

Network Working Group
Internet Draft
Expires: July 2002

Cheenu Srinivasan
Parama Networks, Inc.

Arun Viswanathan
Force10 Networks, Inc.

Thomas D. Nadeau
Cisco Systems, Inc.

January 2002

Multiprotocol Label Switching (MPLS) Traffic Engineering Management Information Base

[draft-ietf-mpls-te-mib-08.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	2
3.	The SNMP Management Framework	3

4.	Feature List	4
5.	Outline	4
5.1.	Summary of Traffic Engineering MIB	4
6.	Brief Description of MIB Objects	5
6.1.	mplsTunnelTable	5
6.2.	mplsTunnelResourceTable	6
6.3.	mplsTunnelHopTable	6
6.4.	mplsTunnelARHopTable	6
6.5.	mplsTunnelCHopTable	6
6.6.	mplsTunnelPerfTable	6
6.7.	mplsTunnelCRLDPResTable	6
7.	Application of the Interface Group to MPLS Tunnels	7
7.1.	Support of the MPLS Tunnel Interface by ifTable	7
8.	Example of Tunnel Setup	9
9.	The Use of RowPointer	10
10.	MPLS Traffic Engineering MIB Definitions	11
11.	Security Considerations	60
12.	Acknowledgments	60
13.	References	60
14.	Authors' Addresses	63
15.	Full Copyright Statement	63

[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 should be used in conjunction with the companion document [[LSRMIB](#)] for MPLS based traffic engineering configuration and management.

[2.](#) Terminology

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

An explicitly routed LSP (ERLSP) is referred to as an MPLS tunnel. It consists of one in-segment and/or one out-segment at the ingress/egress LSRs, each segment being associated with one MPLS interface. These are also referred to as tunnel segments. Additionally, at an intermediate LSR, we model a connection as consisting of

one or more in-segments and/or one or more out-segments.
The binding or interconnection between in-segments and out-

segments in performed using a cross-connect. These objects are defined in the MPLS Label Switch Router MIB [[LSRMIB](#)].

3. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in [RFC 2571](#) [[RFC2571](#)].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIV1 and described in STD 16, [RFC 1155](#) [[RFC1155](#)], STD 16, [RFC 1212](#) [[RFC1212](#)] and STD 16, [RFC 1215](#) [[RFC1215](#)]. The second version, called SMIV2, is described in STD 58, [RFC 2578](#) [[RFC2578](#)], STD 58, [RFC 2579](#) [[RFC2579](#)] and STD 58, [RFC 2580](#) [[RFC2580](#)].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, [RFC 1157](#) [[RFC1157](#)]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in [RFC 1901](#) [[RFC1901](#)] and [RFC 1906](#) [[RFC1906](#)]. The third version of the message protocol is called SNMPv3 and described in [RFC 1906](#) [[RFC1906](#)], [RFC 2572](#) [[RFC2572](#)] and [RFC 2574](#) [[RFC2574](#)].
- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, [RFC 1157](#) [[RFC1157](#)]. A second set of protocol operations and associated PDU formats is described in [RFC 1905](#) [[RFC1905](#)].
- A set of fundamental applications described in [RFC 2573](#) [[RFC2573](#)] and the view-based access control mechanism described in [RFC 2575](#) [[RFC2575](#)].

A more detailed introduction to the current SNMP Management Framework can be found in [RFC 2570](#) [[RFC2570](#)].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB.

Objects in the MIB are defined using the mechanisms defined
in the SMI.

This memo specifies a MIB module that is compliant to the SMIV2. A MIB conforming to the SMIV1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine-readable information in SMIV2 will be converted into textual descriptions in SMIV1 during the translation process. However, this loss of machine-readable information is not considered to change the semantics of the MIB.

4. Feature List

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

- The MIB 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 supports manually configured MPLS tunnels as well as those set up via an MPLS signaling protocol.
- The MIB supports persistent as well as non-persistent tunnels.

5. Outline

Traffic engineering support for MPLS tunnels requires the following configuration.

- Setting up MPLS tunnels along with appropriate configuration parameters.
- Configuring tunnel loose and strict source routed hops.

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

5.1. Summary of Traffic Engineering MIB

Srinivasan et al.

Expires July 2002

[Page 4]

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

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

These tables are described in the subsequent sections.

6. Brief Description of MIB Objects

The objects described in this section support the functionality described in documents [RSVPTE] and [[CRLDP](#)]. The tables support both manually configured and signaled tunnels.

[6.1.](#) mplsTunnelTable

The mplsTunnelTable allows new MPLS tunnels to be created between an MPLS LSR and a remote endpoint, and existing tunnels to be reconfigured or removed. Note that we only support point-to-point tunnel segments, although multi-point-to-point and point-to-multi-point connections are supported by an LSR acting as a cross-connect. Each MPLS tunnel can thus have one out-segment originating at an LSR and/or one in-segment terminating at that LSR.

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

6.2. mplsTunnelResourceTable

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

6.3. mplsTunnelHopTable

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

6.4. mplsTunnelARHopTable

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

6.5. mplsTunnelCHopTable

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

6.6. mplsTunnelPerfTable

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

6.7. mplsTunnelCRLDResTable

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.

7. 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, which has been defined for MPLS interworking. Examples include ATM, Frame Relay, and Ethernet.

7.1. 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.

Srinivasan et al.

Expires July 2002

[Page 7]

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	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.

8. 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.

In mplsTunnelTable:

```
{
  mplsTunnelIndex           = 1,
  mplsTunnelInstance        = 1,
  mplsTunnelIngressLSRId    = 123.123.125.1,
  mplsTunnelEgressLSRId    = 123.123.126.1,
  mplsTunnelName            = "My first tunnel",
  mplsTunnelDescr           = "Here to there",
  mplsTunnelIsIf            = true (1),
  mplsTunnelXCPointer       = mplsXCIndex.2.0.0.15,
  mplsTunnelSignallingProto = none (1),
  mplsTunnelSetupPrio       = 0,
  mplsTunnelHoldingPrio     = 0,
  mplsTunnelSessionAttributes = 0,
  mplsTunnelOwner           = snmp (1),
  mplsTunnelLocalProtectInUse = false (0),
  mplsTunnelResourcePointer = mplsTunnelResourceIndex.5,
  mplsTunnelInstancePriority = 1,
  mplsTunnelHopTableIndex   = 1,
  mplsTunnelPrimaryInstance = 0,
  mplsTunnelIncludeAnyAffinity = 0,
  mplsTunnelIncludeAllAffinity = 0,
  mplsTunnelExcludeAllAffinity = 0,
  mplsTunnelPathInUse       = 1,
  mplsTunnelRole            = head (1),
  mplsTunnelRowStatus       = createAndGo (4)
}
```

```
In mplSTunnelResourceTable:  
{
```

```
mplsTunnelResourceIndex      = 5,  
mplsTunnelResourceMaxRate    = 0,  
mplsTunnelResourceMeanRate   = 0,  
mplsTunnelResourceMaxBurstSize = 0,  
mplsTunnelResourceRowStatus  = createAndGo (4)  
}
```

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

The following denotes the beginning of the network, or the first hop. We have used the fictitious LSR identified by "123.123.125.1" as our example head-end router.

In mplsTunnelHopTable:

```
{  
  mplsTunnelHopListIndex      = 1,  
  mplsTunnelPathOptionIndex   = 1,  
  mplsTunnelHopIndex          = 1,  
  mplsTunnelHopAddrType       = 1,  
  mplsTunnelHopIpv4Addr       = 123.123.125.1,  
  mplsTunnelHopIpv4PrefixLen   = 9,  
  mplsTunnelHopType           = loose (2),  
  mplsTunnelHopRowStatus      = createAndGo (4)  
}
```

The following denotes the end of the network, or the last hop in our example. We have used the fictitious LSR identified by "123.123.126.1" as our end router.

