

Network Working Group
Internet Draft
Expires: May 2004

Cheenu Srinivasan
Bloomberg L.P.

Arun Viswanathan
Force10 Networks, Inc.

Thomas D. Nadeau
Cisco Systems, Inc.

November 2003

Multiprotocol Label Switching (MPLS) Traffic Engineering
Management Information Base

[draft-ietf-mpls-te-mib-14.txt](#)

Status of this Memo

This document is an Internet-Draft and is in full conformance with all provisions of [Section 10 of RFC 2026](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/1id-abstracts.txt>.

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

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

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

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
    LAST-UPDATED
        "200310191200Z" -- 19 October 2003 12:00:00 GMT
    ORGANIZATION
        "Multiprotocol Label Switching (MPLS) Working Group"
    CONTACT-INFO
        "
            Cheenu Srinivasan
            Bloomberg L.P.
            Email: cheenu@bloomberg.net

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

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

            Comments about this document should be emailed
            directly to the MPLS working group mailing list at
            mpls@uu.net."
    DESCRIPTION
        "Copyright (C) The Internet Society (2003). This
        version of this MIB module is part of RFC xxxx; see
        the RFC itself for full legal notices.

        This MIB module contains managed object definitions
        for MPLS Traffic Engineering (TE) as defined in:
        1. Extensions to RSVP for LSP Tunnels, Awduche et
           al, RFC 3209, December 2001
        2. Constraint-Based LSP Setup using LDP, Jamoussi
           (Editor), RFC 3212, January 2002
        3. Requirements for Traffic Engineering Over MPLS,
           Awduche, D., Malcolm, J., Agogbua, J., O'Dell, M.,
           and J. McManus, RFC 2702, September 1999"

        -- Revision history.

    REVISION
        "200310191200Z" -- 19 October 2003 12:00:00 GMT
    DESCRIPTION
        "Initial draft version issued as part of RFC XXXX."

```

```

        ::= { 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

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

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
}

::= { mplsTunnelTable 1 }

```
MplsTunnelEntry ::= SEQUENCE {
    mplsTunnelIndex          MplsTunnelIndex,
```

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

}

mplsTunnelIndex OBJECT-TYPE

SYNTAX MplsTunnelIndex

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Uniquely identifies a set of tunnel instances"

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

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

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,
consequently the value of this object at transit
and egress LSRs MAY be automatically generated or
absent."

DEFVAL {""}

::= { mplsTunnelEntry 6 }

mplsTunnelIsIf OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-create
STATUS current
DESCRIPTION

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

REFERENCE

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

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

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

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

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

isPinned This flag indicates whether the loose-

routed hops of this tunnel are to be pinned.

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

REFERENCE

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

::= { mplsTunnelEntry 15 }

mplsTunnelLocalProtectInUse OBJECT-TYPE

SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"Indicates that the local repair mechanism is in use to maintain this tunnel (usually in the face of an outage of the link it was previously routed over)."

