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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.

Table of Contents

1. Introduction	2
2. Terminology	3
3. The Internet-Standard Management Framework	3

4. Feature List	3
5. Outline	4
5.1. Summary of Traffic Engineering MIB module	4
6. Brief Description of MIB Objects	5
6.1. mplsTunnelTable	5
6.2. mplsTunnelResourceTable	5
6.3. mplsTunnelHopTable	5
6.4. mplsTunnelARHopTable	6
6.5. mplsTunnelCHopTable	6
6.6. mplsTunnelPerfTable	6
6.7. mplsTunnelCRLDPResTable	6
7. Use of 32-bit and 64-bit Counters	7
8. Application of the Interface Group to MPLS Tunnels	7
8.1. Support of the MPLS Tunnel Interface by ifTable	8
9. Example of Tunnel Setup	9
10. The Use of RowPointer	11
11. MPLS Traffic Engineering MIB Definitions	12
12. Security Considerations	62
13. Acknowledgments	63
14. References	64
14.1. Normative References	64
14.2. Informative References	65
15. Authors' Addresses	65
16. Full Copyright Statement	66
17. Intellectual Property Notice	66
18. IANA Considerations	67
18.1. IANA Considerations for MPLS-TE-STD-MIB	67

[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 in-segment(s) and/or out-segment(s) at the egress/ingress LSRs, each segment being associated with one MPLS interface. These are also referred to as tunnel segments. Additionally, at an intermediate LSR, we model a connection as consisting of one or more in-segments and/or one or more out-segments. The binding or interconnection between in-segments and out-segments is performed using a cross-connect. These objects are defined in the MPLS Label Switch Router MIB [[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 by 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 in addition to mplsTunnelPerfTable in this MIB module.

[5.1](#). Summary of Traffic Engineering MIB module

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

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

These tables are described in the subsequent sections.

[6](#). Brief Description of MIB Objects

The objects described in this section support the functionality described in documents [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 tunnels, 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.

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

[6.4.](#) mplsTunnelARHopTable

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

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

[6.5.](#) mplsTunnelCHopTable

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

At transit LSRs this table contains the hops computed to apply to the downstream part of this tunnel. This corresponds to the requested path signaled from this LSR through the signaling protocol.

[6.6.](#) mplsTunnelPerfTable

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

[6.7.](#) mplsTunnelCRLDPResTable

mplsTunnelCRLDPResTable contains resource information for those tunnels that are signaled using CRLDP [[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. The mplsTunnelCRLDPResTable may be supported only by implementations that support the CR-LDP signaling protocol.

[7.](#) Use of 32-bit and 64-bit Counters

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

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

[8.](#) Application of the Interface Group to MPLS Tunnels

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

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

```
{  
    mplsTunnelResourceIndex          = 5,
```

```

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

```

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

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

In `mplsTunnelHopTable`:

```

{
  mplsTunnelHopListIndex      = 1,
  mplsTunnelPathOptionIndex   = 1,
  mplsTunnelHopIndex          = 1,
  mplsTunnelHopAddrType       = ipv4 (1),
  mplsTunnelHopIpAddr         = "192.168.100.1",
  mplsTunnelHopIpPrefixLen    = 32,
  mplsTunnelHopType           = strict (2),
  mplsTunnelHopInclude        = true (1),
  mplsTunnelHopPathOptionName = "Here to there",
  mplsTunnelHopEntryPathComp   = explicit (2),
-- Mandatory parameters needed to activate the row go here
  mplsTunnelHopRowStatus      = createAndGo (4)
}

```

The following denotes the end of the tunnel, or the last hop in our example. We have used the fictitious LSR identified by "192.168.101.1" as our end router.

In `mplsTunnelHopTable`:

```

{
  mplsTunnelHopListIndex      = 1,
  mplsTunnelPathOptionIndex   = 1,
  mplsTunnelHopIndex          = 2,
  mplsTunnelHopAddrType       = ipv4 (1),

```

```

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

```

The following denotes the configured tunnel "head" entry:

In mplsTunnelTable:

```

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

```

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

objects such as the `mplsTunnelXCPointer` set accordingly.

[10.](#) The Use of RowPointer

RowPointer is a textual convention used to identify a conceptual row in a conceptual table in a MIB by pointing to the first accessible object. In this MIB module, in `mplsTunnelTable`, the objects `mplsTunnelXCPointer` and `mplsTunnelResourcePointer` are of type RowPointer. The object `mplsTunnelXCPointer` points to a specific entry in the `mplsXCTable` [[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, ifGeneralInformationGroup,
ifCounterDiscontinuityGroup
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
IndexIntegerNextFree
FROM DIFFSERV-MIB
InetAddressPrefixLength
FROM INET-ADDRESS-MIB
;

mplsTeStdMIB MODULE-IDENTITY

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ORGANIZATION

"Multiprotocol Label Switching (MPLS) Working Group"

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Comments about this document should be emailed

directly to the MPLS working group mailing list at
mpls@uu.net."

DESCRIPTION

"Copyright (C) The Internet Society (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"

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[Page 13]

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MPLS-TE-STD-MIB

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::= { mplsStdMIB XXX } -- Please see IANA considerations section
-- the requested mplsStdMIB subId is 3.

-- Top level components of this MIB module.

-- traps

mplsTeNotifications OBJECT IDENTIFIER ::= { mplsTeStdMIB 0 }

-- tables, scalars

mplsTeScalars OBJECT IDENTIFIER ::= { mplsTeStdMIB 1 }

mplsTeObjects OBJECT IDENTIFIER ::= { mplsTeStdMIB 2 }

-- conformance

mplsTeConformance OBJECT IDENTIFIER ::= { mplsTeStdMIB 3 }

-- MPLS Tunnel scalars.

mplsTunnelConfigured OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of tunnels configured on this device. A tunnel is considered configured if the mplsTunnelRowStatus is active(1)."

::= { mplsTeScalars 1 }

mplsTunnelActive OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of tunnels active on this device. A tunnel is considered active if the mplsTunnelOperStatus is up(1)."

::= { mplsTeScalars 2 }

mplsTunnelTEDistProto OBJECT-TYPE

SYNTAX BITS {

other (0),

ospf (1),

isis (2)

}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The traffic engineering distribution protocol(s) used by this LSR. Note that an LSR may support more than one distribution protocol simultaneously."

