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Cheenu Srinivasan

Arun Viswanathan
Force10 Networks, Inc.

Thomas D. Nadeau
Cisco Systems, Inc.

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Multiprotocol Label Switching (MPLS) Traffic Engineering Management Information Base

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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.

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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 Multi-Protocol Label Switching (MPLS) [[RFC3031](#)] based traffic engineering. This MIB module should be used in conjunction with the companion document [[LSRMIB](#)] for MPLS based traffic engineering configuration and management.

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

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#), reference [[RFC2119](#)].

2. Terminology

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

An explicitly routed LSP (ERLSP) is referred to as an MPLS tunnel. It consists of one in-segment and/or one out-segment at the ingress/egress 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 [[LSRMIB](#)].

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 [[LSRMIB](#)].

- 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 loose and strict source routed hops.

These actions may need to be accompanied with corresponding actions using [[LSRMIB](#)] to establish and configure tunnel segments, if this is done manually. Also, the in-segment and out-segment performance tables, `mplsInSegmentPerfTable` and `mplsOutSegmentPerfTable` [[LSRMIB](#)], should be used to determine performance of the tunnels and tunnel segments.

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.
- CRLDP resource table (`mplsTunnelCRLDPreTable`) 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 [RSVPTE] and [[CRLDP](#)]. 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 tunnel segments, although multi-point-to-point and point-to-multi-point connections are supported by an LSR acting as a cross-connect. Each MPLS tunnel can thus have one out-segment originating at an LSR and/or one in-segment terminating at that LSR.

mplsTunnelTable does not define the in and out segments forming the tunnel. Instead, these are defined by creating rows in the in-segment and out-segment tables, defining relationships in the cross-connect table and referring to these rows in the mplsTunnelTable using a cross-connect index, mplsTunnelXCIndex. These segment and cross-connect related objects are defined in [[LSRMIB](#)].

[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.

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 protocol may support this feature.

6.5. mplsTunnelCHopTable

`mplsTunnelCHopTable` lists the actual hops computed by a constraint-based routing algorithm based on the `mplsTunnelHopTable`. The support of this table is optional since not all implementations may support computation of hop list using a constraint-based routing protocol.

6.6. mplsTunnelPerfTable

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

6.7. mplsTunnelCRLDResTable

`mplsTunnelCRLDResTable` contains resource information for those tunnels that are signaled using CRLDP [[CRLDP](#)]. 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.

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 interrelation 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 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 MPLS tunnel is 150.
ifSpeed	The total bandwidth in bits per second for use by the MPLS tunnel.
ifPhysAddress	Unused.
ifAdminStatus	See [RFC2863].
ifOperStatus	This value reflects the actual operational status of MPLS tunnel. Assumes the value down(2) if the MPLS tunnel is down.
ifLastChange	See [RFC2863].
ifInOctets	The number of octets received over the MPLS tunnel.
ifOutOctets	The number of octets transmitted over the MPLS tunnel.
ifInErrors	The number of labeled packets dropped due to uncorrectable errors.
ifInUnknownProtos	The number of received packets discarded during packet header validation, including packets with unrecognized label values.
ifOutErrors	See [RFC2863].
ifName	Textual name (unique on this system) of

the MPLS tunnel or an octet string of zero length.

ifLinkUpDownTrapEnable

Default is disabled (2).

ifConnectorPresent Set to false (2).

ifHighSpeed

See [[RFC2863](#)].

ifHCInOctets

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

ifHCOctets

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

ifAlias

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

9. Example of Tunnel Setup

This section contains an example of which MIB objects should be modified if one would like to create a best effort, loosely routed, unidirectional traffic engineered tunnel, which spans two hops of a simple network. Note that these objects should be created on the "head-end" LSR. Those objects relevant to illustrating the relationships amongst different tables are shown here. Other objects may be needed before conceptual row activation can happen.

The RowStatus values shown in this section are those to be used in the set request, typically createAndGo(4) which is used to create the conceptual row and have its status immediately set to active. A subsequent retrieval operation on the conceptual row will return a different value, such as active(1). Please see [[RFC2579](#)] for a detailed discussion on the use of RowStatus.