In mplsTunnelHopTable:

```
{  
  mplsTunnelHopListIndex      = 1,  
  mplsTunnelPathOptionIndex   = 1,  
  mplsTunnelHopIndex          = 2,  
  mplsTunnelHopAddrType       = 1,  
  mplsTunnelHopIpv4Addr       = 123.123.126.1,  
  mplsTunnelHopIpv4PrefixLen   = 9,  
  mplsTunnelHopType           = loose (2),  
  mplsTunnelHopRowStatus      = createAndGo (4)  
}
```

9. The Use of RowPointer

RowPointer is a textual convention used to identify a conceptual row in an SNMP Table by pointing to one of its objects. In this MIB, 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.

10. MPLS Traffic Engineering MIB Definitions

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

```
IMPORTS
```

```
    MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
    Integer32, Unsigned32, Counter32, Counter64, TimeTicks
        FROM SNMPv2-SMI
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
        FROM SNMPv2-CONF
    TruthValue, RowStatus, RowPointer, StorageType,
    DisplayString, TimeStamp
        FROM SNMPv2-TC
    InterfaceIndexOrZero
        FROM IF-MIB
    mplsMIB, MplsBitRate, MplsBurstSize, MplsLSPID,
    MplsTunnelIndex, MplsTunnelInstanceIndex,
    MplsTunnelAffinity, MplsLsrIdentifier, MplsPathIndex,
    MplsPathIndexOrZero
        FROM MPLS-TC-MIB
    InetAddressIPv4, InetAddressIPv6
        FROM INET-ADDRESS-MIB
    ;
```

```
mplsTeMIB MODULE-IDENTITY
```

```
    LAST-UPDATED
```

```
        "200201041200Z" -- 4 January 2002 12:00:00 GMT
```

```
    ORGANIZATION
```

```
        "Multiprotocol Label Switching (MPLS) Working Group"
```

```
    CONTACT-INFO
```

```
        "
```

```
            Cheenu Srinivasan
```

```
            Postal: Parama Networks, Inc.
```

```
            1030 Broad Street
```

```
            Shrewsbury, NJ 07702
```

```
            Tel:      +1-732-544-9120 x731
```

```
            Email:    cheenu@paramanet.com
```

Arun Viswanathan
Postal: Force10 Networks, Inc.

Srinivasan et al.

Expires July 2002

[Page 11]

1440 McCarthy Blvd
Milpitas, CA 95035
Tel: +1-408-571-3516
Email: arun@force10networks.com

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

"

DESCRIPTION

"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), Internet Draft <[draft-ietf-mpls-cr-ldp-06.txt](#)>, November 2001
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

"200201041200Z" -- 4 January 2002 12:00:00 GMT

DESCRIPTION

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

::= { mplsMIB 3 }

-- Top level components of this MIB.

-- tables, scalars

mplsTeScalars OBJECT IDENTIFIER ::= { mplsTeMIB 1 }
mplsTeObjects OBJECT IDENTIFIER ::= { mplsTeMIB 2 }

-- traps

mplsTeNotifications OBJECT IDENTIFIER ::= { mplsTeMIB 3 }
mplsTeNotifyPrefix OBJECT IDENTIFIER ::= { mplsTeNotifications 0 }

-- conformance

mplsTeConformance OBJECT IDENTIFIER ::= { mplsTeMIB 4 }

-- MPLS Tunnel scalars.

Srinivasan et al.

Expires July 2002

[Page 12]

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 }

-- End of MPLS Tunnel scalars.

-- MPLS tunnel table.

mplsTunnelIndexNext OBJECT-TYPE

Srinivasan et al.

Expires July 2002

[Page 13]

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains the next appropriate value to be used for mplsTunnelIndex when creating entries in mplsTunnelTable. If the number of unassigned entries is exhausted, a retrieval operation will return a value of 0. This object may also return a value of 0 when the LSR is unable to accept conceptual row creation, for example, if the mplsTunnelTable is implemented as read-only. To obtain the value of mplsTunnelIndex for a new entry, the manager must first issue a management protocol retrieval operation to obtain the current value of this object. The agent should modify the value to reflect the next unassigned index after each retrieval operation. After a manager retrieves a value the agent will determine through its local policy when this index value will be made available for reuse."

::= { mplsTeObjects 1 }

mplsTunnelTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"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

signaling 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)."

REFERENCE

- "1. [RFC 2863](#) - The Interfaces Group MIB, McCloghrie, K., and F. Kastenholz, June 2000
2. [RFC 1700](#) - Assigned Numbers, Reynolds, J. and J. Postel, Oct. 1994"

INDEX {

mplsTunnelIndex,
mplsTunnelInstance,
mplsTunnelIngressLSRId,
mplsTunnelEgressLSRId

}

::= { mplsTunnelTable 1 }

MplsTunnelEntry ::= SEQUENCE {

mplsTunnelIndex	MplsTunnelIndex,
mplsTunnelInstance	MplsTunnelInstanceIndex,
mplsTunnelIngressLSRId	MplsLsrIdentifier,
mplsTunnelEgressLSRId	MplsLsrIdentifier,
mplsTunnelName	DisplayString,
mplsTunnelDescr	DisplayString,
mplsTunnelIsIf	TruthValue,
mplsTunnelIfIndex	InterfaceIndexOrZero,
mplsTunnelXCPointer	RowPointer,
mplsTunnelSignallingProto	INTEGER,
mplsTunnelSetupPrio	INTEGER,
mplsTunnelHoldingPrio	INTEGER,
mplsTunnelSessionAttributes	BITS,
mplsTunnelOwner	INTEGER,
mplsTunnelLocalProtectInUse	TruthValue,
mplsTunnelResourcePointer	RowPointer,
mplsTunnelInstancePriority	Unsigned32,
mplsTunnelHopTableIndex	MplsPathIndexOrZero,
mplsTunnelARHopTableIndex	MplsPathIndexOrZero,
mplsTunnelCHopTableIndex	MplsPathIndexOrZero,
mplsTunnelPrimaryInstance	MplsTunnelInstanceIndex,
mplsTunnelPrimaryTimeUp	TimeTicks,
mplsTunnelPathChanges	Counter32,
mplsTunnelLastPathChange	TimeTicks,
mplsTunnelCreationTime	TimeStamp,
mplsTunnelStateTransitions	Counter32,
mplsTunnelIncludeAnyAffinity	MplsTunnelAffinity,
mplsTunnelIncludeAllAffinity	MplsTunnelAffinity,
mplsTunnelExcludeAllAffinity	MplsTunnelAffinity,
mplsTunnelPathInUse	MplsPathIndexOrZero,
mplsTunnelRole	INTEGER,

mplsTunnelTotalUpTime	TimeTicks,
mplsTunnelInstanceUpTime	TimeTicks,
mplsTunnelAdminStatus	INTEGER,

```
mplsTunnelOperStatus      INTEGER,
mplsTunnelRowStatus        RowStatus,
mplsTunnelStorageType      StorageType
}
```

mplsTunnelIndex OBJECT-TYPE

```
SYNTAX      MplsTunnelIndex
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
    "Uniquely identifies this row."
::= { mplsTunnelEntry 1 }
```

mplsTunnelInstance OBJECT-TYPE

```
SYNTAX      MplsTunnelInstanceIndex
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
    "Uniquely identifies an instance of a tunnel. It is
     useful to identify multiple instances of tunnels
     for the purposes of backup and parallel tunnels."
::= { mplsTunnelEntry 2 }
```

mplsTunnelIngressLSRId OBJECT-TYPE

```
SYNTAX      MplsLsrIdentifier
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
    "The purpose of this object is to uniquely identity a
     tunnel within a network. When the MPLS signalling
     protocol is rsvp(2) this value SHOULD mimic the
     Extended Tunnel Id field in the SESSION object.
     When the MPLS signalling protocol is crldp(3) this
     value SHOULD mimic the Ingress LSR Router ID field
     in the LSPID TLV object."
```

REFERENCE

```
"1. RSVP-TE: Extensions to RSVP for LSP Tunnels,
   Awduche et al, RFC 3209, December 2001
2. Constraint-Based LSP Setup using LDP, Jamoussi
   (Editor), Internet Draft <draft-ietf-mpls-cr-ldp-06.txt>, November 2001"
::= { mplsTunnelEntry 3 }
```

mplsTunnelEgressLSRId OBJECT-TYPE

```
SYNTAX      MplsLsrIdentifier
MAX-ACCESS   not-accessible
STATUS       current
```

DESCRIPTION

"Specifies the egress LSR ID."
::= { mplstunnelEntry 4 }

mplsTunnelName OBJECT-TYPE

SYNTAX DisplayString

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

REFERENCE

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

::= { mplsTunnelEntry 5 }

mplsTunnelDescr OBJECT-TYPE

SYNTAX DisplayString

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."