::= { mplsTeScalars 3 }

mplsTunnelMaxHops OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

```
    "The maximum number of hops that can be specified for
      a tunnel on this device."
 ::= { mplsTeScalars 4 }
```

```
mplsTunnelNotificationMaxRate OBJECT-TYPE
```

```
SYNTAX      Unsigned32
```

```
MAX-ACCESS  read-write
```

```
STATUS      current
```

```
DESCRIPTION
```

```
    "This variable indicates the maximum number of
      notifications issued per second. If events occur
      more rapidly, the implementation may simply fail to
      emit these notifications during that period, or may
      queue them until an appropriate time. A value of 0
      means no throttling is applied and events may be
      notified at the rate at which they occur."
```

```
DEFVAL      { 0 }
```

```
::= { mplsTeScalars 5 }
```

```
-- End of MPLS Tunnel scalars.
```

```
-- MPLS tunnel table.
```

```
mplsTunnelIndexNext OBJECT-TYPE
```

```
SYNTAX      IndexIntegerNextFree (0..65535)
```

```
MAX-ACCESS  read-only
```

```
STATUS      current
```

```
DESCRIPTION
```

```
    "This object contains an unused value for
      mplsTunnelIndex, or a zero to indicate
      that none exist. Negative values are not allowed,
      as they do not correspond to valid values of
      mplsTunnelIndex.
```

```

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

```
::= { mplsTeObjects 1 }
```

```
mplsTunnelTable OBJECT-TYPE
```

SYNTAX SEQUENCE OF MplsTunnelEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"The mplsTunnelTable allows new MPLS tunnels to be created between an LSR and a remote endpoint, and existing tunnels to be reconfigured or removed. Note that only point-to-point tunnel segments are supported, although 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 the LSR originating the tunnel. To uniquely identify a tunnel across an MPLS network requires index mplsTunnelIngressLSRId. The last index mplsTunnelEgressLSRId is useful in identifying all instances of a tunnel that terminate on the same egress LSR."

REFERENCE

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

INDEX { mplsTunnelIndex,
 mplsTunnelInstance,
 mplsTunnelIngressLSRId,
 mplsTunnelEgressLSRId
 }

}

mplsTunnelIndex OBJECT-TYPE

SYNTAX MplsTunnelIndex

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Uniquely identifies a set of tunnel instances between a pair of ingress and egress LSRs. Managers should obtain new values for row creation in this table by reading mplsTunnelIndexNext. When the MPLS signalling protocol is rsvp(2) this value SHOULD be equal to the value signaled in the

Tunnel Id of the Session object. When the MPLS signalling protocol is crldp(3) this value SHOULD be equal to the value signaled in the LSP ID."

::= { mplsTunnelEntry 1 }

mplsTunnelInstance OBJECT-TYPE

SYNTAX MplsTunnelInstanceIndex

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Uniquely identifies a particular instance of a tunnel between a pair of ingress and egress LSRs. It is useful to identify multiple instances of tunnels for the purposes of backup and parallel tunnels. When the MPLS signaling protocol is rsvp(2) this value SHOULD be equal to the LSP Id of the Sender Template object. When the signaling protocol is crldp(3) there is no equivalent signaling object."

::= { mplsTunnelEntry 2 }

mplsTunnelIngressLSRId OBJECT-TYPE

SYNTAX MplsExtendedTunnelId

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Identity of the ingress LSR associated with this tunnel instance. When the MPLS signalling protocol is rsvp(2) this value SHOULD be equal to the Tunnel Sender Address in the Sender Template object and MAY be equal to the Extended Tunnel Id field in the SESSION object. When the MPLS signalling protocol is crldp(3) this value SHOULD be equal to the Ingress LSR Router ID field in the LSPID TLV object."

REFERENCE

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

::= { mplsTunnelEntry 3 }

mplsTunnelEgressLSRId OBJECT-TYPE

SYNTAX MplsExtendedTunnelId

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Identity of the egress LSR associated with this tunnel instance."

::= { mplsTunnelEntry 4 }

mplsTunnelName OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The canonical name assigned to the tunnel. This name can be used to refer to the tunnel on the LSR's console port. If mplsTunnelIsIf is set to true then the ifName of the interface corresponding to this tunnel should have a value equal to mplsTunnelName. Also see the description of ifName in [RFC 2863](#)."

REFERENCE

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

```
DEFVAL {""}  
::= { mplsTunnelEntry 5 }
```

mplsTunnelDescr OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A textual string containing information about the tunnel. If there is no description this object contains a zero length string. This object is may not be signaled by MPLS signaling protocols, consequentially the value of this object at transit and egress LSRs MAY be automatically generated or absent."

DEFVAL {""}

::= { mplsTunnelEntry 6 }

mplsTunnelIsIf OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Denotes whether or not this tunnel corresponds to an interface represented in the interfaces group table. Note that if this variable is set to true then the ifName of the interface corresponding to this tunnel should have a value equal to mplsTunnelName. Also see the description of ifName in [RFC 2863](#). This object is meaningful only at the ingress and egress LSRs."

REFERENCE

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

```
DEFVAL { false }  
::= { mplsTunnelEntry 7 }
```

mplsTunnelIfIndex OBJECT-TYPE

SYNTAX InterfaceIndexOrZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelIsIf is set to true, then this value contains the LSR-assigned ifIndex which corresponds to an entry in the interfaces table. Otherwise this variable should contain the value of zero indicating that a valid ifIndex was not assigned to this tunnel interface."

REFERENCE

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

DEFVAL { 0 }

::= { mplsTunnelEntry 8 }

mplsTunnelOwner OBJECT-TYPE

SYNTAX MplsOwner

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Denotes the entity that created and is responsible for managing this tunnel. This column is automatically filled by the agent on creation of a row."

::= { mplsTunnelEntry 9 }

mplsTunnelRole OBJECT-TYPE

SYNTAX INTEGER { head(1),
transit(2),
tail(3),
headTail(4) }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This value signifies the role that this tunnel entry/instance represents. This value MUST be set to head(1) at the originating point of the tunnel. This value MUST be set to transit(2) at transit points along the tunnel, if transit points are supported. This value MUST be set to tail(3) at the terminating point of the tunnel if tunnel tails are supported.

The value headTail(4) is provided for tunnels that begin and end on the same LSR."


```
DEFVAL { head }
::= { mplsTunnelEntry 10 }
```

mplsTunnelXCPointer OBJECT-TYPE