In mplsTunnelTable:

```
{
  mplsTunnelIndex          = 1,
  mplsTunnelInstance       = 1,
  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         = mplsXCIndex.2.0.0.15,
mplsTunnelSignallingProto   = none (1),
mplsTunnelSetupPrio         = 0,
mplsTunnelHoldingPrio       = 0,
mplsTunnelSessionAttributes = 0,
mplsTunnelLocalProtectInUse = false (0),
-- RowPointer MUST point to the first accessible column
mplsTunnelResourcePointer   = mplsTunnelResourceIndex.5,
mplsTunnelInstancePriority  = 1,
mplsTunnelHopTableIndex     = 1,
mplsTunnelIncludeAnyAffinity = 0,
mplsTunnelIncludeAllAffinity = 0,
mplsTunnelExcludeAllAffinity = 0,
mplsTunnelPathInUse         = 1,
mplsTunnelRole              = head (1),
-- Mandatory parameters needed to activate the row go here
mplsTunnelRowStatus         = createAndGo (4)
}
```

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 network, 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               = loose (2),
mplsTunnelHopInclude           = true (1),
mplsTunnelHopPathOptionName    = "here",
mplsTunnelHopEntryPathComp     = explicit (2),
-- Mandatory parameters needed to activate the row go here
mplsTunnelHopRowStatus         = createAndGo (4)
}

```

The following denotes the end of the network, 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   = "there",
  mplsTunnelHopEntryPathComp    = explicit (2),
-- Mandatory parameters needed to activate the row go here
  mplsTunnelHopRowStatus        = createAndGo (4)
}

```

10. The Use of RowPointer

RowPointer is a textual convention used to identify a conceptual row in a conceptual table in a MIB by pointing to the first accessible object. In this MIB module, in mplsTunnelTable, the objects mplsTunnelXCPointer and mplsTunnelResourcePointer are of type RowPointer. The object mplsTunnelXCPointer points to a specific entry in the mplsXCTable [[LSRMIB](#)]. 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 [[LSRMIB](#)] or MPLS-TE-STD-MIB [[TEMIB](#)]. If object mplsTunnelXCPointer returns zeroDotZero it implies that there is no LSP associated with that particular instance of tunnel entry. If object mplsTunnelResourcePointer returns zeroDotZero it implies that there is no QoS resource associated with that particular instance of tunnel entry.

11. MPLS Traffic Engineering MIB Definitions

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

IMPORTS

```

MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
Integer32, Unsigned32, Counter32, Counter64, TimeTicks,
zeroDotZero
    FROM SNMPv2-SMI
MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
    FROM SNMPv2-CONF
TruthValue, RowStatus, RowPointer, StorageType,
TimeStamp
    FROM SNMPv2-TC
InterfaceIndexOrZero
    FROM IF-MIB
mplsStdMIB, MplsBitRate, MplsBurstSize, MplsLSPID,
MplsTunnelIndex, MplsTunnelInstanceIndex,
MplsTunnelAffinity, MplsExtendedTunnelId, MplsPathIndex,
MplsPathIndexOrZero, MplsOwner, TeHopAddressType,
TeHopAddress, TeHopAddressAS, TeHopAddressUnnum
    FROM MPLS-TC-STD-MIB
SnmpAdminString
    FROM SNMP-FRAMEWORK-MIB
InetAddressPrefixLength
    FROM INET-ADDRESS-MIB
;
```

mplsTeStdMIB MODULE-IDENTITY

LAST-UPDATED

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ORGANIZATION

"Multiprotocol Label Switching (MPLS) Working Group"

CONTACT-INFO

"

Cheenu Srinivasan
Email: cheenu@alumni.princeton.edu

Arun Viswanathan
Force10 Networks, Inc.
Email: arunv@force10networks.com

Thomas D. Nadeau
Cisco Systems, Inc.
Email: tnadeau@cisco.com

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 (2003). This
version of this MIB module is part of RFC xxxx; see
the RFC itself for full legal notices.

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,
Awduche, D., Malcolm, J., Agogbua, J., O'Dell, M.,
and J. McManus, [RFC 2702](#), September 1999"

-- Revision history.