DEFVAL { false }

::= { mplsTunnelEntry 16 }

mplsTunnelResourcePointer OBJECT-TYPE

SYNTAX RowPointer
MAX-ACCESS read-create
STATUS current
DESCRIPTION

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

DEFVAL { zeroDotZero }
::= { mplsTunnelEntry 17 }

mplsTunnelPrimaryInstance OBJECT-TYPE

SYNTAX MplsTunnelInstanceIndex
MAX-ACCESS read-only
STATUS current
DESCRIPTION

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

DEFVAL { 0 }
::= { mplsTunnelEntry 18 }

mplsTunnelInstancePriority OBJECT-TYPE

SYNTAX Unsigned32
MAX-ACCESS read-create
STATUS current
DESCRIPTION

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

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

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

::= { mplsTeObjects 4 }

`mplsTunnelHopEntry` OBJECT-TYPE

SYNTAX MplsTunnelHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

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

INDEX {

`mplsTunnelHopListIndex`,

`mplsTunnelHopPathOptionIndex`,

`mplsTunnelHopIndex`

}

::= { mplsTunnelHopTable 1 }

`MplsTunnelHopEntry` ::= SEQUENCE {

`mplsTunnelHopListIndex`

`MplsPathIndex`,

`mplsTunnelHopPathOptionIndex`

`MplsPathIndex`,

`mplsTunnelHopIndex`

`MplsPathIndex`,

`mplsTunnelHopAddrType`

`TeHopAddressType`,

`mplsTunnelHopIpAddr`

`TeHopAddress`,

`mplsTunnelHopIpPrefixLen`

`InetAddressPrefixLength`,

`mplsTunnelHopAsNumber`

`TeHopAddressAS`,

`mplsTunnelHopAddrUnnum`

`TeHopAddressUnnum`,

`mplsTunnelHopLspId`

`MplsLSPID`,

`mplsTunnelHopType`

INTEGER,

`mplsTunnelHopInclude`

TruthValue,

`mplsTunnelHopPathOptionName`

`SnmpAdminString`,

`mplsTunnelHopEntryPathComp`

INTEGER,

`mplsTunnelHopRowStatus`

`RowStatus`,

`mplsTunnelHopStorageType`

`StorageType`

}

`mplsTunnelHopListIndex` OBJECT-TYPE

SYNTAX MplsPathIndex

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Primary index into this table identifying a particular explicit route object."

::= { mplsTunnelHopEntry 1 }

mplsTunnelHopPathOptionIndex OBJECT-TYPE

SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"Secondary index into this table identifying a particular group of hops representing a particular configured path. This is otherwise known as a path option."

::= { mplsTunnelHopEntry 2 }

mplsTunnelHopIndex OBJECT-TYPE

SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

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

::= { mplsTunnelHopEntry 3 }

mplsTunnelHopAddrType OBJECT-TYPE

SYNTAX TeHopAddressType
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The Hop Address Type of this tunnel hop.

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

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

"

DEFVAL { ipv4 }

::= { mplsTunnelHopEntry 4 }

mplsTunnelHopIpAddr OBJECT-TYPE

SYNTAX TeHopAddress
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The Tunnel Hop Address for this tunnel hop.

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

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

```

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

mplsTunnelHopIpPrefixLen OBJECT-TYPE
SYNTAX      InetAddressPrefixLength
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION "If mplsTunnelHopAddrType is set to ipv4(1) or
             ipv6(2), then this value will contain an
             appropriate prefix length for the IP address in
             object mplsTunnelHopIpAddress. 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

MPLS Working Group

Expires Maay 2004

[Page 33]

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

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

mplSTunnelARHopIndex

mplSTunnelARHopAddrType

mplSTunnelARHopIpAddress

mplSTunnelARHopAddrUnnum

MplsPathIndex,

MplsPathIndex,

TeHopAddressType,

TeHopAddress,

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,
```

```
    mplsTunnelCHopIpAddress
```

```
    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

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

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)
```

[Page 44]

November 24, 2003

```

    }
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "Denotes whether this is tunnel hop is routed in a
    strict or loose fashion."
 ::= { mplsTunnelCHopEntry 9 }

```

```
-- End of mplstunnelCHopTable
```

```
-- MPLS Tunnel Performance Table.
```

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

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

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

mplsTunnelPerfPackets	OBJECT-TYPE
SYNTAX	Counter32
MAX-ACCESS	read-only

STATUS current
DESCRIPTION
 "Number of packets forwarded by the tunnel.
 This object should represents the 32-bit
 value of the least significant part of the
 64-bit value if both mplsTunnelPerfHCPackets

 is returned."
::= { mplsTunnelPerfEntry 1 }

mplsTunnelPerfHCPackets OBJECT-TYPE

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

mplsTunnelPerfErrors OBJECT-TYPE

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

mplsTunnelPerfBytes OBJECT-TYPE

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

mplsTunnelPerfHCBytes OBJECT-TYPE

SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "High capacity counter for number of bytes forwarded
 by the tunnel."

```

 ::= { mplsTunnelPerfEntry 5 }

-- End of mplsTunnelPerfTable

-- CR-LDP Tunnel Resource Table

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