::= { mplsTunnelEntry 6 }

mplsTunnelIsIf OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

REFERENCE

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

DEFVAL { false }

::= { mplsTunnelEntry 7 }

mplsTunnelIfIndex OBJECT-TYPE

SYNTAX	InterfaceIndexOrZero
MAX-ACCESS	read-only
STATUS	current

DESCRIPTION

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

REFERENCE

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

::= { mplSTunnelEntry 8 }

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-08.txt](#)>, December 2001."

::= { mplSTunnelEntry 9 }

mplSTunnelSignallingProto OBJECT-TYPE

SYNTAX INTEGER {
 none(1),
 rsvp(2),
 crldp(3),
 other(4)
}

MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The signaling protocol, if any, which was used to setup this tunnel."

DEFVAL { none }

::= { mplSTunnelEntry 10 }

mplSTunnelSetupPrio OBJECT-TYPE

SYNTAX Integer32 (0..7)

MAX-ACCESS	read-create
STATUS	current
DESCRIPTION	

Srinivasan et al.

Expires July 2002

[Page 18]

"Indicates the setup priority of this tunnel."

REFERENCE

- "1. RSVP-TE: Extensions to RSVP for LSP Tunnels,
Awduche et al, [RFC 3209](#), December 2001
2. Constraint-Based LSP Setup using LDP, Jamoussi
(Editor), Internet Draft <[draft-ietf-mpls-cr-ldp-06.txt](#)>, November 2001"

::= { mplsTunnelEntry 11 }

mplsTunnelHoldingPrio OBJECT-TYPE

SYNTAX Integer32 (0..7)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Indicates the holding priority for this tunnel."

REFERENCE

- "1. RSVP-TE: Extensions to RSVP for LSP Tunnels,
Awduche et al, [RFC3209](#), December 2001
2. Constraint-Based LSP Setup using LDP, Jamoussi
(Editor), Internet Draft <[draft-ietf-mpls-cr-ldp-06.txt](#)>, November 2001"

::= { mplsTunnelEntry 12 }

mplsTunnelSessionAttributes OBJECT-TYPE

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

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This bitmask indicates optional session values for
this tunnel. The following describes these
bitfields:

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

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

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

recordRouteThis flag indicates whether or not the signaling 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."

DEFVAL { 0 }
::= { mplsTunnelEntry 13 }

mplsTunnelOwner OBJECT-TYPE

SYNTAX INTEGER {
admin(1), -- represents all management entities
rsvp(2),
crldp(3),
policyAgent(4),
other(5)
}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Indicates which protocol created and is responsible for managing this tunnel. Values rsvp(2) and crldp(3) should not be used at the head-end of a MPLS tunnel."

::= { mplsTunnelEntry 14 }

mplsTunnelLocalProtectInUse OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

::= { mplsTunnelEntry 15 }

mplsTunnelResourcePointer OBJECT-TYPE

SYNTAX RowPointer

MAX-ACCESS	read-create
STATUS	current

Srinivasan et al.

Expires July 2002

[Page 20]

DESCRIPTION

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

::= { mplsTunnelEntry 16 }

mplsTunnelInstancePriority OBJECT-TYPE

SYNTAX Unsigned32
MAX-ACCESS read-create
STATUS current

DESCRIPTION

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

DEFVAL { 0 }
::= { mplsTunnelEntry 17 }

mplsTunnelHopTableIndex OBJECT-TYPE

SYNTAX MplsPathIndexOrZero
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"Index into the mplsTunnelHopTable entry that specifies the explicit route hops for this tunnel."

::= { mplsTunnelEntry 18 }

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."  
::= { mplsTunnelEntry 19 }
```

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."

::= { mplsTunnelEntry 20 }

mplsTunnelPrimaryInstance OBJECT-TYPE

SYNTAX MplsTunnelInstanceIndex

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Specifies the instance index of the primary instance of this tunnel."

::= { mplsTunnelEntry 21 }

mplsTunnelPrimaryTimeUp 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 22 }

mplsTunnelPathChanges OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Specifies the number of times the paths has changed for this tunnel."

::= { mplsTunnelEntry 23 }

mplsTunnelLastPathChange OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Specifies the time since the last path change for this tunnel."

```
::= { mplsTunnelEntry 24 }
```

```
mplsTunnelCreationTime OBJECT-TYPE
```

SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Specifies the value of SysUpTime when the first
 instance of this tunnel came into existence."
 ::= { mplsTunnelEntry 25 }

mplsTunnelStateTransitions OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Specifies the number of times the state of this
 tunnel instance has changed."
 ::= { mplsTunnelEntry 26 }

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 27 }

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 28 }

mplsTunnelExcludeAllAffinity OBJECT-TYPE

SYNTAX MplsTunnelAffinity
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"A link satisfies the exclude-all constraint if and only if the link contains none of the administrative

groups specifie in the constraint."

REFERENCE

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

::= { mplsTunnelEntry 29 }

mplsTunnelPathInUse OBJECT-TYPE

SYNTAX MplsPathIndexOrZero

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

::= { mplsTunnelEntry 30 }

mplsTunnelRole OBJECT-TYPE

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

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

::= { mplsTunnelEntry 31 }

mplsTunnelTotalUpTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-create

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 32 }

mplsTunnelInstanceUpTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

::= { 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."

::= { mplsTunnelEntry 36 }

mplsTunnelStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable indicates the storage type for this object."

::= { mplsTunnelEntry 37 }

-- End of mplsTunnelTable

mplsTunnelHopListIndexNext OBJECT-TYPE

SYNTAX Unsigned32 (0..2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains an appropriate value to be used for mplsTunnelHopListIndex when creating entries in the mplsTunnelHopTable. If the number of unassigned entries is exhausted, a retrieval operation will return a value of 0. This object may also return a value of 0 when the LSR is unable to accept conceptual row creation, for example, if the mplsTunnelHopTable is implemented as read-only. To obtain the value of mplsTunnelHopListIndex for a new entry in the mplsTunnelHopTable, the manager issues a management protocol retrieval operation to obtain the current value of mplsTunnelHopIndex. After each retrieval operation, the agent should modify the value to reflect the next unassigned index. After a manager retrieves a value the agent will determine through its local policy when this index value will be made available for reuse."

::= { mplsTeObjects 3 }

mplsTunnelHopTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The mplsTunnelHopTable is used to indicate the hops,

strict or loose, for an MPLS tunnel defined in
mplsTunnelTable, when it is established via
signaling, for the outgoing direction of the

tunnel. Each row in this table is indexed by `mplsTunnelHopListIndex`. Each row also has a secondary index `mplsTunnelHopIndex` corresponding to the next hop that this row corresponds to. The first row in the table is the first hop after the origination point of the tunnel. In case we want to specify a particular interface on the originating LSR of an outgoing tunnel by which we want packets to exit the LSR, we specify this as the first hop for this tunnel in `mplsTunnelHopTable`."