```
SYNTAX      RowPointer
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
```

"This variable points to a row in the mplsXCTable. This table identifies the segments that compose this tunnel, their characteristics, and relationships to each other. A value of zeroDotZero indicates that no LSP has been associated with this tunnel yet."

REFERENCE

"Srinivasan, C., Viswanathan, A., and T. Nadeau, MPLS Label Switch Router Management Information Base, Internet Draft <[draft-ietf-mpls-lsr-mib-14.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"
DEFVAL { 0 }
::= { mplsTunnelEntry 13 }

mplsTunnelHoldingPrio OBJECT-TYPE

SYNTAX Integer32 (0..7)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Indicates the holding priority for this tunnel."

REFERENCE

"1. RSVP-TE: Extensions to RSVP for LSP Tunnels,
Awduche et al, [RFC3209](#), December 2001

2. Constraint-Based LSP Setup using LDP, Jamoussi
(Editor), [RFC 3212](#), January 2002"

DEFVAL { 0 }

::= { mplsTunnelEntry 14 }

mplsTunnelSessionAttributes OBJECT-TYPE

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

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

fastRerouteThis flag indicates that the any tunnel
hop may choose to reroute this tunnel without
tearing it down. This flag permits transit routers
to use a local repair mechanism which may result in
violation of the explicit routing of this tunnel.

When a fault is detected on an adjacent downstream link or node, a transit router can re-route traffic for fast service restoration.

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

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

isPinned This flag indicates whether the loose-

routed hops of this tunnel are to be pinned.

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)."

DEFVAL { false }

::= { mplsTunnelEntry 16 }

mplsTunnelResourcePointer OBJECT-TYPE

SYNTAX RowPointer

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable represents a pointer to the traffic parameter specification for this tunnel. This value may point at an entry in the mplsTunnelResourceEntry to indicate which mplsTunnelResourceEntry is to be assigned to this LSP instance. This value may optionally point at an externally defined traffic parameter specification table. A value of zeroDotZero indicates best-effort treatment. By having the same value of this object, two or more LSPs can indicate resource sharing."

DEFVAL { zeroDotZero }
::= { mplsTunnelEntry 17 }

mplsTunnelPrimaryInstance OBJECT-TYPE

SYNTAX MplsTunnelInstanceIndex
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"Specifies the instance index of the primary instance of this tunnel. More details of the definition of tunnel instances and the primary tunnel instance can be found in the description of the textual convention MplsTunnelInstanceIndex."

DEFVAL { 0 }
::= { mplsTunnelEntry 18 }

mplsTunnelInstancePriority OBJECT-TYPE

SYNTAX Unsigned32
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"This value indicates which priority, in descending order, with 0 indicating the lowest priority, within a group of tunnel instances. A group of tunnel instances is defined as a set of LSPs with the same mplsTunnelIndex in this table, but with a different mplsTunnelInstance. Tunnel instance priorities are used to denote the priority at which a particular tunnel instance will supercede

another. Instances of tunnels containing the same
mplsTunnelInstancePriority will be used for load
sharing."

DEFVAL { 0 }
::= { mplsTunnelEntry 19 }

mplsTunnelHopTableIndex OBJECT-TYPE

SYNTAX MplsPathIndexOrZero

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Index into the mplsTunnelHopTable entry that
specifies the explicit route hops for this tunnel.
This object is meaningful only at the head-end of
the tunnel."

DEFVAL { 0 }
::= { mplsTunnelEntry 20 }

mplsTunnelPathInUse OBJECT-TYPE

SYNTAX MplsPathIndexOrZero

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This value denotes the configured path that was
chosen for this tunnel. This value reflects the
secondary index into mplsTunnelHopTable. This path
may not exactly match the one in
mplsTunnelARHopTable due to the fact that some CSPF
modification may have taken place. See
mplsTunnelARHopTable for the actual path being
taken by the tunnel. A value of zero denotes that
no path is currently in use or available."

DEFVAL { 0 }
::= { mplsTunnelEntry 21 }

mplsTunnelARHopTableIndex OBJECT-TYPE

SYNTAX MplsPathIndexOrZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Index into the mplsTunnelARHopTable entry that specifies the actual hops traversed by the tunnel. This is automatically updated by the agent when the actual hops becomes available."

DEFVAL { 0 }

::= { mplsTunnelEntry 22 }

mplsTunnelCHopTableIndex OBJECT-TYPE

SYNTAX MplsPathIndexOrZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Index into the mplsTunnelCHopTable entry that specifies the computed hops traversed by the tunnel. This is automatically updated by the agent when computed hops become available or when computed hops get modified."

DEFVAL { 0 }

::= { mplsTunnelEntry 23 }

mplsTunnelIncludeAnyAffinity OBJECT-TYPE

SYNTAX MplsTunnelAffinity

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A link satisfies the include-any constraint if and only if the constraint is zero, or the link and the constraint have a resource class in common."

REFERENCE

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

::= { mplsTunnelEntry 24 }

mplsTunnelIncludeAllAffinity OBJECT-TYPE

SYNTAX MplsTunnelAffinity

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A link satisfies the include-all constraint if and only if the link contains all of the administrative groups specified in the constraint."

REFERENCE

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

::= { mplsTunnelEntry 25 }

mplsTunnelExcludeAnyAffinity OBJECT-TYPE

SYNTAX MplsTunnelAffinity

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A link satisfies the exclude-any constraint if and only if the link contains none of the administrative groups specified in the constraint."

REFERENCE

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

DEFVAL { 0 }

::= { mplsTunnelEntry 26 }

mplsTunnelTotalUpTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This value represents the aggregate up time for all instances of this tunnel, if available. If this value is unavailable, it MUST return a value of 0."

::= { mplsTunnelEntry 27 }

mplsTunnelInstanceUpTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This value identifies the total time that this tunnel instance's operStatus has been Up(1)."

::= { mplsTunnelEntry 28 }

mplsTunnelPrimaryUpTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Specifies the total time the primary instance of this tunnel has been active. The primary instance of this tunnel is defined in mplsTunnelPrimaryInstance."

::= { mplsTunnelEntry 29 }

mplsTunnelPathChanges OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"Specifies the number of times the actual path for
this tunnel instance has changed."
::= { mplsTunnelEntry 30 }

mplsTunnelLastPathChange OBJECT-TYPE

SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"Specifies the time since the last change to the
actual path for this tunnel instance."
::= { mplsTunnelEntry 31 }

mplsTunnelCreationTime OBJECT-TYPE

SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"Specifies the value of SysUpTime when the first
instance of this tunnel came into existence.
That is, when the value of mplsTunnelOperStatus
was first set to up(1)."
::= { mplsTunnelEntry 32 }

mplsTunnelStateTransitions OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"Specifies the number of times the state
(mplsTunnelOperStatus) of this tunnel instance has
changed."
::= { mplsTunnelEntry 33 }

mplsTunnelAdminStatus OBJECT-TYPE


```

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

```

mplsTunnelOperStatus OBJECT-TYPE

```

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

```

mplsTunnelRowStatus OBJECT-TYPE

```

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

```

mplsTunnelStorageType OBJECT-TYPE

```

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

```

-- End of mplsTunnelTable

mplsTunnelHopListIndexNext OBJECT-TYPE

```

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

```

new entry in the mplsTunnelHopTable, the manager issues a management protocol retrieval operation to obtain the current value of mplsTunnelHopIndex.

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

::= { mplsTeObjects 3 }

mplsTunnelHopTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The mplsTunnelHopTable is used to indicate the hops, strict or loose, for an instance of an MPLS tunnel defined in mplsTunnelTable, when it is established via signalling, for the outgoing direction of the tunnel. Thus at a transit LSR, this table contains the desired path of the tunnel from this LSR onwards. Each row in this table is indexed by mplsTunnelHopListIndex which corresponds to a group of hop lists or path options. Each row also has a secondary index mplsTunnelHopIndex, which indicates a group of hops (also known as a path option).

Finally, the third index, mplsTunnelHopIndex indicates the specific hop information for a path option. In case we want to specify a particular interface on the originating LSR of an outgoing tunnel by which we want packets to exit the LSR, we specify this as the first hop for this tunnel in

```

        mplsTunnelHopTable."
 ::= { mplsTeObjects 4 }

```

mplsTunnelHopEntry OBJECT-TYPE

SYNTAX MplsTunnelHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents a tunnel hop. An entry is created by a network administrator for signaled ERLSP set up by an MPLS signalling protocol."

INDEX {

mplsTunnelHopListIndex,

mplsTunnelHopPathOptionIndex,

mplsTunnelHopIndex

}

