS.
F5 - Corresponds to the EBS.
F6 - Corresponds to the Weight.

Each flag if is a Negotiable Flag corresponding to a Traffic Parameter. The Negotiable Flag value zero denotes Not Negotiable and value one denotes Negotiable."
REFERENCE "1. Section 4.3, Constraint-Based LSP Setup using LDP, Jamoussi (Editor), RFC 3212, January 2002"
DEFVAL { 0 }
::= { mplsTunnelCRLDPResEntry 5 }

mplsTunnelCRLDPResRowStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This variable is used to create, modify, and/or delete a row in this table. When a row in this table is in active(1) state, no objects in that row can be modified by the agent except mplsTunnelCRLDPResRowStatus and mplsTunnelCRLDPResStorageType."

::= { mplsTunnelCRLDPResEntry 6 }

mplsTunnelCRLDPResStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The storage type for this CR-LDP Resource entry. Conceptual rows having the value ‘permanent’ need not allow write-access to any columnar objects in the row."
DEFVAL { volatile }
::= { mplsTunnelCRLDPResEntry 7 }

-- Notifications.

mplsTunnelNotificationEnable OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-write
STATUS current
DESCRIPTION "If this object is true, then it enables the generation of mplsTunnelUp and mplsTunnelDown traps, otherwise these traps are not emitted."
DEFVAL { false }
::= { mplsTeObjects 11 }

mplsTunnelUp NOTIFICATION-TYPE
OBJECTS { mplsTunnelAdminStatus, mplsTunnelOperStatus }
STATUS current
DESCRIPTION "This notification is generated when a mplsTunnelOperStatus object for one of the configured tunnels is about to leave the down state and transition into some other state (but not into the notPresent state). This other state is indicated by the included value of mplsTunnelOperStatus."
::= { mplsTeNotifications 1 }

mplsTunnelDown NOTIFICATION-TYPE
   OBJECTS     {
      mplsTunnelAdminStatus,
      mplsTunnelOperStatus
   }  
   STATUS     current
   DESCRIPTION
      "This notification is generated when a
       mplsTunnelOperStatus object for one of the
       configured tunnels is about to enter the down state
       from some other state (but not from the notPresent
       state). This other state is indicated by the
       included value of mplsTunnelOperStatus."
::= { mplsTeNotifications 2 }

mplsTunnelRerouted NOTIFICATION-TYPE
   OBJECTS     {
      mplsTunnelAdminStatus,
      mplsTunnelOperStatus
   }  
   STATUS     current
   DESCRIPTION
      "This notification is generated when a tunnel is
       rerouted. If the mplsTunnelARHopTable is used, then
       this tunnel instance’s entry in the
       mplsTunnelARHopTable MAY contain the new path for
       this tunnel some time after this trap is issued by
       the agent."
::= { mplsTeNotifications 3 }

mplsTunnelReoptimized NOTIFICATION-TYPE
   OBJECTS     {
      mplsTunnelAdminStatus,
      mplsTunnelOperStatus
   }  
   STATUS     current
   DESCRIPTION
      "This notification is generated when a tunnel is
       reoptimized. If the mplsTunnelARHopTable is used, then
       this tunnel instance’s entry in the
       mplsTunnelARHopTable MAY contain the new path for
       this tunnel some time after this trap is issued by
       the agent."
::= { mplsTeNotifications 4 }

-- End of notifications.
-- Module compliance.

mplsTeGroups
OBJECT IDENTIFIER ::= { mplsTeConformance 1 }

mplsTeCompliances
OBJECT IDENTIFIER ::= { mplsTeConformance 2 }

-- Compliance requirement for fully compliant implementations.

mplsTeModuleFullCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION "Compliance statement for agents that provide full support the MPLS-TE-STD-MIB module."

MODULE IF-MIB -- The Interfaces Group MIB, RFC 2863.
  MANDATORY-GROUPS {
    ifGeneralInformationGroup,
    ifCounterDiscontinuityGroup
  }

MODULE -- this module

  -- The mandatory group has to be implemented by all LSRs that originate/terminate ESLSPs/tunnels.
  -- In addition, depending on the type of tunnels supported, other groups become mandatory as explained below.

  MANDATORY-GROUPS {
    mplsTunnelGroup,
    mplsTunnelScalarGroup
  }

GROUP mplsTunnelManualGroup
  DESCRIPTION "This group is mandatory for devices which support manual configuration of tunnels."