```

```

STATUS          current
DESCRIPTION
    "The mplsTunnelCRLDPResTable allows a manager to
    specify which CR-LDP-specific resources are desired
    for an MPLS tunnel if that tunnel is signaled using
    CR-LDP. Note that these attributes are in addition
    to those specified in mplsTunnelResourceTable. This
    table also allows several tunnels to point to a
    single entry in this table, implying that these
    tunnels should share resources."
 ::= { mplsTeObjects 10 }

```

```

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

```

```

MplsTunnelCRLDPResEntry ::= SEQUENCE {
    mplsTunnelCRLDPResMeanBurstSize  MplsBurstSize,
    mplsTunnelCRLDPResExBurstSize    MplsBurstSize,
    mplsTunnelCRLDPResFrequency      INTEGER,
    mplsTunnelCRLDPResWeight         Unsigned32,
    mplsTunnelCRLDPResFlags          Unsigned32,
    mplsTunnelCRLDPResRowStatus      RowStatus,
    mplsTunnelCRLDPResStorageType    StorageType
}

```

mplsTunnelCRLDPResMeanBurstSize OBJECT-TYPE

SYNTAX MplsBurstSize

UNITS "bytes"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The mean burst size in bytes."

::= { mplsTunnelCRLDPResEntry 1 }

mplsTunnelCRLDPResExBurstSize OBJECT-TYPE

SYNTAX MplsBurstSize

UNITS "bytes"

MAX-ACCESS read-create

STATUS current

MPLS Working Group

Expires Maay 2004

[Page 47]

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

DESCRIPTION

"The Excess burst size in bytes."

REFERENCE

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

::= { mplsTunnelCRLDPResEntry 2 }

mplsTunnelCRLDPResFrequency OBJECT-TYPE

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

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The granularity of the availability of committed rate."

REFERENCE

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

::= { mplsTunnelCRLDPResEntry 3 }

mplsTunnelCRLDPResWeight OBJECT-TYPE

SYNTAX Unsigned32(0..255)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

REFERENCE

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

DEFVAL { 0 }

::= { mplsTunnelCRLDPResEntry 4 }

mplsTunnelCRLDPResFlags OBJECT-TYPE

SYNTAX Unsigned32 (0..63)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

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

Res - These bits are reserved. Zero on transmission.

Ignored on receipt.

F1 - Corresponds to the PDR.

F2 - Corresponds to the PBS.

F3 - Corresponds to the CDR.

F4 - Corresponds to the CBS.

F5 - Corresponds to the EBS.

F6 - Corresponds to the Weight.

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

REFERENCE

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

DEFVAL { 0 }

::= { mplsTunnelCRLDPResEntry 5 }

mplsTunnelCRLDPResRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

```
        mplsTunnelCRLDPResStorageType."  
 ::= { mplsTunnelCRLDPResEntry 6 }
```

mplsTunnelCRLDPResStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

DEFVAL { volatile }

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

-- Notifications.

mplsTunnelNotificationEnable OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

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

DEFVAL { false }

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

mplsTunnelUp NOTIFICATION-TYPE

```
OBJECTS {  
    mplsTunnelAdminStatus,  
    mplsTunnelOperStatus  
}
```

STATUS current

DESCRIPTION

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

```
 ::= { mplsTeNotifications 1 }
```

mplsTunnelDown NOTIFICATION-TYPE

```

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

```

mplsTunnelRerouted NOTIFICATION-TYPE

```

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

```

```

    the agent."
::= { mplsTeNotifications 3 }

```

mplsTunnelReoptimized NOTIFICATION-TYPE

```

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