```
::= { mplsTeObjects 4 }
```

`mplsTunnelHopEntry` OBJECT-TYPE

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 signaling protocol."

INDEX {

`mplsTunnelHopListIndex`,
`mplsTunnelHopPathOptionIndex`,
`mplsTunnelHopIndex`

}

```
::= { mplsTunnelHopTable 1 }
```

`MplsTunnelHopEntry` ::= SEQUENCE {

<code>mplsTunnelHopListIndex</code>	<code>MplsPathIndex</code> ,
<code>mplsTunnelHopPathOptionIndex</code>	<code>MplsPathIndex</code> ,
<code>mplsTunnelHopIndex</code>	<code>MplsPathIndex</code> ,
<code>mplsTunnelHopAddrType</code>	INTEGER,
<code>mplsTunnelHopIpv4Addr</code>	<code>InetAddressIPv4</code> ,
<code>mplsTunnelHopIpv4PrefixLen</code>	Unsigned32,
<code>mplsTunnelHopIpv6Addr</code>	<code>InetAddressIPv6</code> ,
<code>mplsTunnelHopIpv6PrefixLen</code>	Unsigned32,
<code>mplsTunnelHopAsNumber</code>	Unsigned32,
<code>mplsTunnelHopLspId</code>	<code>MplsLSPID</code> ,
<code>mplsTunnelHopType</code>	INTEGER,
<code>mplsTunnelHopIncludeExclude</code>	INTEGER,
<code>mplsTunnelHopPathOptionName</code>	<code>DisplayString</code> ,
<code>mplsTunnelHopEntryPathComp</code>	INTEGER,
<code>mplsTunnelHopRowStatus</code>	<code>RowStatus</code> ,
<code>mplsTunnelHopStorageType</code>	<code>StorageType</code>

}

mplsTunnelHopListIndex OBJECT-TYPE
SYNTAX MplsPathIndex

Srinivasan et al.

Expires July 2002

[Page 27]

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

mplsTunnelHopPathOptionIndex OBJECT-TYPE

SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "Secondary index into this table identifying a
 particular group of hops representing a particular
 configured path. This is otherwise known as a path
 option."
::= { mplsTunnelHopEntry 2 }

mplsTunnelHopIndex OBJECT-TYPE

SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "Secondary index into this table identifying a
 particular hop."
::= { mplsTunnelHopEntry 3 }

mplsTunnelHopAddrType OBJECT-TYPE

SYNTAX INTEGER {
 ipV4(1),
 ipV6(2),
 asNumber(3),
 lspid(4)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
 "Denotes the address type of this tunnel hop. Note
 that lspid(4) is a valid option only for tunnels
 signaled via CRLDP."
DEFVAL { ipV4 }
::= { mplsTunnelHopEntry 4 }

mplsTunnelHopIpv4Addr OBJECT-TYPE

SYNTAX InetAddressIPv4
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"If mplsTunnelHopAddrType is set to ipV4(1), then
this value will contain the IPv4 address of this

hop. If mplsTunnelHopAddrType is set to lspid(4), then this value will contain the Ingress LSR Router ID of the Tunnel. This object is otherwise insignificant and should contain a value of 0."

::= { mplsTunnelHopEntry 5 }

mplsTunnelHopIpv4PrefixLen OBJECT-TYPE

SYNTAX Unsigned32 (0..32)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If mplsTunnelHopAddrType is ipv4(1), then the prefix length for this hop's IPv4 address is contained herein. This object is otherwise insignificant and should contain a value of 0."

::= { mplsTunnelHopEntry 6 }

mplsTunnelHopIpv6Addr OBJECT-TYPE

SYNTAX InetAddressIPv6

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If the mplsTunnelHopAddrType is set to ipv6(2), then this variable contains the IPv6 address of this hop. This object is otherwise insignificant and should contain a value of 0."

::= { mplsTunnelHopEntry 7 }

mplsTunnelHopIpv6PrefixLen OBJECT-TYPE

SYNTAX Unsigned32 (0..128)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If mplsTunnelHopAddrType is set to ipv6(2), this value will contain the prefix length for this hop's IPv6 address. This object is otherwise insignificant and should contain a value of 0."

::= { mplsTunnelHopEntry 8 }

mplsTunnelHopAsNumber OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

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. This object is otherwise insignificant and should

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

mplsTunnelHopLspId OBJECT-TYPE

SYNTAX MplsLSPID
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"If mplsTunnelHopAddrType is set to lspid(4), 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 10 }

mplsTunnelHopType OBJECT-TYPE

SYNTAX INTEGER {
 strict(1),
 loose(2)
 }
MAX-ACCESS read-create
STATUS current
DESCRIPTION

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

::= { mplsTunnelHopEntry 11 }

mplsTunnelHopIncludeExclude OBJECT-TYPE

SYNTAX INTEGER {
 include(1),
 exclude(2)
 }
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"If this value is set to include(1), then this indicates that this hop must be included in the tunnel's path. If this value is set to exclude(2), then this hop must be avoided when calculating the path for this tunnel. The default value of this object is include(1), so that by default all indicated hops are included in the CSPF path computation."

DEFVAL { include }

::= { mplsTunnelHopEntry 12 }

mplsTunnelHopPathOptionName OBJECT-TYPE

SYNTAX DisplayString
MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The description of this series of hops as they

Srinivasan et al.

Expires July 2002

[Page 30]

relate to the specified path option."
::= { mplsTunnelHopEntry 13 }

mplsTunnelHopEntryPathComp OBJECT-TYPE

SYNTAX INTEGER {
 dynamic(1), -- CSPF computed
 explicit(2) -- strict hop
 }
MAX-ACCESS read-create
STATUS current
DESCRIPTION
 "If this value is set to dynamic, then the user
 should only specify the source and destination of
 the path and expect that the CSPF will calculate
 the remainder of the path. If this value is set to
 explicit, the user should specify the entire path
 for the tunnel to take. This path may contain
 strict or loose hops. Each hop along a specific
 path should have this object set to the same value"
::= { mplsTunnelHopEntry 14 }

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."
::= { mplsTunnelHopEntry 15 }

mplsTunnelHopStorageType OBJECT-TYPE

SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION
 "This variable indicates the storage type for this
 object."
::= { mplsTunnelHopEntry 16 }

-- End of mplsTunnelHopTable

-- Begin of mplsTunnelResourceTable

mplsTunnelResourceIndexNext OBJECT-TYPE

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

DESCRIPTION

"This object contains the next appropriate value to be used for `mplsTunnelResourceIndex` when creating

entries in the mplsTunnelResourceTable. If the number of unassigned entries is exhausted, a retrieval operation will return a value of 0. This object may also return a value of 0 when the LSR is unable to accept conceptual row creation, for example, if the mplsTunnelTable is implemented as read-only. To obtain the mplsTunnelResourceIndex value for a new entry, the manager must first issue a management protocol retrieval operation to obtain the current value of this object. The agent should modify the value to reflect the next unassigned index after each retrieval operation. After a manager retrieves a value the agent will determine through its local policy when this index value will be made available for reuse."

```
::= { mplsTeObjects 5 }
```

mplsTunnelResourceTable OBJECT-TYPE

```
SYNTAX          SEQUENCE OF MplsTunnelResourceEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
```

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

```
::= { mplsTeObjects 6 }
```

mplsTunnelResourceEntry OBJECT-TYPE

```
SYNTAX          MplsTunnelResourceEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
```

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

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

MplsTunnelResourceEntry ::= SEQUENCE {

mplsTunnelResourceIndex	Unsigned32,
mplsTunnelResourceMaxRate	MplsBitRate,
mplsTunnelResourceMeanRate	MplsBitRate,
mplsTunnelResourceMaxBurstSize	MplsBurstSize,
mplsTunnelResourceMeanBurstSize	MplsBurstSize,

mplsTunnelResourceExcessBurstSize	MplsBurstSize,
mplsTunnelResourceFrequency	INTEGER,
mplsTunnelResourceWeight	Unsigned32,

```
    mplsTunnelResourceRowStatus      RowStatus,
    mplsTunnelResourceStorageType    StorageType
}
```

mplsTunnelResourceIndex OBJECT-TYPE

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

mplsTunnelResourceMaxRate OBJECT-TYPE

```
SYNTAX      MplsBitRate
UNITS       "bits per second"
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "The maximum rate in bits/second. Note that setting
    mplsTunnelResourceMaxRate,
    mplsTunnelResourceMeanRate, and
    mplsTunnelResourceMaxBurstSize to 0 indicates best-
    effort treatment.
    This object is copied to an instance of
    mplsTrafficParamMaxRate in mplsTrafficParamTable
    the OID of which is copied into the corresponding
    mplsInSegmentTrafficParamPtr."
REFERENCE
    "Srinivasan, C., Viswanathan, A., and T. Nadeau, MPLS
    Label Switch Router Management Information Base,
    Internet Draft <draft-ietf-mpls-lsr-mib-08.txt>,
    December 2001."
 ::= { mplsTunnelResourceEntry 2 }
```

mplsTunnelResourceMeanRate OBJECT-TYPE