GROUP mplsTunnelSignaledGroup
  DESCRIPTION "This group is mandatory for devices which support signaled tunnel set up."

GROUP mplsTunnelIsNotIntfcGroup
  DESCRIPTION "This group is mandatory for devices which support..."
tunnels that are not interfaces."

GROUP mplsTunnelIsIntfcGroup
DESCRIPTION "This group is mandatory for devices which support tunnels that are interfaces."

GROUP mplsTunnelCRLDPResOptionalGroup
DESCRIPTION "Objects in this group are required by implementations supporting the CR-LDP protocol for signalling of TE tunnels."

GROUP mplsTeNotificationGroup
DESCRIPTION "This group is mandatory for those implementations which can implement the notifications contained in this group."

OBJECT mplsTunnelRowStatus
SYNTAX RowStatus { active(1), notInService(2) }
WRITE-SYNTAX RowStatus { active(1), notInService(2), createAndGo(4), destroy(6) }
DESCRIPTION "Support for createAndWait and notReady is not required."

OBJECT mplsTunnelHopRowStatus
SYNTAX RowStatus { active(1), notInService(2) }
WRITE-SYNTAX RowStatus { active(1), notInService(2), createAndGo(4), destroy(6) }
DESCRIPTION "Support for createAndWait and notReady is not required."

OBJECT mplsTunnelCRLDPResRowStatus
SYNTAX RowStatus { active(1), notInService(2) }
WRITE-SYNTAX RowStatus { active(1), notInService(2), createAndGo(4), destroy(6) }
DESCRIPTION "Support for createAndWait and notReady is not required."

::= { mplsTeCompliances 1 }

-- Compliance requirement for read-only implementations.

mplsTeModuleReadOnlyCompliance MODULE-COMPLIANCE
STATUS current
[Page 54]

DESCRIPTION
"Compliance requirement for implementations that only provide read-only support for MPLS-TE-STD-MIB. Such devices can then be monitored but cannot be configured using this MIB modules."

MODULE -- this module

-- mplsTunnelTable

MANDATORY-GROUPS { mplsTunnelGroup, mplsTunnelScalarGroup }

GROUP mplsTunnelManualGroup
DESCRIPTION
"This group is mandatory for devices which support manual configuration of tunnels."

GROUP mplsTunnelSignaledGroup
DESCRIPTION
"This group is mandatory for devices which support signaled tunnel set up."

GROUP mplsTunnelIsNotIntfcGroup
DESCRIPTION
"This group is mandatory for devices which support tunnels that are not interfaces."

GROUP mplsTunnelIsIntfcGroup
DESCRIPTION
"This group is mandatory for devices which support tunnels that are interfaces."

GROUP mplsTunnelCRLDPResOptionalGroup
DESCRIPTION
"Objects in this group are required by implementations supporting the CR-LDP protocol for signalling of TE tunnels."

GROUP mplsTeNotificationGroup
DESCRIPTION "This group is mandatory for those implementations which can implement the notifications contained in this group."

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

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

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

OBJECT     mplsTunnelIfIndex
DESCRIPTION
  "Write access is not required."

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

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

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

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

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

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

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

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

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

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

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

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

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

OBJECT  mplsTunnelAdminStatus
SYNTAX  INTEGER { up (1), down (2) }
MIN-ACCESS  read-only
DESCRIPTION
"Only up and down states must be supported. Write access is not required."

OBJECT  mplsTunnelRowStatus
SYNTAX     RowStatus { active(1) }
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

-- mplsTunnelHopTable

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

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

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

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

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

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

OBJECT      mplsTunnelHopType
SYNTAX      INTEGER { strict(1) }
MIN-ACCESS  read-only
DESCRIPTION "loose(2) need not be supported. Write access is not required."

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

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

OBJECT mplsTunnelHopRowStatus
SYNTAX RowStatus { active(1) }
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

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

-- mplsTunnelResourceTable

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

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

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

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

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

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

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

OBJECT mplsTunnelResourceRowStatus
SYNTAX RowStatus { active(1) }
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."
OBJECT  mplsTunnelResourceStorageType
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

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

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

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

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

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

OBJECT  mplsTunnelCRLDPResRowStatus
SYNTAX  RowStatus { active(1) }
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."

