

Network Working Group
Internet Draft
Expires: July 2002

Thomas D. Nadeau
Cisco Systems, Inc.

Cheenu Srinivasan
Parama Networks, Inc.

Adrian Farrel
Movaz Networks, Inc.

Tim Hall
Edward Harrison
Data Connection Ltd.

January 2002

Generalized Multiprotocol Label Switching (GMPLS) Traffic Engineering Management Information Base

[draft-nadeau-ccamp-gmpls-te-mib-01.txt](#)

Status of this Memo

This document is an Internet-Draft and is in full conformance with all provisions of [Section 10 of RFC2026](#).

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 an experimental 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) [[RFC3031](#)] and Generalized Multiprotocol Label Switching (GMPLS) [[GMPLSArch](#)] based traffic engineering.

Table of Contents

1. Changes and Pending Work	2
1.1. Changes Since Last Version	2
1.2. Pending Work	3
2. Introduction	4
2.1. Migration Strategy	4
3. Terminology	5
4. The SNMP Management Framework	5
5. Feature List	6
6. Outline	7
6.1. Summary of GMPLS Traffic Engineering MIB	7
7. Brief Description of MIB Objects	8
7.1. gmplsTunnelTable	8
7.2. gmplsTunnelResourceTable	9
7.3. gmplsTunnelHopTable	9
7.3.1 Determining next entries in gmplsTunnelHopTable	9
7.4. gmplsTunnelARHopTable	9
7.5. gmplsTunnelCHopTable	10
7.6. gmplsTunnelPerfTable	10
7.7. gmplsTunnelErrorTable	10
8. Support of Interface Table for MPLS and GMPLS Tunnels	10
8.1. Support of the MPLS Tunnel Interface by ifTable	11
9. Example of MPLS Tunnel Setup	12
10. Example of GMPLS Tunnel Setup	14
11. The Use of RowPointer and Other Cross-References	16
11.1. RowPointer	16
11.2. Cross-referencing to the gmplsLabelTable	17
12. GMPLS Traffic Engineering MIB Definitions	17
13. Security Considerations	95
14. Acknowledgments	96
15. References	97
15.1. Normative References	97
15.2. Informational References	100
16. Authors' Addresses	101
17. Full Copyright Statement	102

[1. Changes and Pending Work](#)

This section to be removed before the draft progresses to RFC.

[1.1. Changes Since Last Version](#)

- Add AS Number and LSP Id to AR Hop Table.

Nadeau et al.

Expires July 2002

[Page 2]

- Changes for compilation.
- Last error {MIB code, timestamp, protocol codes} added as new table.
- Add gmplsTunnelInstanceNextTable.
- Apply bug fixes in line with updates to [[TCMIB](#)].
- Update examples and provide more detail.

1.2. Pending Work

The following work items have been identified for this draft. They will be addressed in a future version.

- Clarify which objects can be modified when rowStatus and adminStatus are set to active
- Expand conformance statements to give one for monitoring only, and one for monitoring and control.
- Bring references up to date, include all drafts referenced from this document, and exclude those that are not referenced.
- Provide objects or tables to support getNextIndex for all arbitrary indexes.
- Consider a way to expose tunnel head, tunnel tail, and tunnel transit entries through distinct indexing or tables.
- Provide support for configuring tunnel resources in GMPLS systems. For example, SONET/SDH or G.709. This might be done through an arbitrary RowPointer to an external MIB.
- Link Ids in EROs and RROs for use of bundled links.
- Crankback request and reported information.
- Control and reporting of upstream and downstream Notify Recipients.
- Add support for control and reporting of GMPLS Administrative Status object.

- Update enumerated types in line with latest GMPLS drafts.
- Resolve ownership of enumerated types that are also defined in GMPLS or routing drafts. (See "Ed Note:" in text.) These could be owned by IANA, imported from another MIB, or manually kept in step here. If they are not maintained externally then they are likely to diverge and MIB implementations will need to provide mappings.