REVISION

"200306231200Z" -- 23 June 2003 12:00:00 GMT

DESCRIPTION

"Initial draft version issues as part of RFC XXXX."

::= { 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 Integer32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains the next appropriate value to be used for mplsTunnelIndex when creating entries in mplsTunnelTable. 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 value of mplsTunnelIndex for a new entry, the manager must first issue a management protocol retrieval operation to obtain the current value of this object. The agent should modify the value to reflect the next unassigned index after each retrieval operation. After a manager retrieves a value the agent will determine through its local policy when this index value will be made available for reuse."

::= { mplsTeObjects 1 }

mplsTunnelTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

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Expires December 2003

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"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 multi-point-to-point and point-to-multi-point 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 an LSR originating the tunnel. To uniquely identify a tunnel across a MPLS network requires index mplsTunnelIngressLSRId. 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. Kastenholz, June 2000 "

INDEX {

mplsTunnelIndex,
mplsTunnelInstance,
mplsTunnelIngressLSRId,
mplsTunnelEgressLSRId

}

::= { mplsTunnelTable 1 }

MplsTunnelEntry ::= SEQUENCE {

mplsTunnelIndex MplsTunnelIndex,

mplsTunnelInstance

MplsTunnelInstanceIndex,

mplsTunnelIngressLSRId	MplsExtendedTunnelId,
mplsTunnelEgressLSRId	MplsExtendedTunnelId,
mplsTunnelName	SnmpAdminString,
mplsTunnelDescr	SnmpAdminString,
mplsTunnelIsIf	TruthValue,
mplsTunnelIfIndex	InterfaceIndexOrZero,
mplsTunnelOwner	MplsOwner,
mplsTunnelRole	INTEGER,
mplsTunnelXCPointer	RowPointer,
mplsTunnelSignallingProto	INTEGER,
mplsTunnelSetupPrio	Integer32,
mplsTunnelHoldingPrio	Integer32,
mplsTunnelSessionAttributes	BITS,
mplsTunnelLocalProtectInUse	TruthValue,
mplsTunnelResourcePointer	RowPointer,
mplsTunnelPrimaryInstance	MplsTunnelInstanceIndex,
mplsTunnelInstancePriority	Unsigned32,
mplsTunnelHopTableIndex	MplsPathIndexOrZero,
mplsTunnelPathInUse	MplsPathIndexOrZero,
mplsTunnelARHopTableIndex	MplsPathIndexOrZero,
mplsTunnelCHopTableIndex	MplsPathIndexOrZero,
mplsTunnelIncludeAnyAffinity	MplsTunnelAffinity,
mplsTunnelIncludeAllAffinity	MplsTunnelAffinity,
mplsTunnelExcludeAllAffinity	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."

::= { 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. The tunnel entry with instance index 0 should refer to the configured tunnel interface (if one exists), and values greater than 0 but less than or equal to 65535 should be used to indicate signaled (or backup) tunnel LSP instances. For tunnel LSPs signaled using RSVP, this value should correspond to the RSVP source port used for the RSVP-TE session. Values greater than 65535 apply to Fast Re-Route (FRR) detour instances "

::= { 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 mimic the Extended Tunnel Id field in the SESSION object. When the MPLS signalling protocol is crldp(3) this value SHOULD mimic 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. Kastenholz, June 2000"

::= { 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."

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](#)."

REFERENCE

"[RFC 2863](#) - The Interfaces Group MIB, McCloghrie, K., and F. Kastenholz, June 2000"

DEFVAL { false }

::= { mplsTunnelEntry 7 }

mplsTunnelIfIndex OBJECT-TYPE

SYNTAX InterfaceIndexOrZero

MAX-ACCESS read-only

STATUS

current

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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. Kastenholz, June 2000"

::= { 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) }

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."

::= { 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, MPLS Label Switch Router Management Information Base, Internet Draft <[draft-ietf-mpls-lsr-mib-10.txt](#)>, June 2003."