```
SYNTAX      MplsBitRate
UNITS       "bits per second"
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "This object is copied into an instance of
    mplsTrafficParamMeanRate in the
    mplsTrafficParamTable. The OID of this table entry
    is then copied into the corresponding
    mplsInSegmentTrafficParamPtr.
```

When resource allocation is performed as requested

by this TSpec object, it is copied into an entry in
mplsTrafficParamTable [[LSRMIB](#)):
mplsTunnelInMeanRate to mplsTrafficParamMeanRate.

The OID of this entry is copied to
mplsInSegmentTrafficParamPtr of the corresponding
in-segment entry."

REFERENCE

"Srinivasan, C., Viswanathan, A., and T. Nadeau, MPLS
Label Switch Router Management Information Base,
Internet Draft <[draft-ietf-mpls-lsr-mib-08.txt](#)>,
December 2001."

::= { mplsTunnelResourceEntry 3 }

mplsTunnelResourceMaxBurstSize OBJECT-TYPE

SYNTAX MplsBurstSize

UNITS "bytes"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

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

REFERENCE

"Srinivasan, C., Viswanathan, A., and T. Nadeau, MPLS
Label Switch Router Management Information Base,
Internet Draft <[draft-ietf-mpls-lsr-mib-08.txt](#)>,
December 2001."

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

::= { mplsTunnelResourceEntry 5 }

mplsTunnelResourceExcessBurstSize OBJECT-TYPE

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

STATUS current

DESCRIPTION

"The Excess burst size in bytes. The implementations which do not implement this variable must return 0 for this value and must not allow a user to set this value."

REFERENCE

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

::= { mplsTunnelResourceEntry 6 }

mplsTunnelResourceFrequency OBJECT-TYPE

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

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

REFERENCE

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

::= { mplsTunnelResourceEntry 7 }

mplsTunnelResourceWeight OBJECT-TYPE

SYNTAX Unsigned32(0..255)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

REFERENCE

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

::= { mplsTunnelResourceEntry 8 }

mplsTunnelResourceRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable is used to create, modify, and/or delete a row in this table."

::= { mplsTunnelResourceEntry 9 }

mplsTunnelResourceStorageType OBJECT-TYPE
SYNTAX StorageType

Srinivasan et al.

Expires July 2002

[Page 35]

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable indicates the storage type for this object."

::= { mplsTunnelResourceEntry 10 }

-- End mplsTunnelResourceTable

-- Tunnel Actual Route Hop table.

mplsTunnelARHopTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelARHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The mplsTunnelARHopTable is used to indicate the hops, strict or loose, for an MPLS tunnel defined in mplsTunnelTable, as reported by the MPLS signaling protocol, for the outgoing direction of the tunnel. Each row in this table is indexed by mplsTunnelARHopListIndex. Each row also has a secondary index mplsTunnelARHopIndex, corresponding to the next hop that this row corresponds to. The first row in the table is the first hop after the origination point of the tunnel. In case we want to specify a particular interface on the originating LSR of an outgoing tunnel by which we want packets to exit the LSR, we specify this as the first hop for this tunnel in mplsTunnelARHopTable.

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

::= { mplsTeObjects 7 }

mplsTunnelARHopEntry OBJECT-TYPE

SYNTAX MplsTunnelARHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents a tunnel hop. An

Srinivasan et al.

Expires July 2002

[Page 36]

entry is created by a network administrator for signaled ERLSP set up by an MPLS signaling protocol."

INDEX { mplsTunnelARHopListIndex, mplsTunnelARHopIndex }
::= { mplsTunnelARHopTable 1 }

MplsTunnelARHopEntry ::= SEQUENCE {
 mplsTunnelARHopListIndex MplsPathIndex,
 mplsTunnelARHopIndex MplsPathIndex,
 mplsTunnelARHopAddrType INTEGER,
 mplsTunnelARHopIpv4Addr InetAddressIPv4,
 mplsTunnelARHopIpv4PrefixLen Unsigned32,
 mplsTunnelARHopIpv6Addr InetAddressIPv6,
 mplsTunnelARHopIpv6PrefixLen Unsigned32,
 mplsTunnelARHopAsNumber Unsigned32,
 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 INTEGER {
 ipV4(1),
 ipV6(2),
 asNumber(3),
 lspId(4)
 }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Denotes the address type of this tunnel hop."

```
DEFVAL      { ipv4 }  
:= { mplsTunnelARHopEntry 3 }
```

mplsTunnelARHopIPv4Addr OBJECT-TYPE

SYNTAX InetAddressIPv4

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelARHopAddrType is set to ipv4(1), then this value will contain the IPv4 address of this hop. This object is otherwise insignificant and should contain a value of 0."

::= { mplsTunnelARHopEntry 4 }

mplsTunnelARHopIPv4PrefixLen OBJECT-TYPE

SYNTAX Unsigned32 (0..32)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelARHopAddrType is ipv4(1), then the prefix length for this hop's IPv4 address is contained herein. This object is otherwise insignificant and should contain a value of 0."

::= { mplsTunnelARHopEntry 5 }

mplsTunnelARHopIPv6Addr OBJECT-TYPE

SYNTAX InetAddressIPv6

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If the mplsTunnelARHopAddrType is set to ipv6(2), then this variable contains the IPv6 address of this hop. This object is otherwise insignificant and should contain a value of 0."

::= { mplsTunnelARHopEntry 6 }

mplsTunnelARHopIPv6PrefixLen OBJECT-TYPE

SYNTAX Unsigned32 (0..128)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelARHopAddrType is set to ipv6(2), this value will contain the prefix length for this hop's IPv6 address. This object is otherwise insignificant and should contain a value of 0."

::= { mplsTunnelARHopEntry 7 }

mplsTunnelARHopAsNumber OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelARHopAddrType is set to asNumber(3),

then this value will contain the AS number of this hop. This object is otherwise insignificant and should contain a value of 0 to indicate this fact."
 ::= { mplsTunnelARHopEntry 8 }

mplsTunnelARHopLspId OBJECT-TYPE

SYNTAX MplsLSPID

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelARHopAddrType is set to lspid(4), 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 9 }

-- End of mplsTunnelARHopTable

-- Tunnel Computed Hop table.

mplsTunnelCHopTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelCHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The mplsTunnelCHopTable is used to indicate the hops, strict or loose, for an MPLS tunnel defined in mplsTunnelTable, as computed by a constraint-based routing protocol, based on the mplsTunnelHopTable for the outgoing direction of the tunnel. Each row in this table is indexed by mplsTunnelCHopListIndex. Each row also has a secondary index mplsTunnelCHopIndex, corresponding to the next hop that this row corresponds to. The first row in the table is the first hop after the origination point of the tunnel. In case we want to specify a particular interface on the originating LSR of an outgoing tunnel by which we want packets to exit the LSR, we specify this as the first hop for this tunnel in mplsTunnelCHopTable.

Please note that since the information necessary to build entries within this table may not be supported by some LSRs, implementation of this table is optional. Furthermore, since the

information in this table is actually provided by
routing protocol after the path has been computed,

the entries in this table are provided only for observation, and hence, all variables in this table are accessible exclusively as read-only."

::= { mplsTeObjects 8 }

mplsTunnelCHopEntry OBJECT-TYPE

SYNTAX MplsTunnelCHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents a tunnel hop. An entry in this table is created by a constraint-based routing protocol based on the hops specified in the corresponding mplsTunnelHopTable."

INDEX { mplsTunnelCHopListIndex, mplsTunnelCHopIndex }

::= { mplsTunnelCHopTable 1 }

MplsTunnelCHopEntry ::= SEQUENCE {

mplsTunnelCHopListIndex	MplsPathIndex,
mplsTunnelCHopIndex	MplsPathIndex,
mplsTunnelCHopAddrType	INTEGER,
mplsTunnelCHopIpv4Addr	InetAddressIPv4,
mplsTunnelCHopIpv4PrefixLen	Unsigned32,
mplsTunnelCHopIpv6Addr	InetAddressIPv6,
mplsTunnelCHopIpv6PrefixLen	Unsigned32,
mplsTunnelCHopAsNumber	Unsigned32,
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      INTEGER {
```

```
        ipv4(1),
        ipv6(2),
        asNumber(3),
        lspId(4)
    }
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "Denotes the address type of this tunnel hop. Note
     that lspId(4) is a valid option only for tunnels
     signaled via CRLDP."
DEFVAL        { ipv4 }
::= { mplsTunnelCHopEntry 3 }
```