2. Introduction

This memo defines an experimental 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) [[RFC3031](#)] and Generalized Multiprotocol Label Switching (GMPLS) [[GMPLSArch](#)] based traffic engineering.

Comments should be made directly to the CCAMP mailing list at ccamp@ops.ietf.org.

This memo does not, in its draft form, specify a standard for the Internet community.

2.1. Migration Strategy

This MIB is built upon the traffic engineering MIB defined for use with MPLS [[TEMIB](#)]. The only changes made are additions for support of GMPLS or changes that are necessary to support the increased complexity of a GMPLS system.

In all cases, these changes have been made such that migration from [[TEMIB](#)] to this MIB will be as simple as possible.

Note that this MIB may be used in systems that support MPLS, GMPLS or both.

This MIB may be seen as a replacement for the MPLS TE MIB [[TEMIB](#)] in systems which support GMPLS, but it is not a requirement that it replace the MPLS TE MIB in systems that only support MPLS.

The companion document modeling and managing GMPLS based

Nadeau et al.

Expires July 2002

[Page 4]

LSRs [[GMPLSLSRMIB](#)] is based on the MPLS LSR MIB [[LSRMIB](#)] with the same intentions. It is not expected that a system would mix MPLS and GMPLS MIBs.

Textual conventions and OBJECT-IDENTIFIERS are defined in [[GMPLSTCMIB](#)] which extends the set of textual conventions defined in [[TCMIB](#)].

See [section 11.1](#) for a description of how the gmplsLabelTable may be omitted in systems that support MPLS only.

3. Terminology

This document uses terminology from the MPLS architecture document [[RFC3031](#)] and GMPLS Label Switching Router MIB [[GMPLSLSRMIB](#)]. It imports constructs from the GMPLS textual conventions MIB [[GMPLSTCMIB](#)] and from the MPLS textual conventions MIB [[TCMIB](#)]. Some frequently used terms are described next.

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

Additionally, at an intermediate LSR, we model a connection as consisting of one or more in-segments and/or one or more out-segments. The binding or interconnection between in-segments and out-segments is performed using a cross-connect. These objects are defined in the GMPLS Label Switching Router MIB [[GMPLSLSRMIB](#)].

4. 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 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.

[5. Feature List](#)

Nadeau et al.

Expires July 2002

[Page 6]

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

- The MIB supports MPLS and GMPLS tunnels.
- The MIB supports configuration of point-to-point unidirectional and bidirectional tunnels.
- Tunnels need not be interfaces, but it is possible to configure a tunnel as an interface.
- The MIB supports manually configured tunnels as well as those set up via an MPLS or GMPLS signaling protocol.
- The MIB supports persistent as well as non-persistent tunnels.

6. Outline

Support for MPLS or GMPLS traffic-engineered tunnels requires the following configuration.

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

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

6.1. Summary of GMPLS Traffic Engineering MIB

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

- Tunnel Table (gmplsTunnelTable) for setting up MPLS or GMPLS tunnels.
- Resource table (gmplsTunnelResourceTable) for setting

up the tunnel resources.

- Tunnel specified, actual, and computed hop tables (gmplsTunnelHopTable, gmplsTunnelARHopTable, and gmplsTunnelCHopTable) for strict and loose source routed tunnel hops.
- CRLDP resource table (gmplsTunnelCRLDPResTable) for specifying resource objects applicable only to tunnels signaled using CRLDP.
- Performance and error reporting tables (gmplsTunnelPerfTable and gmplsTunnelErrorTable).

These tables are described in the subsequent sections.

7. Brief Description of MIB Objects

The objects described in this section support the functionality described in documents [[RSVPTE](#)] and [[CRLDP](#)] for MPLS tunnels and the functionality described in [[GMPLSRSVPTTE](#)] and [[GMPLSCRLDP](#)] for GMPLS tunnels.

The tables support both manually configured and signaled tunnels.