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"

::= { 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, [RFC3209](#), December 2001
- "2. Constraint-Based LSP Setup using LDP, Jamoussi

(Editor), [RFC 3212](#), January 2002"

::= { mplsTunnelEntry 14 }

mplsTunnelSessionAttributes OBJECT-TYPE

SYNTAX BITS {
 fastReroute (0),
 mergingPermitted (1),
 isPersistent (2),
 isPinned (3),
 recordRoute(4)
}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This bit mask indicates optional session values for this tunnel. The following describes these bit fields:

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

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

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

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

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

REFERENCE

"1. RSVP-TE: Extensions to RSVP for LSP Tunnels, Awduche et al, [RFC 3209](#), December 2001."

::= { mplsTunnelEntry 15 }

mplsTunnelLocalProtectInUse OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-create
STATUS current
DESCRIPTION
 "Indicates that the local repair mechanism is in use
 to maintain this tunnel (usually in the face of an
 outage of the link it was previously routed over)."
 ::= { 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
 segment. 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 segments 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."
 ::= { 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 tunnels
 with the same mplsTunnelIndex in this table, but
 with a different mplsTunnelInstance. Tunnel group

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."

::= { 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."

::= { 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."

::= { mplsTunnelEntry 22 }

mplsTunnelCHopTableIndex OBJECT-TYPE

SYNTAX MplsPathIndexOrZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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"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."

::= { 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 }

mplsTunnelExcludeAllAffinity OBJECT-TYPE

SYNTAX MplsTunnelAffinity

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A link satisfies the exclude-all 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."

::= { mplsTunnelEntry 26 }

mplsTunnelTotalUpTime OBJECT-TYPE

SYNTAX

TimeTicks

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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 paths has changed
 for this tunnel since its creation."
 ::= { mplsTunnelEntry 30 }

mplsTunnelLastPathChange OBJECT-TYPE

SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Specifies the time since the last path change for
 this tunnel."
 ::= { 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."

::= { mplSTunnelEntry 32 }

mplSTunnelStateTransitions OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Specifies the number of times the state 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

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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 except mplsTunnelRowStatus and mplsTunnelStorageType."

::= { mplsTunnelEntry 36 }

mplsTunnelStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable indicates the storage type for this object. If this variable is set to readOnly(5), and the corresponding entry is removed, then the agent must remove this row shortly thereafter [[RFC2579](#)]."

Setting this object to permanent(4) indicates that this object should be restored automatically after failures. The agent MUST ensure that the associated mplsTunnelXCPointer, mplsTunnelResourcePointer and associated row in mplsTunnelHopTable also has the same StorageType value and is restored consistently upon restoration.

No objects are required to be writable for rows in this table with this object set to permanent(4). The default value is volatile(2)."

DEFVAL { volatile }

::= { mplsTunnelEntry 37 }

-- End of mplsTunnelTable

mplsTunnelHopListIndexNext OBJECT-TYPE

SYNTAX Unsigned32 (0..2147483647)

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. After each retrieval operation, the agent should modify the value to reflect the next unassigned index. After a manager retrieves a value the agent will determine through its local policy when this index value will be made available for reuse."

::= { 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 MPLS tunnel defined in mplsTunnelTable, when it is established via signalling, for the outgoing direction of the tunnel. Each row in this table is indexed by mplsTunnelHopListIndex. Each row also has a secondary index mplsTunnelHopIndex corresponding to the next hop that this row corresponds to. The first row in the table is the first hop after the origination point of the tunnel. 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

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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,
mplsTunnelHopIpAddress	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

"Secondary index into this table identifying a particular hop."

::= { mplsTunnelHopEntry 3 }

mplsTunnelHopAddrType OBJECT-TYPE

SYNTAX TeHopAddressType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Denotes the address type of this tunnel hop. If set to ipv4(1) or ipv6(2), it indicates that the mplsTunnelHopIpAddr contains respectively the IPv4 or IPv6 address of this hop. The values contained in mplsTunnelHopAsNumber, mplsTunnelHopAddrUnnum and mplsTunnelHopLspId should be ignored. If this object is set to asnumber(3), the IP address related objects should be ignored, and the mplsTunnelHopAsNumber should be referred to. If this object is set to unnum(4), then only the object mplsTunnelHopAddrUnnum should be referred to. If the object is set to lspid(5), then all but the mplsTunnelHopLspId should be referred to. Note that lspid(5) is a valid option only for tunnels signaled via CRLDP"