```
 ::= { mplsTunnelHopTable 1 }

```

MplsTunnelHopEntry ::= SEQUENCE {

mplsTunnelHopListIndex

MplsPathIndex,

mplsTunnelHopPathOptionIndex

MplsPathIndex,

mplsTunnelHopIndex

MplsPathIndex,

mplsTunnelHopAddrType

TeHopAddressType,

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
```

```
    "Tertiary index into this table identifying a
       particular hop."
```

```
::= { mplsTunnelHopEntry 3 }
```

mplsTunnelHopAddrType OBJECT-TYPE

```
SYNTAX      TeHopAddressType
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION
```

```
    "The Hop Address Type of this tunnel hop.
```

```

       The value of this object cannot be changed
       if the value of the corresponding
       mplsTunnelHopRowStatus object is 'active'.
```

```

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

```
    "
```

```
DEFVAL      { ipv4 }
```

```
::= { mplsTunnelHopEntry 4 }
```

mplsTunnelHopIpAddr OBJECT-TYPE

```
SYNTAX      TeHopAddress
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION
```

```
    "The Tunnel Hop Address for this tunnel hop.
```

```

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

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

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

```

        "
    DEFVAL      { '00000000'h }  -- IPv4 address 0.0.0.0
    ::= { mplsTunnelHopEntry 5 }

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

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

mplsTunnelHopAddrUnnum OBJECT-TYPE
    SYNTAX      TeHopAddressUnnum
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION  "If mplsTunnelHopAddrType is set to unnum(4), then
                  this value will contain the interface identifier of
                  the unnumbered interface for this hop. This object
```

should be used in conjunction with
mplsTunnelHopIpAddress which would contain the LSR
Router ID in this case. Otherwise the agent should
set this object to zero-length string and the
manager should ignore this."

::= { mplsTunnelHopEntry 8 }

mplsTunnelHopLspId OBJECT-TYPE

SYNTAX MplsLSPID
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"If mplsTunnelHopAddrType is set to lspid(5), then
this value will contain the LSPID of a tunnel of

this hop. The present tunnel being configured is
tunneled through this hop (using label stacking).
This object is otherwise insignificant and should
contain a value of 0 to indicate this fact."

::= { mplsTunnelHopEntry 9 }

mplsTunnelHopType OBJECT-TYPE

SYNTAX INTEGER {
strict(1),
loose(2)
}

MAX-ACCESS read-create
STATUS current
DESCRIPTION

"Denotes whether this tunnel hop is routed in a
strict or loose fashion. The value of this object
has no meaning if the mplsTunnelHopInclude object
is set to 'false'."

::= { mplsTunnelHopEntry 10 }

mplsTunnelHopInclude OBJECT-TYPE

SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"If this value is set to true, then this indicates

that this hop must be included in the tunnel's path. If this value is set to 'false', then this hop must be avoided when calculating the path for this tunnel. The default value of this object is 'true', so that by default all indicated hops are included in the CSPF path computation. If this object is set to 'false' the value of mplsTunnelHopType should be ignored."

```
DEFVAL { true }
::= { mplsTunnelHopEntry 11 }
```

mplsTunnelHopPathOptionName OBJECT-TYPE

```
SYNTAX      SnmpAdminString
```

```
MAX-ACCESS  read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

"The description of this series of hops as they relate to the specified path option. The value of this object SHOULD be the same for each hop in the series that comprises a path option."

```
::= { mplsTunnelHopEntry 12 }
```

mplsTunnelHopEntryPathComp OBJECT-TYPE

```
SYNTAX      INTEGER {
                    dynamic(1),    -- CSPF computed
                    explicit(2)    -- strict hop
                    }
```

```
MAX-ACCESS  read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

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

```
::= { mplsTunnelHopEntry 13 }
```


mplsTunnelHopRowStatus OBJECT-TYPE

SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"This variable is used to create, modify, and/or delete a row in this table. When a row in this table is in active(1) state, no objects in that row can be modified by the agent except mplsTunnelHopRowStatus and mplsTunnelHopStorageType."

::= { mplsTunnelHopEntry 14 }

mplsTunnelHopStorageType OBJECT-TYPE

SYNTAX StorageType
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The storage type for this Hop entry. Conceptual rows having the value 'permanent' need not allow write-access to any columnar objects in the row."

DEFVAL { volatile }

::= { mplsTunnelHopEntry 15 }

-- End of mplsTunnelHopTable

-- Begin of mplsTunnelResourceTable

mplsTunnelResourceIndexNext OBJECT-TYPE

SYNTAX Unsigned32 (0.. 2147483647)
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"This object contains the next appropriate value to be used for mplsTunnelResourceIndex when creating entries in the mplsTunnelResourceTable. If the number of unassigned entries is exhausted, a retrieval operation will return a value of 0. This

object may also return a value of 0 when the LSR is unable to accept conceptual row creation, for example, if the mplsTunnelTable is implemented as read-only. To obtain the mplsTunnelResourceIndex value for a new entry, the manager must first issue a management protocol retrieval operation to obtain the current value of this object.

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

::= { mplsTeObjects 5 }

mplsTunnelResourceTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelResourceEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The mplsTunnelResourceTable allows a manager to specify which resources are desired for an MPLS tunnel. This table also allows several tunnels to point to a single entry in this table, implying that these tunnels should share resources."

::= { mplsTeObjects 6 }

mplsTunnelResourceEntry OBJECT-TYPE

SYNTAX MplsTunnelResourceEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents a set of resources for an MPLS tunnel. An entry can be created by a network administrator or by an SNMP agent as instructed by any MPLS signalling protocol."

An entry in this table referenced by a tunnel instance with zero mplsTunnelInstance value indicates a configured set of resource parameter. An entry referenced by a tunnel instance with a non-zero mplsTunnelInstance reflects the in-use resource parameters for the tunnel instance which may have been negotiated or modified by the MPLS signaling protocols."

```
INDEX          { mplsTunnelResourceIndex }
::= { mplsTunnelResourceTable 1 }
```

```
MplsTunnelResourceEntry ::= SEQUENCE {
    mplsTunnelResourceIndex          Unsigned32,
    mplsTunnelResourceMaxRate        MplsBitRate,
    mplsTunnelResourceMeanRate       MplsBitRate,
    mplsTunnelResourceMaxBurstSize   MplsBurstSize,
    mplsTunnelResourceMeanBurstSize  MplsBurstSize,
    mplsTunnelResourceExBurstSize    MplsBurstSize,
    mplsTunnelResourceFrequency      INTEGER,
    mplsTunnelResourceWeight         Unsigned32,
    mplsTunnelResourceRowStatus      RowStatus,
    mplsTunnelResourceStorageType    StorageType
}
```

```
mplsTunnelResourceIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Uniquely identifies this row."
    ::= { mplsTunnelResourceEntry 1 }
```

```
mplsTunnelResourceMaxRate OBJECT-TYPE
    SYNTAX      MplsBitRate
    UNITS       "kilobits per second"
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The maximum rate in bits/second. Note that setting
         mplsTunnelResourceMaxRate,
         mplsTunnelResourceMeanRate, and
         mplsTunnelResourceMaxBurstSize to 0 indicates best-
         effort treatment."
    ::= { mplsTunnelResourceEntry 2 }
```

```
mplsTunnelResourceMeanRate OBJECT-TYPE
```

SYNTAX	MplsBitRate
UNITS	"kilobits per second"
MAX-ACCESS	read-create
STATUS	current

DESCRIPTION

"This object is copied into an instance of
 mplsTrafficParamMeanRate in the
 mplsTrafficParamTable. The OID of this table entry
 is then copied into the corresponding
 mplsInSegmentTrafficParamPtr."