7.1. gmplsTunnelTable

The gmplsTunnelTable allows new MPLS and GMPLS tunnels to be created between an 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 tunnel can thus have one out-segment originating at an LSR and/or one in-segment terminating at that LSR.

gmplsTunnelTable 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 gmplsTunnelTable using a cross-connect index, gmplsTunnelXCIndex.

These segment and cross-connect related objects are defined in [[GMPLSLSRMIB](#)].

The `gmplsTunnelTable` is indexed by two arbitrary indexes

(and some other indexes). The next available value for the primary index (`gmplsTunnelIndex`) can be found by reading the `gmplsNextIndex` object. For any specific set of values of the primary indexes (`gmplsTunnelIndex`, `gmplsTunnelIngressLSRId` and `gmplsTunnelEgressLSRId`) the next value of the secondary index (`gmplsTunnelInstance`) can be found by reading the `gmplsTunnelInstanceNextTable` entry with the same primary indexes.

7.2. gmplsTunnelResourceTable

The `gmplsTunnelResourceTable` 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.

7.3. gmplsTunnelHopTable

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

7.3.1 Determining next entries in gmplsTunnelHopTable

Two tables (`gmplsTunnelHopPathOptionIndexNextTable` and `gmplsTunnelHopIndexNextTable`) can be used in association with a scalar (`gmplsTunnelHopListIndexNext`) to determine the next available indexing values in the `gmplsTunnelHopTable`.

7.4. gmplsTunnelARHopTable

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

7.5. gmplsTunnelCHopTable

The gmplsTunnelCHopTable lists the actual hops computed by a constraint-based routing algorithm based on the gmplsTunnelHopTable.

The support of this table is optional since not all implementations support computation of hop list using a constraint-based routing protocol.

7.6. gmplsTunnelPerfTable

gmplsTunnelPerfTable provides several counters to measure the performance of the MPLS and GMPLS tunnels. This table augments gmplsTunnelTable.

Note that not all counters may be appropriate or available for some types of tunnel.

7.7. gmplsTunnelErrorTable

The gmplsTunnelErrorTable provides access to information about the last error that occurred on each tunnel known about by the MIB. It indicates the nature of the error, when and how it was reported and can give recovery advice through a display string. gmplsTunnelCRLDResTable

The gmplsTunnelCRLDResTable contains additional resource information for those tunnels that are signaled using CRLDP [[CRLDP](#)]. This is a sparse extension to mplsTunnelResourceTable and is also indexed by gmplsTunnelResourceIndex. As with gmplsTunnelResourceTable, 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.

8. Support of Interface Table for MPLS and GMPLS Tunnels

This memo contains media-specific extensions to the Interfaces Group for managing MPLS and GMPLS Tunnels as logical interfaces and 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 (from this perspective, MPLS and GMPLS should be considered to operate at the MPLS interface).

The interrelation of entries in the ifTable is defined by the Interfaces Stack Group defined in [[RFC2863](#)].

MPLS and GMPLS tunnels may themselves be used as interfaces. When using 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.

8.1. Support of the MPLS Tunnel Interface by ifTable

Some specific interpretations of ifTable for those MPLS tunnels represented as interfaces follow:

Object	Use for the MPLS tunnel
ifIndex	Each MPLS tunnel is represented by an ifEntry.
ifDescr	Description of the MPLS tunnel..
ifType	The value that is allocated for MPLS tunnel is 150.
ifSpeed	The total bandwidth in bits per second for use by the MPLS tunnel.
ifAdminStatus	See [RFC2863].
ifOperStatus	Assumes the value down(2) if the MPLS tunnel is down.

ifLastChange See [[RFC2863](#)].

Nadeau et al.