OBJECT  mplsTunnelCRLDPResStorageType
MIN-ACCESS  read-only
DESCRIPTION "Write access is not required."
::= { mplsTeCompliances 2 }

-- Units of conformance.

mplsTunnelGroup OBJECT-GROUP
OBJECTS {
  mplsTunnelIndexNext,
  mplsTunnelName,
  mplsTunnelDescr,
  mplsTunnelOwner,
  mplsTunnelXCPPointer,
  mplsTunnelIfIndex,
mplsTunnelHopTableIndex,
mplsTunnelARHopTableIndex,
mplsTunnelCHopTableIndex,
mplsTunnelAdminStatus,
mplsTunnelOperStatus,
mplsTunnelRowStatus,
mplsTunnelNotificationEnable,
mplsTunnelStorageType,
mplsTunnelConfigured,
mplsTunnelActive,
mplsTunnelPrimaryInstance,
mplsTunnelPrimaryUpTime,
mplsTunnelPathChanges,
mplsTunnelLastPathChange,
mplsTunnelCreationTime,
mplsTunnelStateTransitions,
mplsTunnelIncludeAnyAffinity,
mplsTunnelIncludeAllAffinity,
mplsTunnelExcludeAnyAffinity,
mplsTunnelPerfPacketCount,
mplsTunnelPerfHCpacketCount,
mplsTunnelPerfErrors,
mplsTunnelPerfBytes,
mplsTunnelPerfHCbytes,
mplsTunnelResourcePointer,
mplsTunnelInstancePriority,
mplsTunnelPathInUse,
mplsTunnelRole,
mplsTunnelTotalUpTime,
mplsTunnelInstanceUpTime,
mplsTunnelResourceId,
mplsTunnelResourceMaxRate,
mplsTunnelResourceMeanRate,
mplsTunnelResourceMaxBurstSize,
mplsTunnelResourceMeanBurstSize,
mplsTunnelResourceExBurstSize,
mplsTunnelResourceFrequency,
mplsTunnelResourceWeight,
mplsTunnelResourceRowStatus,
mplsTunnelResourceStorageType,
mplsTunnelARHopAddrType,
mplsTunnelARHopIpAddr,
mplsTunnelARHopAddrUnnum,
mplsTunnelARHopLspId,
mplsTunnelCHopAddrType,
mplsTunnelCHopIpAddr,
mplsTunnelCHopIpPrefixLen,
mplsTunnelCHopAddrUnnum,
mplsTunnelCHopLspId,
mplsTunnelCHopType
}
STATUS current
DESCRIPTION
"Necessary, but not sufficient, set of objects to implement tunnels. In addition, depending on the type of the tunnels supported (for example, manually configured or signaled, persistent or non-persistent, etc.), the following other groups defined below are mandatory: mplsTunnelManualGroup and/or mplsTunnelSignaledGroup, mplsTunnelIsNotIntfcGroup and/or mplsTunnelIsIntfcGroup."
::= { mplsTeGroups 1 }

mplsTunnelManualGroup OBJECT-GROUP
OBJECTS { mplsTunnelSignallingProto }
STATUS current
DESCRIPTION
"Object(s) needed to implement manually configured tunnels."
::= { mplsTeGroups 2 }

mplsTunnelSignaledGroup OBJECT-GROUP
OBJECTS {
  mplsTunnelSetupPrio,
  mplsTunnelHoldingPrio,
  mplsTunnelSignallingProto,
  mplsTunnelLocalProtectInUse,
  mplsTunnelSessionAttributes,
  mplsTunnelHopListIndexNext,
  mplsTunnelHopAddrType,
  mplsTunnelHopIpAddr,
  mplsTunnelHopIpPrefixLen,
  mplsTunnelHopAddrUnnum,
  mplsTunnelHopAsNumber,
  mplsTunnelHopLspId,
  mplsTunnelHopType,
  mplsTunnelHopInclude,
  mplsTunnelHopPathOptionName,
  mplsTunnelHopEntryPathComp,
  mplsTunnelHopRowStatus,
  mplsTunnelHopStorageType
}
STATUS current
DESCRIPTION
"Objects needed to implement signaled tunnels."
 ::= { mplsTeGroups 3 }