::= { mplsTunnelResourceEntry 3 }

mplsTunnelResourceMaxBurstSize OBJECT-TYPE

SYNTAX	MplsBurstSize
UNITS	"bytes"
MAX-ACCESS	read-create
STATUS	current

DESCRIPTION

"The maximum burst size in bytes."

::= { mplsTunnelResourceEntry 4 }

mplsTunnelResourceMeanBurstSize OBJECT-TYPE

SYNTAX	MplsBurstSize
UNITS	"bytes"
MAX-ACCESS	read-create
STATUS	current

DESCRIPTION

"The mean burst size in bytes. The implementations
 which do not implement this variable must return
 a noSuchObject exception for this object and must
 not allow a user to set this object."

::= { mplsTunnelResourceEntry 5 }

mplsTunnelResourceExBurstSize OBJECT-TYPE

SYNTAX	MplsBurstSize
UNITS	"bytes"
MAX-ACCESS	read-create
STATUS	current

DESCRIPTION

"The Excess burst size in bytes. The implementations

which do not implement this variable must return
noSuchObject exception for this object and must
not allow a user to set this value."

REFERENCE

"CR-LDP Specification, [Section 4.3](#)."
::= { mplsTunnelResourceEntry 6 }

mplsTunnelResourceFrequency OBJECT-TYPE
SYNTAX INTEGER { unspecified(1),
frequent(2),
veryFrequent(3)
}
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The granularity of the availability of committed
rate. The implementations which do not implement
this variable must return unspecified(1) for this
value and must not allow a user to set this value."

REFERENCE

"CR-LDP Specification, [Section 4.3](#)."
::= { mplsTunnelResourceEntry 7 }

mplsTunnelResourceWeight OBJECT-TYPE
SYNTAX Unsigned32(0..255)
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The relative weight for using excess bandwidth above
its committed rate. The value of 0 means that
weight is not applicable for the CR-LSP."

REFERENCE

"CR-LDP Specification, [Section 4.3](#)."
::= { mplsTunnelResourceEntry 8 }

mplsTunnelResourceRowStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"This variable is used to create, modify, and/or delete a row in this table. When a row in this table is in active(1) state, no objects in that row can be modified by the agent except mplsTunnelResourceRowStatus and mplsTunnelResourceStorageType."
 ::= { mplsTunnelResourceEntry 9 }

mplsTunnelResourceStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The storage type for this Hop entry. Conceptual rows having the value 'permanent' need not allow write-access to any columnar objects in the row."

DEFVAL { volatile }

::= { mplsTunnelResourceEntry 10 }

-- End mplsTunnelResourceTable

-- Tunnel Actual Route Hop table.

mplsTunnelARHopTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelARHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The mplsTunnelARHopTable is used to indicate the hops for an MPLS tunnel defined in mplsTunnelTable, as reported by the MPLS signalling protocol. Thus at a transit LSR, this table (if the table is supported and if the signaling protocol is recording actual route information) contains the actual route of the whole tunnel. If the signaling protocol is not recording the actual route, this table MAY report the information from the mplsTunnelHopTable or the

mplsTunnelCHopTable.

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

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

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

::= { mplsTeObjects 7 }

mplsTunnelARHopEntry OBJECT-TYPE

SYNTAX MplsTunnelARHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents a tunnel hop. An entry is created by the agent for signaled ERLSP set up by an MPLS signalling protocol."

INDEX { mplsTunnelARHopListIndex, mplsTunnelARHopIndex }

::= { mplsTunnelARHopTable 1 }

MplsTunnelARHopEntry ::= SEQUENCE {

mplsTunnelARHopListIndex

MplsPathIndex,

mplsTunnelARHopIndex

MplsPathIndex,

mplsTunnelARHopAddrType

TeHopAddressType,

mplsTunnelARHopIpAddr	TeHopAddress,
mplsTunnelARHopAddrUnnum	TeHopAddressUnnum,
mplsTunnelARHopLspId	MplsLSPID

}

mplsTunnelARHopListIndex OBJECT-TYPE

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

mplsTunnelARHopIndex OBJECT-TYPE

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

mplsTunnelARHopAddrType OBJECT-TYPE

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

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

mplsTunnelARHopIpAddr OBJECT-TYPE

SYNTAX TeHopAddress
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The Tunnel Hop Address for this tunnel hop.

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

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

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

mplsTunnelARHopAddrUnnum OBJECT-TYPE

SYNTAX TeHopAddressUnnum

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelARHopAddrType is set to unnum(4), then this value will contain the interface identifier of the unnumbered interface for this hop. This object should be used in conjunction with mplsTunnelARHopIpAddr which would contain the LSR Router ID in this case. Otherwise the agent should set this object to zero-length string and the manager should ignore this."

::= { mplsTunnelARHopEntry 5 }

mplsTunnelARHopLspId OBJECT-TYPE

SYNTAX MplsLSPID

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelARHopAddrType is set to lspid(5), then this value will contain the LSP ID of this hop. This object is otherwise insignificant and should contain a value of 0 to indicate this fact."

::= { mplsTunnelARHopEntry 6 }

-- End of mplsTunnelARHopTable

-- Tunnel Computed Hop table.

mplsTunnelCHopTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelCHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The mplsTunnelCHopTable is used to indicate the

hops, strict or loose, for an MPLS tunnel defined in mplsTunnelTable, as computed by a constraint-based routing protocol, based on the mplsTunnelHopTable for the outgoing direction of

the tunnel. Thus at a transit LSR, this table (if the table is supported) MAY contain the path computed by the CSPF engine on (or on behalf of) this LSR. Each row in this table is indexed by mplsTunnelCHopListIndex. Each row also has a secondary index mplsTunnelCHopIndex, corresponding to the next hop that this row corresponds to. In case we want to specify a particular interface on the originating LSR of an outgoing tunnel by which we want packets to exit the LSR, we specify this as the first hop for this tunnel in mplsTunnelCHopTable.

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

::= { mplsTeObjects 8 }

mplsTunnelCHopEntry OBJECT-TYPE

SYNTAX MplsTunnelCHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents a tunnel hop. An entry in this table is created by a path computation engine using CSPF techniques applied to the information collected by routing protocols and the hops specified in the corresponding mplsTunnelHopTable."