mplsTunnelCHopIpv4Addr OBJECT-TYPE

```
SYNTAX        InetAddressIPv4
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "If mplsTunnelCHopAddrType is set to ipv4(1), then
     this value will contain the IPv4 address of this
     hop. This object is otherwise insignificant and
     should contain a value of 0."
::= { mplsTunnelCHopEntry 4 }
```

mplsTunnelCHopIpv4PrefixLen OBJECT-TYPE

```
SYNTAX        Unsigned32 (0..32)
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "If mplsTunnelCHopAddrType is ipv4(1), then the
     prefix length for this hop's IPv4 address is
     contained herein. This object is otherwise
     insignificant and should contain a value of 0."
::= { mplsTunnelCHopEntry 5 }
```

mplsTunnelCHopIpv6Addr OBJECT-TYPE

```
SYNTAX        InetAddressIPv6
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "If the mplsTunnelCHopAddrType is set to ipv6(2),
     then this variable contains the IPv6 address of
     this hop. This object is otherwise insignificant
     and should contain a value of 0."
::= { mplsTunnelCHopEntry 6 }
```

mplsTunnelCHopIpv6PrefixLen OBJECT-TYPE
SYNTAX Unsigned32 (0..128)
MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelCHopAddrType is set to ipv6(2), this value will contain the prefix length for this hop's IPv6 address. This object is otherwise insignificant and should contain a value of 0."

::= { mplsTunnelCHopEntry 7 }

mplsTunnelCHopAsNumber OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

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. This object is otherwise insignificant and should contain a value of 0 to indicate this fact."

::= { mplsTunnelCHopEntry 8 }

mplsTunnelCHopLspId OBJECT-TYPE

SYNTAX MplsLSPID

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If mplsTunnelCHopAddrType is set to lspid(4), 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 9 }

mplsTunnelCHopType OBJECT-TYPE

SYNTAX INTEGER {

strict(1),

loose(2)

}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

::= { mplsTunnelCHopEntry 10 }

-- End of mplsTunnelCHopTable

-- MPLS Tunnel Performance Table.

mplsTunnelPerfTable OBJECT-TYPE

SYNTAX	SEQUENCE OF MplsTunnelPerfEntry
MAX-ACCESS	not-accessible

STATUS current

DESCRIPTION

"This table provides per-tunnel MPLS performance information."

::= { mplsTeObjects 9 }

mplsTunnelPerfEntry OBJECT-TYPE

SYNTAX MplsTunnelPerfEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table is created by the LSR for every tunnel. Its is an extension to mplsTunnelEntry."

AUGMENTS { mplsTunnelEntry }

::= { mplsTunnelPerfTable 1 }

MplsTunnelPerfEntry ::= SEQUENCE {

mplsTunnelPerfPackets Counter32,

mplsTunnelPerfHCPackets Counter64,

mplsTunnelPerfErrors Counter32,

mplsTunnelPerfBytes Counter32,

mplsTunnelPerfHCBytes Counter64

}

mplsTunnelPerfPackets OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Number of packets forwarded by the tunnel."

::= { mplsTunnelPerfEntry 1 }

mplsTunnelPerfHCPackets OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"High capacity counter for number of packets forwarded by the tunnel."

::= { mplsTunnelPerfEntry 2 }

mplsTunnelPerfErrors OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

```
"Number of errored packets."  
::= { mplsTunnelPerfEntry 3 }
```

mplsTunnelPerfBytes OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Number of bytes forwarded by the tunnel."

::= { mplsTunnelPerfEntry 4 }

mplsTunnelPerfHCBytes OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"High capacity counter for number of bytes forwarded
by the tunnel."

::= { mplsTunnelPerfEntry 5 }

-- End of mplsTunnelPerfTable

-- CR-LDP Tunnel Resource Table

mplsTunnelCRLDResTable OBJECT-TYPE

SYNTAX SEQUENCE OF MplsTunnelCRLDResEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The mplsTunnelCRLDResTable 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 }

mplsTunnelCRLDResEntry OBJECT-TYPE

SYNTAX MplsTunnelCRLDResEntry

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

```
    signaling protocol."
INDEX { mplsTunnelResourceIndex }
::= { mplsTunnelCRLDPResTable 1 }
```

```
MplsTunnelCRLDPResEntry ::= SEQUENCE {  
    mplsTunnelCRLDPResMeanBurstSize  MplsBurstSize,  
    mplsTunnelCRLDPResExcessBurstSize MplsBurstSize,  
    mplsTunnelCRLDPResFrequency       Integer32,  
    mplsTunnelCRLDPResWeight          Unsigned32,  
    mplsTunnelCRLDPResFlags           Unsigned32,  
    mplsTunnelCRLDPResRowStatus       RowStatus,  
    mplsTunnelCRLDPResStorageType     StorageType  
}
```

mplsTunnelCRLDPResMeanBurstSize OBJECT-TYPE

```
SYNTAX      MplsBurstSize  
UNITS       "bytes"  
MAX-ACCESS  read-create  
STATUS      current  
DESCRIPTION  
    "The mean burst size in bytes."  
::= { mplsTunnelCRLDPResEntry 2 }
```

mplsTunnelCRLDPResExcessBurstSize OBJECT-TYPE

```
SYNTAX      MplsBurstSize  
UNITS       "bytes"  
MAX-ACCESS  read-create  
STATUS      current  
DESCRIPTION  
    "The Excess burst size in bytes."  
REFERENCE  
    "CR-LDP Specification, Section 4.3."  
::= { mplsTunnelCRLDPResEntry 3 }
```

mplsTunnelCRLDPResFrequency OBJECT-TYPE

```
SYNTAX  INTEGER {  
    unspecified(1),  
    frequent(2),  
    veryFrequent(3)  
}  
MAX-ACCESS  read-create  
STATUS      current  
DESCRIPTION  
    "The granularity of the availability of committed  
    rate."  
REFERENCE  
    "CR-LDP Specification, Section 4.3."  
::= { mplsTunnelCRLDPResEntry 4 }
```

mplsTunnelCRLDPResWeight OBJECT-TYPE

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

DESCRIPTION

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

REFERENCE

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

DEFVAL { 0 }

::= { mplsTunnelCRLDPResEntry 5 }

mplsTunnelCRLDPResFlags OBJECT-TYPE

SYNTAX Unsigned32 (0..63)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

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

Res - These bits are reserved. Zero on transmission.
Ignored on receipt.

F1 - Corresponds to the PDR.

F2 - Corresponds to the PBS.

F3 - Corresponds to the CDR.

F4 - Corresponds to the CBS.

F5 - Corresponds to the EBS.

F6 - Corresponds to the Weight.

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

REFERENCE

"1. [Section 4.3](#), Constraint-Based LSP Setup using LDP, Jamoussi (Editor), Internet Draft <[draft-ietf-mpls-crldp-06.txt](#)>, November 2001"

DEFVAL { 0 }

::= { mplsTunnelCRLDPResEntry 6 }

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."

Srinivasan et al.