DEFVAL { ipv4 }

::= { mplsTunnelHopEntry 4 }

mplsTunnelHopIpAddr OBJECT-TYPE

SYNTAX TeHopAddress

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If mplsTunnelHopAddrType is set to ipv4(1) or ipv6(2), then this value will contain respectively the IPv4 address or the IPv6 address prefix of this hop. This object should be used in conjunction with mplsTunnelHopIpPrefixLen that provides the prefix

length of the address. If mplsTunnelHopAddrType is

set to lspid(5), then this value will contain the Ingress LSR Router ID of the Tunnel. Otherwise the agent should set this object to zero-length string and the manager should ignore this."

::= { 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 a management entity SHOULD set this object to 0 and an agent MUST ignore it."

::= { 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 id of the unnumbered interface for this hop. 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."

::= { 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."

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."

::= { 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 except mplsTunnelHopRowStatus and mplsTunnelHopStorageType."

::= { mplsTunnelHopEntry 14 }

mplsTunnelHopStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable indicates the storage type for this object. If this variable is set to readOnly(5), and the corresponding entry is removed, then the agent must remove this row shortly thereafter [[RFC2579](#)]."

Setting this object to permanent(4) indicates that this object should be restored automatically after failures.

No objects are required to be writable for rows in this table with this object set to permanent(4). The default value is volatile(2)."

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. The agent should modify the value to reflect the next unassigned index after each retrieval operation. After a manager retrieves a value the agent will determine through its local policy when this index value will be made available for reuse."

::= { 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."

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 "bits 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.

This object is copied to an instance of mplsTrafficParamMaxRate in mplsTrafficParamTable the OID of which is copied into the corresponding mplsInSegmentTrafficParamPtr."

REFERENCE

"Srinivasan, C., Viswanathan, A., and T. Nadeau, MPLS Label Switch Router Management Information Base, Internet Draft <[draft-ietf-mpls-lsr-mib-10.txt](#)>, June 2003."

```
::= { mplsTunnelResourceEntry 2 }
```

mplsTunnelResourceMeanRate OBJECT-TYPE

SYNTAX MplsBitRate

UNITS "bits 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.

When resource allocation is performed as requested
by this TSpec object, it is copied into an entry in
mplsTrafficParamTable [[LSRMIB](#)]:
mplsTunnelInMeanRate to mplsTrafficParamMeanRate.
The OID of this entry is copied to
mplsInSegmentTrafficParamPtr of the corresponding
in-segment entry."

REFERENCE

"Srinivasan, C., Viswanathan, A., and T. Nadeau, MPLS
Label Switch Router Management Information Base,
Internet Draft <[draft-ietf-mpls-lsr-mib-10.txt](#)>,
June 2003."

::= { mplsTunnelResourceEntry 3 }

mplsTunnelResourceMaxBurstSize OBJECT-TYPE

SYNTAX MplsBurstSize

UNITS "bytes"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The maximum burst size in bytes. This object is
copied to mplsInSegmentMaxBurstSize of the
corresponding in-segment.

When resource allocation is performed as requested
by this TSpec object, it is copied into an entry in
mplsTrafficParamTable [[LSRMIB](#)]:
mplsTunnelInMaxBurstSize to
mplsTrafficParamMaxBurstSize. The OID of this entry
is copied to mplsInSegmentTrafficParamPtr of the
corresponding in-segment entry."

REFERENCE

"Srinivasan, C., Viswanathan, A., and T. Nadeau, MPLS
Label Switch Router Management Information Base,
Internet Draft <[draft-ietf-mpls-lsr-mib-10.txt](#)>,
June 2003."

::= { mplsTunnelResourceEntry 4 }

mplsTunnelResourceMeanBurstSize OBJECT-TYPE

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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 0
 for this value and must not allow a user to set
 this value."
::= { 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 0
 for this value 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 except mplsTunnelResourceRowStatus and mplsTunnelResourceStorageType."

::= { mplsTunnelResourceEntry 9 }

mplsTunnelResourceStorageType OBJECT-TYPE

SYNTAX StorageType
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"This variable indicates the storage type for this object. If this variable is set to readOnly(5), and the corresponding entry is removed, then the agent must remove this row shortly thereafter [[RFC2579](#)].