```

-- End of notifications.

```

-- Module compliance.

mplsTeGroups
    OBJECT IDENTIFIER ::= { mplsTeConformance 1 }

mplsTeCompliances
    OBJECT IDENTIFIER ::= { mplsTeConformance 2 }

-- Compliance requirement for fully compliant implementations.

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

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

    MODULE -- this module

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

```

```

MANDATORY-GROUPS    {
    mplsTunnelGroup,
    mplsTunnelScalarGroup
}

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

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

```

GROUP mplsTunnelIsNotIntfcGroup

DESCRIPTION

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

GROUP mplsTunnelIsIntfcGroup

DESCRIPTION

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

GROUP mplsTunnelCRLDPResOptionalGroup

DESCRIPTION

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

GROUP mplsTeNotificationGroup

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

OBJECT mplsTunnelRowStatus

SYNTAX RowStatus { active(1), notInService(2) }

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

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

OBJECT mplsTunnelHopRowStatus

SYNTAX RowStatus { active(1), notInService(2) }

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

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

OBJECT mplsTunnelCRLDPResRowStatus

SYNTAX RowStatus { active(1), notInService(2) }

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

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

::= { mplsTeCompliances 1 }

-- Compliance requirement for read-only implementations.

mplsTeModuleReadOnlyCompliance MODULE-COMPLIANCE

STATUS current

DESCRIPTION

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

MODULE -- this module

-- mplsTunnelTable

MANDATORY-GROUPS {
 mplsTunnelGroup,
 mplsTunnelScalarGroup
}

GROUP mplsTunnelManualGroup

DESCRIPTION

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

GROUP mplsTunnelSignaledGroup

DESCRIPTION

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

GROUP mplsTunnelIsNotIntfcGroup

DESCRIPTION

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

GROUP mplsTunnelIsIntfcGroup

DESCRIPTION

"This group is mandatory for devices which support

tunnels that are interfaces."

GROUP mplsTunnelCRLDPResOptionalGroup

DESCRIPTION

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

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

-- mplsTunnelTable

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

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

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

OBJECT mplsTunnelIfIndex
DESCRIPTION
"Write access is not required."

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

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

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

OBJECT mplsTunnelHoldingPrio

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

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

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

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

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

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

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

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

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

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

OBJECT mplsTunnelRole

```

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

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

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

-- mplsTunnelHopTable

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

OBJECT      mplsTunnelHopIpAddress
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."

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

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.

Internet Draft

MPLS-TE-STD-MIB

November 24, 2003

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,
mplsTunnelIsNotIntfGroup and/or
mplsTunnelIsIntfGroup."

::= { mplsTeGroups 1 }

mplsTunnelManualGroup OBJECT-GROUP

OBJECTS { mplsTunnelSignallingProto }

STATUS current

DESCRIPTION

"Object(s) needed to implement manually configured
tunnels."

::= { mplsTeGroups 2 }

mplsTunnelSignaledGroup OBJECT-GROUP

OBJECTS {

mplsTunnelSetupPrio,
mplsTunnelHoldingPrio,
mplsTunnelSignallingProto,
mplsTunnelLocalProtectInUse,
mplsTunnelSessionAttributes,
mplsTunnelHopListIndexNext,
mplsTunnelHopAddrType,


```
mplsTunnelHopIpAddr,  
mplsTunnelHopIpPrefixLen,  
mplsTunnelHopAddrUnnum,  
mplsTunnelHopAsNumber,  
mplsTunnelHopLspId,  
mplsTunnelHopType,  
mplsTunnelHopInclude,  
mplsTunnelHopPathOptionName,  
mplsTunnelHopEntryPathComp,  
mplsTunnelHopRowStatus,
```

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

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

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

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

```

mplsTunnelCRLDPResOptionalGroup OBJECT-GROUP
    OBJECTS {
        mplsTunnelCRLDPResMeanBurstSize,
        mplsTunnelCRLDPResExBurstSize,
        mplsTunnelCRLDPResFrequency,
        mplsTunnelCRLDPResWeight,
        mplsTunnelCRLDPResFlags,
        mplsTunnelCRLDPResRowStatus,
        mplsTunnelCRLDPResStorageType
    }
    STATUS current
    DESCRIPTION
        "Set of objects implemented for resources applicable
        for tunnels signaled using CR-LDP."

```