Expires July 2002

[Page 46]

```
::= { mplsTunnelCRLDResEntry 7 }
```

```
mplsTunnelCRLDResStorageType OBJECT-TYPE
```

```
SYNTAX      StorageType
```

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

```
STATUS      current
```

```
DESCRIPTION
```

```
    "This variable indicates the storage type for this  
    object."
```

```
::= { mplsTunnelCRLDResEntry 8 }
```

```
-- Notifications.
```

```
mplsTunnelTrapEnable 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."
```

```
::= { mplsTeNotifyPrefix 1 }
```

```
mplsTunnelDown NOTIFICATION-TYPE
```

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

```
STATUS      current
```

DESCRIPTION

"This notification is generated when a
mplsTunnelOperStatus object for one of the

Srinivasan et al.

Expires July 2002

[Page 47]

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."

::= { mplsTeNotifyPrefix 2 }

mplsTunnelRerouted NOTIFICATION-TYPE

OBJECTS {
 mplsTunnelAdminStatus,
 mplsTunnelOperStatus
}

STATUS current

DESCRIPTION

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

::= { mplsTeNotifyPrefix 3 }

mplsTunnelReoptimized NOTIFICATION-TYPE

OBJECTS {
 mplsTunnelAdminStatus,
 mplsTunnelOperStatus
}

STATUS current

DESCRIPTION

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

::= { mplsTeNotifyPrefix 4 }

-- End of notifications.

-- Module compliance.

mplsTeGroups

OBJECT IDENTIFIER ::= { mplsTeConformance 1 }

mplsTeCompliances

OBJECT IDENTIFIER ::= { mplsTeConformance 2 }

mplsTeModuleCompliance MODULE-COMPLIANCE

STATUS current

DESCRIPTION

"Compliance statement for agents that support the
MPLS TE MIB."

Srinivasan et al.

Expires July 2002

[Page 48]

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, in addition to mplsTunnelGroup. The following constraints apply: mplsTunnelSignallingProto should be at least read-only with a value of none(1)."

GROUP mplsTunnelSignaledGroup

DESCRIPTION

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

GROUP mplsTunnelIsNotIntfcGroup

DESCRIPTION

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

GROUP mplsTunnelIsIntfcGroup

DESCRIPTION

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

GROUP mplsTunnelOptionalGroup

DESCRIPTION

"Objects in this group are optional."

-- mplsTunnelTable

Srinivasan et al.

Expires July 2002

[Page 49]

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 mplsTunnelOwner
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

Srinivasan et al.

Expires July 2002

[Page 50]

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

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

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

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

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

OBJECT mplsTunnelStateTransitions
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

Srinivasan et al.

Expires July 2002

[Page 51]

OBJECT mplsTunnelARHopTableIndex
DESCRIPTION

 "Write access is not required."

OBJECT mplsTunnelCHopTableIndex
DESCRIPTION

 "Write access is not required."

OBJECT mplsTunnelAdminStatus
SYNTAX INTEGER { up (1), down (2) }
MIN-ACCESS read-only
DESCRIPTION

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

OBJECT mplsTunnelOperStatus
SYNTAX INTEGER { up (1), down (2) }
DESCRIPTION

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

OBJECT mplsTunnelRowStatus
SYNTAX INTEGER {
 active(1),
 notInService(2),
 createAndGo(4),
 destroy(6)
 }
MIN-ACCESS read-only
DESCRIPTION

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

OBJECT mplsTunnelStorageType
SYNTAX INTEGER { other(1) }
MIN-ACCESS read-only
DESCRIPTION

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

OBJECT mplsTunnelPathInUse
MIN-ACCESS read-only
DESCRIPTION

 "Read-only support is required."

OBJECT mplsTunnelRole
SYNTAX INTEGER { head(1) }
MIN-ACCESS read-only
DESCRIPTION

"Only support for head is required."

Srinivasan et al.

Expires July 2002

[Page 52]

```
OBJECT      mplsTunnelTotalUpTime
MIN-ACCESS  read-only
DESCRIPTION
    "Read-only support is required."

OBJECT      mplsTunnelInstanceUpTime
MIN-ACCESS  read-only
DESCRIPTION
    "Read-only support is required."

-- mplsTunnelHopTable

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

OBJECT      mplsTunnelHopIpv4Addr
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

OBJECT      mplsTunnelHopIpv4PrefixLen
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

OBJECT      mplsTunnelHopIpv6Addr
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

OBJECT      mplsTunnelHopIpv6PrefixLen
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 mplsTunnelHopIncludeExclude

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelHopPathOptionName

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelHopEntryPathComp

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelHopRowStatus

SYNTAX INTEGER {

 active(1),

 notInService(2),

 createAndGo(4),

 destroy(6)

}

MIN-ACCESS read-only

DESCRIPTION

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

OBJECT mplsTunnelHopStorageType

SYNTAX INTEGER { other(1) }

MIN-ACCESS read-only

DESCRIPTION

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

-- mplsTunnelResourceTable

OBJECT mplsTunnelResourceMaxRate

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelResourceMeanRate

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelResourceMaxBurstSize

Srinivasan et al.

Expires July 2002

[Page 54]

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelResourceMeanBurstSize

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelResourceExcessBurstSize

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelResourceFrequency

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelResourceWeight

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelResourceRowStatus

SYNTAX INTEGER {

active(1),

notInService(2),

createAndGo(4),

destroy(6)

}

MIN-ACCESS read-only

DESCRIPTION

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

OBJECT mplsTunnelResourceStorageType

SYNTAX INTEGER { other(1) }

MIN-ACCESS read-only

DESCRIPTION

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

-- mplsTunnelPerfTable

OBJECT mplsTunnelPerfPackets

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT mplsTunnelPerfHCPackets

Srinivasan et al.

Expires July 2002

[Page 55]

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

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

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

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

::= { mplsTeCompliances 1 }

-- Units of conformance.

mplsTunnelGroup OBJECT-GROUP

OBJECTS {
 mplsTunnelIndexNext,
 mplsTunnelName,
 mplsTunnelDescr,
 mplsTunnelOwner,
 mplsTunnelXCPointer,
 mplsTunnelIfIndex,
 mplsTunnelHopTableIndex,
 mplsTunnelARHopTableIndex,
 mplsTunnelCHopTableIndex,
 mplsTunnelAdminStatus,
 mplsTunnelOperStatus,
 mplsTunnelRowStatus,
 mplsTunnelTrapEnable,
 mplsTunnelStorageType,
 mplsTunnelConfigured,
 mplsTunnelActive,
 mplsTunnelPrimaryInstance,
 mplsTunnelPrimaryTimeUp,
 mplsTunnelPathChanges,
 mplsTunnelLastPathChange,
 mplsTunnelCreationTime,
 mplsTunnelStateTransitions,

```
mplsTunnelIncludeAnyAffinity,  
mplsTunnelIncludeAllAffinity,
```

```
mplsTunnelExcludeAllAffinity,  
mplsTunnelPerfPackets,  
mplsTunnelPerfHCPackets,  
mplsTunnelPerfErrors,  
mplsTunnelPerfBytes,  
mplsTunnelPerfHCBytes,  
mplsTunnelResourcePointer,  
mplsTunnelInstancePriority,  
mplsTunnelPathInUse,  
mplsTunnelRole,  
mplsTunnelTotalUpTime,  
mplsTunnelInstanceUpTime
```

```
}
```

```
STATUS current
```

```
DESCRIPTION
```

```
"Necessary, but not sufficient, set of objects to  
implement tunnels. In addition, depending on the  
type of the tunnels supported (for example,  
manually configured or signaled, persistent or non-  
persistent, etc.), the following other groups  
defined below are mandatory: mplsTunnelManualGroup  
and/or mplsTunnelSignaledGroup,  
mplsTunnelIsNotIntfcGroup and/or  
mplsTunnelIsIntfcGroup."
```