Setting this object to permanent(4) indicates that this object should be restored automatically after failures.

No objects are required to be writable for rows in this table with this object set to permanent(4). The default value is volatile(2)."

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, strict or loose, for an MPLS tunnel defined in mplsTunnelTable, as reported by the MPLS signalling protocol, for the outgoing direction of the tunnel. 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. The first row in the table is the first hop after the origination point of the tunnel. 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 mplsTunnelARHopTable.

Please note that since the information necessary to build entries within this table are 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."

::= { 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 a network administrator 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,

mplsTunnelARHopIpPrefixLen InetAddressPrefixLength,

```
mplsTunnelARHopAsNumber      TeHopAddressAS,
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
    "Denotes the address type of this tunnel hop."
DEFVAL      { ipv4 }
 ::= { mplsTunnelARHopEntry 3 }
```

mplsTunnelARHopIpAddr OBJECT-TYPE

```
SYNTAX      TeHopAddress
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "If mplsTunnelARHopAddrType is set to ipv4(1) or
     ipv6(2), then this value will contain respectively
     the IPv4 address or the IPv6 address of this hop.
     Otherwise the agent should set this object to zero-
     length string and the manager should ignore this."
 ::= { mplsTunnelARHopEntry 4 }
```

mplsTunnelARHopIpPrefixLen OBJECT-TYPE

```
SYNTAX      InetAddressPrefixLength
MAX-ACCESS  read-only
```

STATUS

current

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DESCRIPTION

"If mplSTunnelARHopAddrType is set to ipv4(1) or ipv6(2), then this value will contain an appropriate prefix length for the IP address in object mplSTunnelARHopIpAddr. Otherwise a management entity SHOULD set this object to 0 and an agent MUST ignore it."

::= { mplSTunnelARHopEntry 5 }

mplSTunnelARHopAsNumber OBJECT-TYPE

SYNTAX TeHopAddressAS

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplSTunnelARHopAddrType 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."

::= { mplSTunnelARHopEntry 6 }

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. Otherwise the agent should set this object to zero-length string and the manager should ignore this."

::= { mplSTunnelARHopEntry 7 }

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 8 }

-- 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. 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. The first row in the table is the first hop after the origination point of the tunnel. 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 is actually provided by routing protocol after the path has been computed, the entries in this table are provided only for observation, and hence, all variables in this table are accessible exclusively as 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 constraint-based routing protocol based on the hops specified in the corresponding mplsTunnelHopTable."

INDEX { mplsTunnelCHopListIndex, mplsTunnelCHopIndex }

::= { mplsTunnelCHopTable 1 }

MplsTunnelCHopEntry ::= SEQUENCE {

mplsTunnelCHopListIndex

MplsPathIndex,

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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
"Denotes the address type of this tunnel hop. Note
that lspid(5) is a valid option only for tunnels
signaled via CRLDP."
DEFVAL { ipv4 }
::= { mplsTunnelCHopEntry 3 }

mplsTunnelCHopIpAddr OBJECT-TYPE

SYNTAX TeHopAddress
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"If mplsTunnelCHopAddrType is set to ipv4(1) or
ipv6(2), then this value will contain respectively
the IPv4 address or the IPv6 address of this hop."

Otherwise the agent should set this object to zero-

length string and the manager should ignore this."
 ::= { 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 a management
entity SHOULD set this object to 0 and an agent
MUST ignore it. "

::= { 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. 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 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 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."
 ::= { 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 with errors."
 ::= { mplsTunnelPerfEntry 3 }

mplsTunnelPerfBytes OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Number of bytes forwarded by the tunnel."
 ::= { 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 2 }

mplsTunnelCRLDPResExBurstSize OBJECT-TYPE

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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 3 }

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 4 }

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 5 }

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 }

::= { mplsTunnelCRLDResEntry 6 }

mplsTunnelCRLDResRowStatus 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 except mplsTunnelCRLDResRowStatus and mplsTunnelCRLDResStorageType."

