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**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).

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## [1. Introduction](#)

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects for 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, `mplsTunnelXCIIndex`. 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 [ <a href="#">RFC2863</a> ].
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 [ <a href="#">RFC2863</a> ].



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 [ <a href="#">RFC2863</a> ].
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 [ <a href="#">RFC2863</a> ].
ifHCInOctets	The 64-bit version of ifInOctets; supported if required by the compliance statements in [ <a href="#">RFC2863</a> ].
ifHCOutOctets	The 64-bit version of ifOutOctets; supported if required by the compliance statements in [ <a href="#">RFC2863</a> ].
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 mplsTunnelXCPPointer 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 mplsTunnelXCPPointer and mplsTunnelResourcePointer are of type RowPointer. The object mplsTunnelXCPPointer 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 mplsTunnelXCPPointer 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, MplsTunnelInstanceIndex,
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**

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**ORGANIZATION**

"Multiprotocol Label Switching (MPLS) Working Group"

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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



(Editor), [RFC 3212](#), January 2002  
3. Requirements for Traffic Engineering Over MPLS,  
Awduch, D., Malcolm, J., Agogbua, J., O'Dell, M.,  
and J. McManus, [[RFC2702](#)], September 1999"

-- 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   MplsExtended TunnelId,
    mplsTunnelEgressLSRId    MplsExtended TunnelId,
    mplsTunnelName            SnmpAdminString,
    mplsTunnelDescr           SnmpAdminString,
    mplsTunnelIsIf             TruthValue,
    mplsTunnelIfIndex         InterfaceIndexOrZero,
    mplsTunnelOwner            MplsOwner,
    mplsTunnelRole              INTEGER,
    mplsTunnelXCPPointer      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."
    REFERENCE
        "Srinivasan, C., Viswanathan, A., and T. Nadeau,
         Multiprotocol Label Switching (MPLS) Label Switching
         Router (LSR) Management Information Base (MIB), RFC 3813,
         June 2004"
    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** This 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.

**recordRouteThis** 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,  
 Awduch 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 supercede
         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 }

mplsTunnelHopIpAddress 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
```



```
        contain a value of 0 to indicate this fact."
 ::= { mplsTunnelHopEntry 9 }

mplsTunnelHopType OBJECT-TYPE
    SYNTAX      INTEGER {
                  strict(1),
                  loose(2)
                }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "Denotes whether this tunnel hop is routed in a
         strict or loose fashion. The value of this object
         has no meaning if the mplsTunnelHopInclude object
         is set to 'false'."
 ::= { mplsTunnelHopEntry 10 }

mplsTunnelHopInclude OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "If this value is set to true, then this indicates
         that this hop must be included in the tunnel's
         path. If this value is set to 'false', then this hop
         must be avoided when calculating the path for this
         tunnel. The default value of this object is 'true',
         so that by default all indicated hops are included
         in the CSPF path computation. If this object is set
         to 'false' the value of mplsTunnelHopType should be
         ignored."
    DEFVAL { true }
 ::= { mplsTunnelHopEntry 11 }

mplsTunnelHopPathOptionName OBJECT-TYPE
    SYNTAX      SnmpAdminString
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The description of this series of hops as they
         relate to the specified path option. The
         value of this object SHOULD be the same for
         each hop in the series that comprises a
         path option."
 ::= { mplsTunnelHopEntry 12 }

mplsTunnelHopEntryPathComp OBJECT-TYPE
    SYNTAX      INTEGER {
```



```
        dynamic(1),      -- CSPF computed
        explicit(2)      -- strict hop
    }
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "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 signalling 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
     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
```



```
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 lpid(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 lpid(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 represents 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 represents 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