INDEX { mplsTunnelCHopListIndex, mplsTunnelCHopIndex }

::= { mplsTunnelCHopTable 1 }

```

MplsTunnelCHopEntry ::= SEQUENCE {
    mplsTunnelCHopListIndex      MplsPathIndex,
    mplsTunnelCHopIndex          MplsPathIndex,
    mplsTunnelCHopAddrType       TeHopAddressType,
    mplsTunnelCHopIpAddr         TeHopAddress,
    mplsTunnelCHopIpPrefixLen    InetAddressPrefixLength,
    mplsTunnelCHopAsNumber       TeHopAddressAS,
    mplsTunnelCHopAddrUnnum      TeHopAddressUnnum,
    mplsTunnelCHopLspId          MplsLSPID,
    mplsTunnelCHopType           INTEGER
}

```

```

mplsTunnelCHopListIndex OBJECT-TYPE
    SYNTAX      MplsPathIndex

```

```

MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION

```

```

    "Primary index into this table identifying a
      particular computed hop list."
 ::= { mplsTunnelCHopEntry 1 }

```

```

mplsTunnelCHopIndex OBJECT-TYPE

```

```

    SYNTAX      MplsPathIndex
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION

```

```

    "Secondary index into this table identifying the
      particular hop."
 ::= { mplsTunnelCHopEntry 2 }

```

```

mplsTunnelCHopAddrType OBJECT-TYPE

```

```

    SYNTAX      TeHopAddressType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION

```

```

    "The Hop Address Type of this tunnel hop.

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

```

```
::= { mplsTunnelCHopEntry 3 }
```

mplsTunnelCHopIpAddr OBJECT-TYPE

SYNTAX TeHopAddress

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The Tunnel Hop Address for this tunnel hop.

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

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

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

```
::= { mplsTunnelCHopEntry 4 }
```

mplsTunnelCHopIpPrefixLen OBJECT-TYPE

SYNTAX InetAddressPrefixLength

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelCHopAddrType is set to ipv4(1) or ipv6(2), then this value will contain an appropriate prefix length for the IP address in object mplsTunnelCHopIpAddr. Otherwise this value is irrelevant and should be ignored.

"

DEFVAL { 32 }

```
::= { mplsTunnelCHopEntry 5 }
```

mplsTunnelCHopAsNumber OBJECT-TYPE

SYNTAX TeHopAddressAS

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelCHopAddrType is set to asnumber(3),

then this value will contain the AS number of this hop. Otherwise the agent should set this object to zero-length string and the manager should ignore this."

::= { mplsTunnelCHopEntry 6 }

mplsTunnelCHopAddrUnnum OBJECT-TYPE

SYNTAX TeHopAddressUnnum

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelCHopAddrType is set to unnum(4), then this value will contain the unnumbered interface identifier of this hop. This object should be used in conjunction with mplsTunnelCHopIpAddr which would contain the LSR Router ID in this case. Otherwise the agent should set this object to zero-length string and the manager should ignore this."

::= { mplsTunnelCHopEntry 7 }

mplsTunnelCHopLspId OBJECT-TYPE

SYNTAX MplsLSPID

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelCHopAddrType is set to lspid(5), then this value will contain the LSP ID of this hop. This object is otherwise insignificant and should contain a value of 0 to indicate this fact."

::= { mplsTunnelCHopEntry 8 }

mplsTunnelCHopType OBJECT-TYPE

SYNTAX INTEGER { strict(1),
loose(2)

MAX-ACCESS read-only
STATUS current
DESCRIPTION

"Denotes whether this tunnel hop is routed in a strict or loose fashion."

```

::= { mplsTunnelCHopEntry 9 }

-- End of mplsTunnelCHopTable

-- MPLS Tunnel Performance Table.

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

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

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

mplsTunnelPerfPackets OBJECT-TYPE
    SYNTAX          Counter32
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "Number of packets forwarded by the tunnel.
         This object should represents the 32-bit
         value of the least significant part of the
         64-bit value if both mplsTunnelPerfHCPackets

```

```
        is returned."
 ::= { mplsTunnelPerfEntry 1 }

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

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

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

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

-- End of mplsTunnelPerfTable

-- CR-LDP Tunnel Resource Table
```

mplsTunnelCRLDPResTable OBJECT-TYPE
 SYNTAX SEQUENCE OF MplsTunnelCRLDPResEntry
 MAX-ACCESS not-accessible

MPLS Working Group

Expires Maay 2004

[Page 46]

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

STATUS current

DESCRIPTION

"The mplsTunnelCRLDPResTable allows a manager to specify which CR-LDP-specific resources are desired for an MPLS tunnel if that tunnel is signaled using CR-LDP. Note that these attributes are in addition to those specified in mplsTunnelResourceTable. This table also allows several tunnels to point to a single entry in this table, implying that these tunnels should share resources."

::= { mplsTeObjects 10 }

mplsTunnelCRLDPResEntry OBJECT-TYPE

SYNTAX MplsTunnelCRLDPResEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents a set of resources for an MPLS tunnel established using CRLDP (mplsTunnelSignallingProto equal to crldp (3)). An entry can be created by a network administrator or by an SNMP agent as instructed by any MPLS signalling protocol."

INDEX { mplsTunnelResourceIndex }

::= { mplsTunnelCRLDPResTable 1 }

MplsTunnelCRLDPResEntry ::= SEQUENCE {

mplsTunnelCRLDPResMeanBurstSize	MplsBurstSize,
mplsTunnelCRLDPResExBurstSize	MplsBurstSize,
mplsTunnelCRLDPResFrequency	INTEGER,
mplsTunnelCRLDPResWeight	Unsigned32,
mplsTunnelCRLDPResFlags	Unsigned32,
mplsTunnelCRLDPResRowStatus	RowStatus,
mplsTunnelCRLDPResStorageType	StorageType

}

mplsTunnelCRLDPResMeanBurstSize OBJECT-TYPE

SYNTAX MplsBurstSize

UNITS "bytes"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The mean burst size in bytes."

::= { mplsTunnelCRLDPResEntry 1 }

mplsTunnelCRLDPResExBurstSize OBJECT-TYPE

SYNTAX MplsBurstSize

UNITS "bytes"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The Excess burst size in bytes."

REFERENCE

"CR-LDP Specification, [Section 4.3](#)."

::= { mplsTunnelCRLDPResEntry 2 }

mplsTunnelCRLDPResFrequency OBJECT-TYPE

SYNTAX INTEGER {
 unspecified(1),
 frequent(2),
 veryFrequent(3)
}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The granularity of the availability of committed rate."

REFERENCE

"CR-LDP Specification, [Section 4.3](#)."

::= { mplsTunnelCRLDPResEntry 3 }

mplsTunnelCRLDPResWeight OBJECT-TYPE

SYNTAX Unsigned32(0..255)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The relative weight for using excess bandwidth above its committed rate. The value of 0 means that weight is not applicable for the CR-LSP."

REFERENCE

"CR-LDP Specification, [Section 4.3](#)."