::= { mplsTunnelCRLDResEntry 7 }

mplsTunnelCRLDResStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable indicates the storage type for this object. If this variable is set to readOnly(5), and the corresponding entry is removed, then the agent must remove this row shortly thereafter [[RFC2579](#)].

Setting this object to permanent(4) indicates that

this object should be restored automatically after

failures.

No objects are required to be writable for rows in this table with this object set to permanent(4).

The default value is volatile(2)."

DEFVAL { volatile }

::= { mplsTunnelCRLDResEntry 8 }

-- 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 actual path is used, then this tunnel's entry 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 actual path is used, then this tunnel's entry 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,  
    mplsTeNotificationGroup  
}
```

GROUP mplsTunnelManualGroup

DESCRIPTION

"This group is mandatory for devices which support manual configuration of tunnels, in addition to mplsTunnelGroup. The following constraints apply: mplsTunnelSignallingProto should be at least read-only with a value of none(1)."

GROUP mplsTunnelSignaledGroup

DESCRIPTION

"This group is mandatory for devices which support signaled tunnel set up, in addition to mplsTunnelGroup. The following constraints apply: mplsTunnelSignallingProto should be at least read-only returning a value of ldp(2), or rsvp(3)."

GROUP mplsTunnelIsNotIntfGroup

DESCRIPTION

"This group is mandatory for devices which support tunnels that are not interfaces, in addition to mplsTunnelGroup. The following constraints apply: mplsTunnelIsIf must at least be read-only returning false(1)."

GROUP mplsTunnelIsIntfcGroup

DESCRIPTION

"This group is mandatory for devices which support tunnels that are interfaces, in addition to mplsTunnelGroup. The following constraints apply: mplsTunnelIsIf must at least be read-only returning true(2)."

GROUP mplsTunnelCRLDPResOptionalGroup

DESCRIPTION

"Objects in this group are optional except for implementations supporting the CR-LDP protocol for signalling of TE tunnels."

-- mplsTunnelTable

OBJECT mplsTunnelIsIf

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelSignallingProto

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 mplsTunnelOperStatus

SYNTAX INTEGER { up (1), down (2) }

DESCRIPTION

"Only up and down states must be supported. Write access is not required."

OBJECT mplsTunnelRowStatus

SYNTAX INTEGER {

active(1),

notInService(2),

createAndGo(4),

destroy(6)

}

MIN-ACCESS read-only

DESCRIPTION

"The notReady(3) and createAndWait(5) states need not be supported. Write access is not required."

OBJECT mplsTunnelStorageType

SYNTAX INTEGER { other(1) }

DESCRIPTION

"Only other (1) needs to be supported."

OBJECT mplsTunnelRole

SYNTAX INTEGER { head(1) }

MIN-ACCESS read-only

DESCRIPTION

"Only support for head is 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,
 mplsTunnelManualGroup,
 mplsTunnelScalarGroup,
 mplsTunnelIsNotIntfcGroup,
 mplsTunnelCRLDPResOptionalGroup
}

GROUP mplsTunnelSignaledGroup

DESCRIPTION

"This group is mandatory for devices which support signaled tunnel set up, in addition to mplsTunnelGroup. The following constraints apply: mplsTunnelSignallingProto should be at least read-only returning a value of ldp(2), or rsvp(3)."

-- 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 mplsTunnelExcludeAllAffinity
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 mplsTunnelOperStatus
SYNTAX INTEGER { up (1), down (2) }
DESCRIPTION
 "Only up and down states must be supported. Write
 access is not required."

OBJECT mplsTunnelRowStatus
SYNTAX INTEGER {
 active(1),
 notInService(2),
 createAndGo(4),
 destroy(6)
}
MIN-ACCESS read-only
DESCRIPTION
 "The notReady(3) and createAndWait(5) states need
 not be supported. Write access is not required."

OBJECT mplsTunnelStorageType
SYNTAX INTEGER { other(1) }
DESCRIPTION
 "Only other (1) needs to be supported."

-- 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 INTEGER {

active(1),

notInService(2),

createAndGo(4),

destroy(6)

}

MIN-ACCESS read-only

DESCRIPTION

"The notReady(3) and createAndWait(5) states need not be supported. Write access is not required."

OBJECT mplsTunnelHopStorageType

SYNTAX INTEGER { other(1) }

DESCRIPTION

"Only other (1) needs to be supported."

-- 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 INTEGER {
 active(1),
 notInService(2),
 createAndGo(4),
 destroy(6)
}
MIN-ACCESS read-only
DESCRIPTION
 "The notReady(3) and createAndWait(5) states need
 not be supported. Write access is not required."

OBJECT mplsTunnelResourceStorageType


```
SYNTAX      INTEGER { other(1) }
DESCRIPTION
    "Only other (1) needs to be supported."