**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      mplsTunnelXCPointer
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."
-- 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,
mplsTunnelPerfPackets,
mplsTunnelPerfHCPackets,
mplsTunnelPerfErrors,
mplsTunnelPerfBytes,
mplsTunnelPerfHCBytes,
mplsTunnelResourcePointer,
mplsTunnelInstancePriority,
mplsTunnelPathInUse,
mplsTunnelRole,
mplsTunnelTotalUpTime,
mplsTunnelInstanceUpTime,
mplsTunnelResourceIndexNext,
mplsTunnelResourceMaxRate,
mplsTunnelResourceMeanRate,
mplsTunnelResourceMaxBurstSize,
mplsTunnelResourceMeanBurstSize,
mplsTunnelResourceExBurstSize,
mplsTunnelResourceFrequency,
mplsTunnelResourceWeight,
mplsTunnelResourceRowStatus,
mplsTunnelResourceStorageType,
mplsTunnelARHopAddrType,
mplsTunnelARHopIpAddr,
mplsTunnelARHopAddrUnnum,
mplsTunnelARHopLspId,
mplsTunnelCHopAddrType,
mplsTunnelCHopIpAddr,
mplsTunnelCHopIpPrefixLen,
mplsTunnelCHopAsNumber,
```



```
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 mplsTunnelCRLDPResTable 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**

We wish to thank Adrian Farrel, Bert Wijnen, Eric Gray, Joan Cucchiara, Patrick Kerharo, Paul Langille, Marcus Brunner, Mike MacFaden, and Mike Piecuch for their comments on this document.

Comments should be made directly to the MPLS mailing list at [mpls@uu.net](mailto: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\*\*](#)

- [RFC2119] Bradner, S., "Key Words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC2578] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Structure of Management Information Version 2 (SMIV2)", STD 58, [RFC 2578](#), April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Textual Conventions for SMIV2", STD 58, [RFC 2579](#), April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIV2", STD 58, [RFC 2580](#), April 1999.
- [RFC2702] Awdanche, D., Malcolm, J., Agogbua, J., O'Dell, M., and J. McManus, "Requirements for Traffic Engineering Over MPLS", [RFC 2702](#), September 1999.
- [RFC2863] McCloghrie, K. and F. Kastenholtz, "The Interfaces Group MIB ", [RFC 2863](#), June 2000.
- [RFC3031] Rosen, E., Viswanathan, A., and R. Callon, "Multiprotocol Label Switching Architecture", [RFC 3031](#), January 2001.
- [RFC3209] Awdanche, D., Berger, L., Gan, D., Li, T., Srinivasan, V., and G. Swallow, "RSVP-TE: Extensions to RSVP for LSP Tunnels", [RFC 3209](#), December 2001.
- [RFC3212] Jamoussi, B., Ed., Andersson, L., Callon, R., Dantu, R., Wu, L., Doolan, P., Worster, T., Feldman, N., Fredette, A., Girish, M., Gray, E., Heinanen, J., Kilty, T., and A. Malis, "Constraint-Based LSP Setup using LDP", [RFC 3212](#), January 2002.
- [RFC3289] Baker, F., Chan, K., and A. Smith, "Management Information Base for the Differentiated Services Architecture", [RFC 3289](#), May 2002.



- [RFC3291] Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "TextualConventions for Internet Network Addresses", [RFC 3291](#), May 2002.
- [RFC3411] Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks", STD 62, [RFC 3411](#), December 2002.
- [RFC3811] Nadeau, T. and J. Cucchiara, "Definition of Textual Conventions and for Multiprotocol Label Switching (MPLS) Management", [RFC 3811](#), June 2004.
- [RFC3813] Srinivasan, C., Viswanathan, A., and T. Nadeau, "Multiprotocol Label Switching (MPLS) Label Switching (LSR) Router Management Information Base (MIB)", [RFC 3813](#), June 2004.

## 15.2. Informative References

- [MPLSMGMT] Nadeau, T., Srinivasan, C., and A. Farrel, "Multiprotocol Label Switching (MPLS) Management Overview", Work in Progress, September 2003.
- [RFC2434] Narten, T. and H. Alvestrand., "Guidelines for Writing an IANA Considerations Section in RFCs", [BCP 26](#), [RFC 2434](#), October 1998.
- [RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statement for Internet Standard Management Framework", [RFC 3410](#), December 2002.



**16. Authors' Addresses**

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