DEFVAL { 0 }

::= { mplsTunnelCRLDPResEntry 4 }

mplsTunnelCRLDPResFlags OBJECT-TYPE

SYNTAX Unsigned32 (0..63)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of the 1 byte Flags conveyed as part of the traffic parameters during the establishment of the CRLSP. The bits in this object are to be interpreted as follows.

```
+---+---+---+---+---+---+---+
| Res |F6|F5|F4|F3|F2|F1|
+---+---+---+---+---+---+---+
```

Res - These bits are reserved. Zero on transmission.

Ignored on receipt.

F1 - Corresponds to the PDR.

F2 - Corresponds to the PBS.

F3 - Corresponds to the CDR.

F4 - Corresponds to the CBS.

F5 - Corresponds to the EBS.

F6 - Corresponds to the Weight.

Each flag if is a Negotiable Flag corresponding to a Traffic Parameter. The Negotiable Flag value zero denotes Not Negotiable and value one denotes Negotiable."

REFERENCE

"1. [Section 4.3](#), Constraint-Based LSP Setup using LDP, Jamoussi (Editor), [RFC 3212](#), January 2002"

DEFVAL { 0 }

```
::= { mplsTunnelCRLDPResEntry 5 }
```

```
mplsTunnelCRLDPResRowStatus OBJECT-TYPE
```

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

```
DESCRIPTION
```

```
"This variable is used to create, modify, and/or
delete a row in this table. When a row in this
table is in active(1) state, no objects in that row
can be modified by the agent except
mplsTunnelCRLDPResRowStatus and
mplsTunnelCRLDPResStorageType."
```

```
::= { mplsTunnelCRLDPResEntry 6 }
```

```
mplsTunnelCRLDPResStorageType OBJECT-TYPE
```

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

```
DESCRIPTION
```

```
"The storage type for this CR-LDP Resource entry.
Conceptual rows having the value 'permanent'
need not allow write-access to any columnar
objects in the row."
```

```
DEFVAL { volatile }
```

```
::= { mplsTunnelCRLDPResEntry 7 }
```

```
-- Notifications.
```

```
mplsTunnelNotificationEnable OBJECT-TYPE
```

```
SYNTAX      TruthValue
MAX-ACCESS   read-write
STATUS       current
```

```
DESCRIPTION
```

```
"If this object is true, then it enables the
generation of mplsTunnelUp and mplsTunnelDown
traps, otherwise these traps are not emitted."
```

```
DEFVAL { false }
```

```
::= { mplsTeObjects 11 }
```

mplsTunnelUp NOTIFICATION-TYPE

OBJECTS {
 mplsTunnelAdminStatus,
 mplsTunnelOperStatus
}

STATUS current

DESCRIPTION

"This notification is generated when a mplsTunnelOperStatus object for one of the configured tunnels is about to leave the down state and transition into some other state (but not into the notPresent state). This other state is indicated by the included value of mplsTunnelOperStatus."

::= { mplsTeNotifications 1 }

mplsTunnelDown NOTIFICATION-TYPE

OBJECTS {
 mplsTunnelAdminStatus,
 mplsTunnelOperStatus
}

STATUS current

DESCRIPTION

"This notification is generated when a mplsTunnelOperStatus object for one of the configured tunnels is about to enter the down state from some other state (but not from the notPresent state). This other state is indicated by the included value of mplsTunnelOperStatus."

::= { mplsTeNotifications 2 }

mplsTunnelRerouted NOTIFICATION-TYPE

OBJECTS {
 mplsTunnelAdminStatus,
 mplsTunnelOperStatus
}

STATUS current

DESCRIPTION

"This notification is generated when a tunnel is rerouted. If the mplsTunnelARHopTable is used, then this tunnel instance's entry in the mplsTunnelARHopTable MAY contain the new path for this tunnel some time after this trap is issued by

```
        the agent."
 ::= { mplsTeNotifications 3 }

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

-- End of notifications.

-- Module compliance.

mplsTeGroups
    OBJECT IDENTIFIER ::= { mplsTeConformance 1 }

mplsTeCompliances
    OBJECT IDENTIFIER ::= { mplsTeConformance 2 }

-- Compliance requirement for fully compliant implementations.

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

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

    MODULE -- this module

        -- The mandatory group has to be implemented by all
```

-- LSRs that originate/terminate ESLSPs/tunnels.
-- In addition, depending on the type of tunnels
-- supported, other groups become mandatory as
-- explained below.

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

```
MANDATORY-GROUPS    {  
    mplsTunnelGroup,  
    mplsTunnelScalarGroup  
}
```

GROUP mplsTunnelManualGroup

DESCRIPTION

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

GROUP mplsTunnelSignaledGroup

DESCRIPTION

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

GROUP mplsTunnelIsNotIntfcGroup

DESCRIPTION

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

GROUP mplsTunnelIsIntfcGroup

DESCRIPTION

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

GROUP mplsTunnelCRLDPResOptionalGroup

DESCRIPTION

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

GROUP mplsTeNotificationGroup

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

```

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

```

```

OBJECT      mplsTunnelHopRowStatus
SYNTAX      RowStatus { active(1), notInService(2) }
WRITE-SYNTAX RowStatus { active(1), notInService(2),
                        createAndGo(4), destroy(6)
                        }

```

```

DESCRIPTION "Support for createAndWait and notReady is not
            required."

```

```

OBJECT      mplsTunnelCRLDResRowStatus
SYNTAX      RowStatus { active(1), notInService(2) }
WRITE-SYNTAX RowStatus { active(1), notInService(2),
                        createAndGo(4), destroy(6)
                        }

```

```

DESCRIPTION "Support for createAndWait and notReady is
            not required."

```

```
 ::= { mplsTeCompliances1 }

```

```
-- Compliance requirement for read-only implementations.

```

```
mplsTeModuleReadOnlyCompliance MODULE-COMPLIANCE

```

```
  STATUS current

```

```
  DESCRIPTION

```

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

```

```
  MODULE -- this module

```

```
    -- mplsTunnelTable

```

```
MANDATORY-GROUPS    {  
    mplsTunnelGroup,  
    mplsTunnelScalarGroup  
}
```

```
GROUP mplsTunnelManualGroup
```

```
DESCRIPTION
```

```
    "This group is mandatory for devices which support  
    manual configuration of tunnels."
```

```
GROUP mplsTunnelSignaledGroup
```

```
DESCRIPTION
```

```
    "This group is mandatory for devices which support  
    signaled tunnel set up."
```

```
GROUP mplsTunnelIsNotIntfcGroup
```

```
DESCRIPTION
```

```
    "This group is mandatory for devices which support  
    tunnels that are not interfaces."
```

```
GROUP mplsTunnelIsIntfcGroup
```

```
DESCRIPTION
```

```
    "This group is mandatory for devices which support
```

```
tunnels that are interfaces."
```

```
GROUP mplsTunnelCRLDPResOptionalGroup
```

```
DESCRIPTION
```

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

```
GROUP mplsTeNotificationGroup
```

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