```

 ::= { mplsTeGroups 7 }

```

```

mplsTeNotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
        mplsTunnelUp,
        mplsTunnelDown,
        mplsTunnelRerouted,
        mplsTunnelReoptimized
    }
    STATUS current
    DESCRIPTION
        "Set of notifications implemented in this module.
        None is mandatory."
    ::= { mplsTeGroups 8 }

```

END

12. Security Considerations

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

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

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

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

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework "see [\[RFC3410\]](#), section 8", including full support for the

SNMPv3 cryptographic mechanisms "for authentication and privacy".

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

13. Acknowledgments

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

14.1. Normative References

- [RFC2119] S. Bradner, "Key Words for use in RFCs to Indicate Requirement Levels", [RFC 2119](#), [BCP 14](#), March 1997.
- [RFC2578] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, [RFC 2578](#), April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, [RFC 2579](#), April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, [RFC 2580](#), April 1999.
- [RFC2702] Awduche, D., Malcolm, J., Agogbua, J., O'Dell, M., and J. McManus, "Requirements

for Traffic Engineering Over MPLS", [RFC 2702](#), September 1999.

- [RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB ", [RFC 2863](#), June 2000.
- [RFC3031] Rosen, E., Viswanathan, A., and R. Callon, "Multiprotocol Label Switching Architecture", [RFC 3031](#), January 2001.
- [RFC3209] Awduche, D., Berger, L., Gan, D., Li, T., Srinivasan, V., and G. Swallow, "RSVP-TE: Extensions to RSVP for LSP Tunnels", [RFC 3209](#), December 2001.
- [RFC3291] Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "Textual Conventions for Internet Network Addresses", [RFC 3291](#), May 2002.
- [RFC3411] Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks", [RFC 3411](#), December 2002.

- [TCMIB] Nadeau, T. and J. Cucchiara (Editors), "Definition of Textual Conventions and OBJECT-IDENTITIES for Multi-Protocol Label Switching(MPLS) Management", Internet Draft <[draft-ietf-mpls-tc-mib-08.txt](#)>, June 2003.
- [LSRMIB] Srinivasan, C., Viswanathan, A. and T. Nadeau, "MPLS Multiprotocol Label Switching (MPLS) Label Switch Router Management Information Base ", Internet Draft <[draft-ietf-mpls-lsr-mib-14.txt](#)>, November 2003.
- [CRLDP] B. Jamoussi (Editor), "Constraint-Based LSP Setup using LDP", [RFC 3212](#), January 2002.

[14.2.](#) Informative References

- [RFC2026] S. Bradner, "The Internet Standards Process -- Revision 3", [RFC 2026](#), October 1996.

- [RFC2401] Kent, S., and R. Atkinson, "Security Architecture for the Internet Protocol", [RFC 2401](#), November 1998.
- [RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statement for Internet Standard Management Framework", [RFC 3410](#), December 2002.

[15.](#) Authors' Addresses

Cheenu Srinivasan
Bloomberg L.P.
499 Park Ave., New York, NY 10022
Phone: +1-212-893-3682
Email: cheenu@bloomberg.net

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

Thomas D. Nadeau
Cisco Systems, Inc.
300 Apollo Drive
Chelmsford, MA 01824

Phone: +1-978-244-3051
Email: tnadeau@cisco.com

[16.](#) Full Copyright Statement

Copyright (C) The Internet Society (2003). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this

document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns. This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

17. Intellectual Property Notice

The IETF takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on the IETF's procedures with respect to rights in standards-track and standards-related documentation can be found in [BCP-11 \[RFC2028\]](#). Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a

general license or permission for the use of such proprietary rights by implementors or users of this specification can be obtained from the IETF Secretariat. The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to practice this standard. Please address the information to the IETF Executive Director.

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.