-- 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      INTEGER {
    active(1),
    notInService(2),
    createAndGo(4),
    destroy(6)
}
MIN-ACCESS  read-only
DESCRIPTION
    "The notReady(3) and createAndWait(5) states need
    not be supported. Write access is not required."

OBJECT      mplsTunnelCRLDPResStorageType
SYNTAX      INTEGER { other(1) }
DESCRIPTION
    "Only other (1) needs to be supported."
```



```
::= { mplsTeCompliances 2 }
```

```
-- Units of conformance.
```

```
mplsTunnelGroup OBJECT-GROUP
```

```
OBJECTS {
```

```
    mplsTunnelIndexNext,  
    mplsTunnelName,  
    mplsTunnelDescr,  
    mplsTunnelOwner,  
    mplsTunnelXCPointer,  
    mplsTunnelIfIndex,  
    mplsTunnelHopTableIndex,  
    mplsTunnelARHopTableIndex,  
    mplsTunnelCHopTableIndex,  
    mplsTunnelAdminStatus,  
    mplsTunnelOperStatus,  
    mplsTunnelRowStatus,  
    mplsTunnelNotificationEnable,  
    mplsTunnelStorageType,  
    mplsTunnelConfigured,  
    mplsTunnelActive,  
    mplsTunnelPrimaryInstance,  
    mplsTunnelPrimaryUpTime,  
    mplsTunnelPathChanges,  
    mplsTunnelLastPathChange,  
    mplsTunnelCreationTime,  
    mplsTunnelStateTransitions,  
    mplsTunnelIncludeAnyAffinity,  
    mplsTunnelIncludeAllAffinity,  
    mplsTunnelExcludeAllAffinity,  
    mplsTunnelPerfPackets,  
    mplsTunnelPerfHCPackets,  
    mplsTunnelPerfErrors,  
    mplsTunnelPerfBytes,  
    mplsTunnelPerfHCBytes,  
    mplsTunnelResourcePointer,  
    mplsTunnelInstancePriority,  
    mplsTunnelPathInUse,  
    mplsTunnelRole,  
    mplsTunnelTotalUpTime,  
    mplsTunnelInstanceUpTime,  
    mplsTunnelResourceIndexNext,  
    mplsTunnelResourceMaxRate,  
    mplsTunnelResourceMeanRate,  
    mplsTunnelResourceMaxBurstSize,
```

mplsTunnelResourceMeanBurstSize,

```
mplsTunnelResourceExBurstSize,
mplsTunnelResourceFrequency,
mplsTunnelResourceWeight,
mplsTunnelResourceRowStatus,
mplsTunnelResourceStorageType,
mplsTunnelARHopAddrType,
mplsTunnelARHopIpAddr,
mplsTunnelARHopIpPrefixLen,
mplsTunnelARHopAsNumber,
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

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```
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 monitoring of MPLS TE tunnels. This MIB module can also be used for 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, mplsTunnelARHopTable, mplsTunnelCHopTable, and mplsTunnelCRLDResTable 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 mplsTunnelCRLDResTable 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 to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module, is properly configured to give access to the objects only to those principals "users" that have legitimate.

13. Acknowledgments

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15. Authors' Addresses

Cheenu Srinivasan
Email: cheenu@alumni.princeton.edu

Arun Viswanathan
Force10 Networks, Inc.
1440 McCarthy Blvd
Milpitas, CA 95035
Phone: +1-408-571-3516
Email: arunv@force10networks.com

Thomas D. Nadeau
Cisco Systems, Inc.
300 Apollo Drive
Chelmsford, MA 01824
Phone: +1-978-244-3051
Email: tnadeau@cisco.com

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