Expires July 2002

[Page 11]

ifInOctets	The number of octets received over the MPLS tunnel.
ifOutOctets	The number of octets transmitted over the MPLS tunnel.
ifInErrors	The number of labeled packets dropped due to uncorrectable errors.
ifInUnknownProtos	The number of received packets discarded during packet header validation, including packets with unrecognized label values.
ifOutErrors	See [RFC2863].
ifName	Textual name (unique on this system) of the MPLS tunnel or an octet string of zero length.
ifLinkUpDownTrapEnable	Default is disabled (2).
ifConnectorPresent	Set to false (2).
ifHighSpeed	See [RFC2863].
ifHCInOctets	The 64-bit version of ifInOctets; supported if required by the compliance statements in [RFC2863].
ifHCOctets	The 64-bit version of ifOutOctets; supported if required by the compliance statements in [RFC2863].
ifAlias	The non-volatile 'alias' name for the MPLS tunnel as specified by a network manager.

9. Example of MPLS Tunnel Setup

This section contains an example of which MIB objects should be modified 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.

This example is for an MPLS tunnel. It does not use any features of GMPLS.

In gmplsTunnelTable:

```
{
  gmplsTunnelIndex = 1,
  gmplsTunnelInstance = 1,
  gmplsTunnelIngressLSRId = 123.123.125.1,
  gmplsTunnelEgressLSRId = 123.123.126.1,
  gmplsTunnelName = "Tunnel to Bagend",
  gmplsTunnelDescr = "There and back again",
  gmplsTunnelIsIf = true (1),
  gmplsTunnelXCPointer = mplsXCIndex.2.0.0.15,
  gmplsTunnelSignallingProto = none (1),
  gmplsTunnelSetupPrio = 0,
  gmplsTunnelHoldingPrio = 0,
  gmplsTunnelAttributes = 0,
  gmplsTunnelOwner = snmp (2),
  gmplsTunnelLocalProtectInUse = false (0),
  gmplsTunnelResourcePointer
    = mplsTunnelResourceIndex.5,
  gmplsTunnelInstancePriority = 1,
  gmplsTunnelHopTableIndex = 1,
  gmplsTunnelPrimaryInstance = 0,
  gmplsTunnelIncludeAnyAffinity = 0,
  gmplsTunnelIncludeAllAffinity = 0,
  gmplsTunnelExcludeAnyAffinity = 0,
  gmplsTunnelPathInUse = 1,
  gmplsTunnelRole = head (1),
  gmplsTunnelRowStatus = createAndGo (4)
}
```

In gmplsTunnelResourceTable:

```
{
  gmplsTunnelResourceIndex = 5,
  gmplsTunnelResourceMaxRate = 0,
  gmplsTunnelResourceMeanRate = 0,
  gmplsTunnelResourceMaxBurstSize = 0,
  gmplsTunnelResourceRowStatus = createAndGo (4)
}
```

The next two instances of gmplsTunnelHopEntry 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 gmplsTunnelHopTable:
{
  gmplsTunnelHopListIndex = 1,
  gmplsTunnelPathOptionIndex = 1,

  gmplsTunnelHopIndex = 1,
  gmplsTunnelHopAddrType = 1,
  gmplsTunnelHopIpv4Addr = 123.123.125.1,
  gmplsTunnelHopIpv4PrefixLen = 9,
  gmplsTunnelHopType = loose (2),
  gmplsTunnelHopRowStatus = 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 gmplsTunnelHopTable:
{
  gmplsTunnelHopListIndex = 1,
  gmplsTunnelPathOptionIndex = 1,
  gmplsTunnelHopIndex = 2,
  gmplsTunnelHopAddrType = 1,
  gmplsTunnelHopIpv4Addr = 123.123.126.1,
  gmplsTunnelHopIpv4PrefixLen = 9,
  gmplsTunnelHopType = loose (2),
  gmplsTunnelHopRowStatus = createAndGo (4)
}
```

10. Example of GMPLS Tunnel Setup

This section contains an example of which MIB objects should be modified to create a GMPLS tunnel. This example shows a best effort, loosely routed, bidirectional traffic engineered tunnel, which spans two hops of a simple network, uses Generalized Label requests with Lambda encoding, has label recording and shared link layer protection. Note that these objects should be created on the "head-end" LSR.