```
::= { mplsTeGroups 1 }
```

```
mplsTunnelManualGroup OBJECT-GROUP
```

```
OBJECTS { mplsTunnelSignallingProto }
```

```
STATUS current
```

```
DESCRIPTION
```

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

```
::= { mplsTeGroups 2 }
```

```
mplsTunnelSignaledGroup OBJECT-GROUP
```

```
OBJECTS {
```

```
mplsTunnelSetupPrio,  
mplsTunnelHoldingPrio,  
mplsTunnelSignallingProto,  
mplsTunnelLocalProtectInUse,  
mplsTunnelSessionAttributes,  
mplsTunnelHopListIndexNext,  
mplsTunnelHopAddrType,  
mplsTunnelHopIpv4Addr,  
mplsTunnelHopIpv4PrefixLen,  
mplsTunnelHopIpv6Addr,  
mplsTunnelHopIpv6PrefixLen,
```

mplsTunnelHopAsNumber,
mplsTunnelHopLspId,
mplsTunnelHopType,

```
    mplsTunnelHopIncludeExclude,
    mplsTunnelHopPathOptionName,
    mplsTunnelHopEntryPathComp,
    mplsTunnelHopRowStatus,
    mplsTunnelHopStorageType
}
STATUS current
DESCRIPTION
    "Object needed to implement signaled tunnels."
 ::= { mplsTeGroups 3 }
```

```
mplsTunnelScalarGroup OBJECT-GROUP
OBJECTS {
    mplsTunnelConfigured,
    mplsTunnelActive,
    mplsTunnelTEDistProto,
    mplsTunnelMaxHops
}
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 }
```

```
mplsTunnelOptionalGroup OBJECT-GROUP
OBJECTS {
    mplsTunnelResourceIndexNext,
    mplsTunnelResourceMaxRate,
    mplsTunnelResourceMeanRate,
    mplsTunnelResourceMaxBurstSize,
    mplsTunnelResourceMeanBurstSize,
    mplsTunnelResourceExcessBurstSize,
```

mplsTunnelResourceFrequency,
mplsTunnelResourceWeight,
mplsTunnelResourceRowStatus,

```
    mplsTunnelResourceStorageType,
    mplsTunnelARHopAddrType,
    mplsTunnelARHopIpv4Addr,
    mplsTunnelARHopIpv4PrefixLen,
    mplsTunnelARHopIpv6Addr,
    mplsTunnelARHopIpv6PrefixLen,
    mplsTunnelARHopAsNumber,
    mplsTunnelARHopLspId,
    mplsTunnelCHopAddrType,
    mplsTunnelCHopIpv4Addr,
    mplsTunnelCHopIpv4PrefixLen,
    mplsTunnelCHopIpv6Addr,
    mplsTunnelCHopIpv6PrefixLen,
    mplsTunnelCHopAsNumber,
    mplsTunnelCHopLspId,
    mplsTunnelCHopType
}
STATUS current
DESCRIPTION
    "The objects in this group are optional."
::= { mplsTeGroups 7 }
```

mplsTunnelCRLDPResOptionalGroup OBJECT-GROUP

```
OBJECTS {
    mplsTunnelCRLDPResMeanBurstSize,
    mplsTunnelCRLDPResExcessBurstSize,
    mplsTunnelCRLDPResFrequency,
    mplsTunnelCRLDPResWeight,
    mplsTunnelCRLDPResFlags,
    mplsTunnelCRLDPResRowStatus,
    mplsTunnelCRLDPResStorageType
}
STATUS current
DESCRIPTION
    "Set of objects implemented for resources applicable
    for tunnels signaled using CR-LDP."
::= { mplsTeGroups 8 }
```

mplsTeNotificationGroup NOTIFICATION-GROUP

```
NOTIFICATIONS {
    mplsTunnelUp,
    mplsTunnelDown,
    mplsTunnelRerouted,
    mplsTunnelReoptimized
}
STATUS current
DESCRIPTION
```

```
"Set of notifications implemented in this module.  
None is mandatory."  
::= { mplSTeGroups 9 }
```

END

11. Security Considerations

There are a number of management objects defined in this MIB that have 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.

It is thus important to control even GET access to these objects and possibly to even encrypt the values of these object when sending them over the network via SNMP. Not all versions of SNMP provide features for such a secure environment.

SNMPv1 by itself is not a secure environment. Even if the network itself is secure (for example by using IPSec [[RFC2401](#)]), 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. It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model [[RFC2574](#)] and the View-based Access Control [[RFC2575](#)] is recommended. It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

12. Acknowledgments

We wish to thank Adrian Farrel, Eric Gray, Joan Cucchiara, Patrick Kerharo, Paul Langille and Mike Piecuch for their comments on this draft.

13. References

[Assigned] Reynolds, J., and J. Postel, "Assigned Numbers", [RFC 1700](#), October 1994. See also:

[http://www.isi.edu/in-
notes/iana/assignments/smi-numbers](http://www.isi.edu/in-notes/iana/assignments/smi-numbers)

Srinivasan et al.

Expires July 2002

[Page 60]

- [TCMIB] Nadeau, T., Cucchiara, J., Srinivasan, C, Viswanathan, A. and H. Sjostrand, "Definition of Textual Conventions and OBJECT-IDENTITIES for Multi-Protocol Label Switching (MPLS) Management", Internet Draft <[draft-ietf-mpls-tc-mib-03.txt](#)>, January 2002.
- [LSRMIB] Srinivasan, C., Viswanathan, A. and T. Nadeau, "MPLS Label Switch Router Management Information Base ", Internet Draft <[draft-ietf-mpls-lsr-mib-08.txt](#)>, January 2002.
- [CRLDP] B. Jamoussi (Editor), "Constraint-Based LSP Setup using LDP", Internet Draft <[draft-ietf-mpls-cr-ldp-06.txt](#)>, November 2001.
- [RFC1155] Rose, M., and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based Internets", [RFC 1155](#), May 1990.
- [RFC1157] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "Simple Network Management Protocol", [RFC 1157](#), May 1990.
- [RFC1212] Rose, M., and K. McCloghrie, "Concise MIB Definitions", [RFC 1212](#), March 1991.
- [RFC1215] M. Rose, "A Convention for Defining Traps for use with the SNMP", [RFC 1215](#), March 1991.
- [RFC1901] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Introduction to Community-based SNMPv2", [RFC 1901](#), January 1996.
- [RFC1905] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2)", [RFC 1905](#), January 1996.
- [RFC1906] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)", [RFC 1906](#), January 1996.
- [RFC2026] S. Bradner, "The Internet Standards Process

-- Revision 3", [RFC 2026](#), October 1996.

Srinivasan et al.

Expires July 2002

[Page 61]

- [RFC2401] Kent, S., and Atkinson, R., "Security Architecture for the Internet Protocol", [RFC 2401](#), November 1998.
- [RFC2570] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction to Version 3 of the Internet-standard Network Management Framework", [RFC 2570](#), April 1999.
- [RFC2571] Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing SNMP Management Frameworks", [RFC 2571](#), April 1999.
- [RFC2572] Case, J., Harrington D., Presuhn R., and B. Wijnen, "Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)", [RFC 2572](#), April 1999.
- [RFC2573] Levi, D., Meyer, P., and B. Stewart, "SNMPv3 Applications", [RFC 2573](#), April 1999.
- [RFC2574] Blumenthal, U., and B. Wijnen, "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", [RFC 2574](#), April 1999.
- [RFC2575] Wijnen, B., Presuhn, R., and K. McCloghrie, "View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)", [RFC 2575](#), April 1999.
- [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.
- [RFC2851] Daniele, M., Haberman, B., Routhier, S., and

J. Schoenwaelder, "Textual Conventions for
Internet Network Addresses", [RFC 2851](#), June

Srinivasan et al.

Expires July 2002

[Page 62]

2000.

- [RFC2863] McCloghrie, K. and F. Kastenholtz, "The Interfaces Group MIB ", [RFC 2863](#), June 2000.
- [RFC3031] Rosen, E., Viswanathan, A., and R. Callon, "Multiprotocol Label Switching Architecture", [RFC 3031](#), January 2001.
- [RFC3209] 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.

14. Authors' Addresses

Cheenu Srinivasan
Parama Networks, Inc.
1030 Broad Street
Shrewsbury, NJ 07702
Phone: +1-732-544-9120 x731
Email: cheenu@paramanet.com

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

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

15. Full Copyright Statement

Copyright (C) The Internet Society (2001). 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.