mplsTunnelScalarGroup OBJECT-GROUP
 OBJECTS {
   mplsTunnelConfigured,
   mplsTunnelActive,
   mplsTunnelTEDistProto,
   mplsTunnelMaxHops,
   mplsTunnelNotificationMaxRate
 }
 STATUS current
 DESCRIPTION
   "Scalar object needed to implement MPLS tunnels."
 ::= { mplsTeGroups 4 }

mplsTunnelIsIntfcGroup OBJECT-GROUP
 OBJECTS { mplsTunnelIsIf }
 STATUS current
 DESCRIPTION
   "Objects needed to implement tunnels that are interfaces."
 ::= { mplsTeGroups 5 }

mplsTunnelIsNotIntfcGroup OBJECT-GROUP
 OBJECTS { mplsTunnelIsIf }
 STATUS current
 DESCRIPTION
   "Objects needed to implement tunnels that are not interfaces."
 ::= { mplsTeGroups 6 }

mplsTunnelCRLDPResOptionalGroup OBJECT-GROUP
 OBJECTS {
   mplsTunnelCRLDPResMeanBurstSize,
   mplsTunnelCRLDPResExBurstSize,
   mplsTunnelCRLDPResFrequency,
   mplsTunnelCRLDPResWeight,
   mplsTunnelCRLDPResFlags,
   mplsTunnelCRLDPResRowStatus,
   mplsTunnelCRLDPResStorageType
 }
 STATUS current
 DESCRIPTION
   "Set of objects implemented for resources applicable for tunnels signaled using CR-LDP."
 ::= { mplsTeGroups 7 }
mplsTeNotificationGroup NOTIFICATION-GROUP
  NOTIFICATIONS {
    mplsTunnelUp,
    mplsTunnelDown,
    mplsTunnelRerouted,
    mplsTunnelReoptimized
  }
  STATUS    current
  DESCRIPTION
             "Set of notifications implemented in this module.
             None is mandatory."
  ::= { mplsTeGroups 8 }
END

12. Security Considerations

It is clear that this MIB module is potentially useful for the
monitoring of MPLS TE tunnels. This MIB module can also be used for
the configuration of certain objects, and anything that can be
configured can be incorrectly configured, with potentially disastrous
results.

There are a number of management objects defined in this MIB module
with a MAX-ACCESS clause of read-write and/or read-create. Such
objects may be considered sensitive or vulnerable in some network
environments. The support for SET operations in a non-secure
environment without proper protection can have a negative effect on
network operations. These are the tables and objects and their
sensitivity/vulnerability:

- the mplsTunnelTable, mplsTunnelHopTable, mplsTunnelResourceTable,
  and mplsTunnelCRLDPResTable collectively contain objects to
  provision MPLS tunnels, tunnel hops, and tunnel resources.
  Unauthorized access to objects in these tables, could result in
disruption of traffic on the network. This is especially true if
a tunnel has been established. The use of stronger mechanisms,
such as SNMPv3 security, should be considered where possible.
Specifically, SNMPv3 VACM and USM MUST be used with any v3 agent
which implements this MIB. Administrators should consider whether
read access to these objects should be allowed, since read access
may be undesirable under certain circumstances.

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

- the mplsTunnelTable, mplsTunnelHopTable, mplsTunnelResourceTable, mplsTunnelARHopTable, mplsTunnelChopTable, mplsTunnelPerfTable, and mplsTunnelCRLDFResTable collectively show the MPLS-TE tunnel network topology and its performance characteristics. If an Administrator does not want to reveal this information, then these tables should be considered sensitive/vulnerable.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED that SNMPv3 be deployed and cryptographic security enabled. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to only those principals (users) that have legitimate rights to those objects.

13. Acknowledgments

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Comments should be made directly to the MPLS mailing list at mpls@uu.net.

14. IANA Considerations

As described in [MPLSMGMT] and as requested in the MPLS-TC-STD-MIB [RFC3811], MPLS related standards track MIB modules should be rooted under the mplsStdMIB subtree. There are 4 MPLS MIB Modules contained in this document, each of the following "IANA Considerations" subsections requests IANA for a new assignment under the mplsStdMIB subtree. New assignments can only be made via a Standards Action as specified in [RFC2434].
14.1. IANA Considerations for MPLS-TE-STD-MIB

The IANA has assigned {mplsStdMIB 3} to the MPLS-TE-STD-MIB module specified in this document.

15. References

15.1. Normative References


15.2. Informative References


16. Authors’ Addresses

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