```
-- mplsTunnelTable
```

```
OBJECT          mplsTunnelName
```


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

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

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

OBJECT mplsTunnelIfIndex
DESCRIPTION
"Write access is not required."

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

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

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

OBJECT mplsTunnelHoldingPrio

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

OBJECT mplsTunnelSessionAttributes
MIN-ACCESS read-only

DESCRIPTION
 "Write access is not required."

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

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

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

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

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

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

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

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

OBJECT mplsTunnelRole

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelAdminStatus

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

MIN-ACCESS read-only

DESCRIPTION

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

OBJECT mplsTunnelRowStatus

SYNTAX RowStatus { active(1) }

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

-- mplsTunnelHopTable

OBJECT mplsTunnelHopAddrType

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelHopIpAddr

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelHopIpPrefixLen

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelHopAddrUnnum

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelHopAsNumber

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelHopLspId

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelHopType
SYNTAX INTEGER { strict(1) }
MIN-ACCESS read-only
DESCRIPTION

"loose(2) need not be supported. Write access is
not required."

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

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

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

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

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

-- mplsTunnelResourceTable

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

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

OBJECT mplsTunnelResourceMaxBurstSize
MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelResourceMeanBurstSize

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelResourceExBurstSize

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelResourceFrequency

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelResourceWeight

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelResourceRowStatus

SYNTAX RowStatus { active(1) }

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelResourceStorageType

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

-- mplsTunnelCRLDPResTable

OBJECT mplsTunnelCRLDPResMeanBurstSize

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelCRLDPResExBurstSize

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelCRLDPResFrequency

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelCRLDPResWeight

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelCRLDPResFlags

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelCRLDPResRowStatus

SYNTAX RowStatus { active(1) }

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

OBJECT mplsTunnelCRLDPResStorageType

MIN-ACCESS read-only

DESCRIPTION "Write access is not required."

::= { mplsTeCompliances 2 }

-- Units of conformance.

mplsTunnelGroup OBJECT-GROUP

OBJECTS {

mplsTunnelIndexNext,
mplsTunnelName,
mplsTunnelDescr,
mplsTunnelOwner,
mplsTunnelXCPointer,
mplsTunnelIfIndex,
mplsTunnelHopTableIndex,
mplsTunnelARHopTableIndex,
mplsTunnelCHopTableIndex,
mplsTunnelAdminStatus,
mplsTunnelOperStatus,
mplsTunnelRowStatus,
mplsTunnelNotificationEnable,
mplsTunnelStorageType,

mplsTunnelConfigured,
mplsTunnelActive,
mplsTunnelPrimaryInstance,
mplsTunnelPrimaryUpTime,
mplsTunnelPathChanges,
mplsTunnelLastPathChange,
mplsTunnelCreationTime,
mplsTunnelStateTransitions,
mplsTunnelIncludeAnyAffinity,
mplsTunnelIncludeAllAffinity,
mplsTunnelExcludeAnyAffinity,
mplsTunnelPerfPackets,
mplsTunnelPerfHCPackets,
mplsTunnelPerfErrors,
mplsTunnelPerfBytes,
mplsTunnelPerfHCBytes,
mplsTunnelResourcePointer,
mplsTunnelInstancePriority,
mplsTunnelPathInUse,
mplsTunnelRole,
mplsTunnelTotalUpTime,
mplsTunnelInstanceUpTime,
mplsTunnelResourceIndexNext,
mplsTunnelResourceMaxRate,
mplsTunnelResourceMeanRate,
mplsTunnelResourceMaxBurstSize,
mplsTunnelResourceMeanBurstSize,
mplsTunnelResourceExBurstSize,
mplsTunnelResourceFrequency,
mplsTunnelResourceWeight,
mplsTunnelResourceRowStatus,
mplsTunnelResourceStorageType,
mplsTunnelARHopAddrType,
mplsTunnelARHopIpAddr,

mplsTunnelARHopAddrUnnum,
mplsTunnelARHopLspId,
mplsTunnelCHopAddrType,
mplsTunnelCHopIpAddr,
mplsTunnelCHopIpPrefixLen,
mplsTunnelCHopAsNumber,

```

mplsTunnelCHopAddrUnnum,
mplsTunnelCHopLspId,
mplsTunnelCHopType
}
STATUS current
DESCRIPTION
    "Necessary, but not sufficient, set of objects to
    implement tunnels. In addition, depending on the
    type of the tunnels supported (for example,
    manually configured or signaled, persistent or non-
    persistent, etc.), the following other groups
    defined below are mandatory: mplsTunnelManualGroup
    and/or mplsTunnelSignaledGroup,
    mplsTunnelIsNotIntfcGroup and/or
    mplsTunnelIsIntfcGroup."
::= { mplsTeGroups 1 }

```

```

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

```

```

mplsTunnelSignaledGroup OBJECT-GROUP
OBJECTS {
    mplsTunnelSetupPrio,
    mplsTunnelHoldingPrio,
    mplsTunnelSignallingProto,
    mplsTunnelLocalProtectInUse,
    mplsTunnelSessionAttributes,
    mplsTunnelHopListIndexNext,
    mplsTunnelHopAddrType,
    mplsTunnelHopIpAddr,
    mplsTunnelHopIpPrefixLen,
    mplsTunnelHopAddrUnnum,
    mplsTunnelHopAsNumber,
    mplsTunnelHopLspId,
    mplsTunnelHopType,
    mplsTunnelHopInclude,
    mplsTunnelHopPathOptionName,
    mplsTunnelHopEntryPathComp,
    mplsTunnelHopRowStatus,

```



```
    mplsTunnelHopStorageType
  }
  STATUS    current
  DESCRIPTION
    "Objects needed to implement signaled tunnels."
  ::= { mplsTeGroups 3 }
```

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

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

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

```
mplsTunnelCRLDPResOptionalGroup OBJECT-GROUP
  OBJECTS {
    mplsTunnelCRLDPResMeanBurstSize,
    mplsTunnelCRLDPResExBurstSize,
    mplsTunnelCRLDPResFrequency,
    mplsTunnelCRLDPResWeight,
    mplsTunnelCRLDPResFlags,
    mplsTunnelCRLDPResRowStatus,
    mplsTunnelCRLDPResStorageType
  }
```

STATUS current

DESCRIPTION

"Set of objects implemented for resources applicable
for tunnels signaled using CR-LDP."

MPLS Working Group

Expires Maay 2004

[Page 61]

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

::= { 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, and

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

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

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

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

It is RECOMMENDED that implementers consider the security

features as provided by the SNMPv3 framework "see [\[RFC3410\]](#), [section 8](#)", including full support for the SNMPv3 cryptographic mechanisms "for authentication and privacy".

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED 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

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

[14.](#) References

MPLS Working Group	Expires Maay 2004	[Page 63]
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Internet Draft	MPLS-TE-STD-MIB	November 24, 2003
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[15](#). Authors' Addresses

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[18.](#) IANA Considerations

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

[18.1.](#) IANA Considerations for MPLS-TE-STD-MIB

The IANA is requested to assign { mplsStdMIB 3 } to the MPLS-TE-STD-MIB module specified in this document.