```
In gmplsTunnelTable:
{
  gmplsTunnelIndex = 1,
  gmplsTunnelInstance = 1,
  gmplsTunnelIngressLSRId = 123.123.125.1,
  gmplsTunnelEgressLSRId = 123.123.126.1,
  gmplsTunnelName = "A tunnel in the ground",
```

```
gmplsTunnelDescr = "There and back again",  
gmplsTunnelIsIf = true (1),
```

```
gmplsTunnelXCPointer = gmplsXCIndex.3.0.0.12,
gmplsTunnelSignallingProto = none (1),
gmplsTunnelSetupPrio = 0,
gmplsTunnelHoldingPrio = 0,
gmplsTunnelAttributes = labelRecordingRequired (1),
gmplsTunnelOwner = snmp (2),
gmplsTunnelLocalProtectInUse = false (0),
gmplsTunnelResourcePointer =
    gmplsTunnelResourceIndex.6,
gmplsTunnelInstancePriority = 1,
gmplsTunnelHopTableIndex = 1,

gmplsTunnelPrimaryInstance = 0,
gmplsTunnelIncludeAnyAffinity = 0,
gmplsTunnelIncludeAllAffinity = 0,
gmplsTunnelExcludeAnyAffinity = 0,
gmplsTunnelPathInUse = 1,
gmplsTunnelRole = head(1),
gmplsTunnelRowStatus = createAndGo (4),
gmplsTunnelLSPEncoding = tunnelLspLambda (8),
gmplsTunnelSwitchingType = lsc (150),
gmplsTunnelLinkProtection = shared (2),
gmplsTunnelGPid = lambda (37),
gmplsTunnelDirection = bidirectional (1)
}
```

Entries in the gmplsTunnelResourceTable and gmplsTunnelHopTable are created and activated at this time.

In gmplsTunnelResourceTable:

```
{
    gmplsTunnelResourceIndex = 6,
    gmplsTunnelResourceMaxRate = 0,
    gmplsTunnelResourceMeanRate = 0,
    gmplsTunnelResourceMaxBurstSize = 0,
    gmplsTunnelResourceRowStatus = createAndGo (4)
}
```

The next two instances of gmplsTunnelHopEntry 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. This hop explicitly specifies the labels that will be used for the out segment on the forward path and the in segment on

the reverse path.

In `gmplsTunnelHopTable`:

```
{
  gmplsTunnelHopListIndex = 1,
  gmplsTunnelPathOptionIndex = 1,
  gmplsTunnelHopIndex = 1,
  gmplsTunnelHopAddrType = 1,
  gmplsTunnelHopIpv4Addr = 123.123.125.1,
  gmplsTunnelHopIpv4PrefixLen = 9,
  gmplsTunnelHopType = strict (1),
  gmplsTunnelHopRowStatus = createAndGo (4),
  gmplsTunnelHopLabelStatuses =
    forwardPresent(0)+reversePresent(1),
  gmplsTunnelHopExplicitLabel = gmplsLabelIndex.2756132,
  gmplsTunnelHopExplicitReverseLabel =
    gmplsLabelIndex.65236213
}
```

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 gmplsTunnelHopTable:

```
{
  gmplsTunnelHopListIndex = 1,

  gmplsTunnelPathOptionIndex = 1,
  gmplsTunnelHopIndex = 2,
  gmplsTunnelHopAddrType = 1,
  gmplsTunnelHopIpv4Addr = 123.123.126.1,
  gmplsTunnelHopIpv4PrefixLen = 9,
  gmplsTunnelHopType = loose (2),
  gmplsTunnelHopRowStatus = createAndGo (4),
  gmplsTunnelHopLabelStatuses = 0
}
```

11. The Use of RowPointer and Other Cross-References

11.1. 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 gmplsTunnelTable, the objects gmplsTunnelXCPointer and gmplsTunnelResourcePointer are of type RowPointer. The object gmplsTunnelXCPointer points to a specific entry in the gmplsXCTable [[GMPLSLSRMIB](#)]. This entry in the gmplsXCTable is the associated LSP for the given tunnel entry. The object

gmplsTunnelResourcePointer points to a specific entry in a traffic parameter table. An example of such a traffic

parameter table is gmplsTunnelResourceTable. It indicates a specific instance of a traffic parameter entry that is associated with a given tunnel entry.

11.2. Cross-referencing to the gmplsLabelTable

The gmplsLabelTable [GMPLSLABELMIB] provides a way to model labels in a GMPLS system where labels might not be simple 32 bit integers.

The hop tables in this document (gmplsHopTable, gmplsCHopTable and gmplsARHopTable) use arbitrary indexes to point to entries in the gmplsLabelTable to indicate specific label values.

Since the primary index into gmplsLabelTable is a simple 32 bit integer (gmplsLabelIndex), in systems where the nature of a label is well-known, and where the label can safely be encoded as a 32 bit integer (for example a conventional MPLS system), the gmplsLabelTable does not need to be supported and the pointers to the gmplsLabelTable (gmplsTunnelHopExplicitLabel, gmplsTunnelHopExplicitReverseLabel, gmplsTunnelCHopExplicitLabel, gmplsTunnelCHopExplicitReverseLabel, gmplsTunnelARHopExplicitLabel, gmplsTunnelARHopExplicitReverseLabel) may be replaced with the direct label values.

This provides both a good way to support legacy systems that implement the previous version of this MIB [[TEMIB](#)], and a significant simplification in GMPLS systems that are limited to a single, simple label type.

Note that gmplsLabelTable supports concatenated labels through the use of a sub-label index (gmplsSublabelIndex).

12. GMPLS Traffic Engineering MIB Definitions

```
GMPLS-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

Nadeau et al.

Expires July 2002

[Page 17]

```
FROM SNMPv2-CONF
TruthValue, RowStatus, RowPointer, StorageType,
DisplayString, TimeStamp
FROM SNMPv2-TC
InterfaceIndexOrZero
FROM IF-MIB
MplsBitRate, MplsBurstSize, MplsInitialCreationSource,
MplsLSPID, MplsTunnelIndex, MplsTunnelInstanceIndex,
MplsTunnelAffinity, MplsLsrIdentifier, MplsPathIndex,
MplsPathIndexOrZero
FROM MPLS-TC-MIB
gmplsMIB, GmplsHopAddrType, GmplsTrapEnable
FROM GMPLS-TC-MIB
InetAddressIPv4, InetAddressIPv6
FROM INET-ADDRESS-MIB
;
```

gmplsTeMIB MODULE-IDENTITY

LAST-UPDATED

"200201251200Z" -- 25 January 2002 12:00:00 GMT ""

ORGANIZATION

"Common Control And Management Protocols (CCAMP)
Working Group"

CONTACT-INFO

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

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

Adrian Farrel
Postal: Movaz Networks, Inc.
7926 Jones Branch Drive
McLean, VA 22102
Tel: +1-703-847-1986
Email: afarrel@movaz.com

Edward Harrison
Postal: Data Connection Ltd.

100 Church Street
Enfield, Middlesex
EN2 6BQ, United Kingdom

Nadeau et al.

Expires July 2002

[Page 18]

Tel: +44-20-8366-1177
Email: eph@dataconnection.com

Tim Hall
Postal: Data Connection Ltd.
100 Church Street
Enfield, Middlesex
EN2 6BQ, United Kingdom
Tel: +44-20-8366-1177
Email: timhall@dataconnection.com

Email comments to the CCAMP WG Mailing List
at ccamp@ops.ietf.org."

DESCRIPTION

"This MIB module contains managed object
definitions for MPLS and GMPLS Traffic
Engineering (TE)."

-- Revision history.

REVISION

"200111111100Z" -- 11 Nov 2001 11:00:00 GMT

DESCRIPTION

"First revision draft version."

REVISION

"200201251200Z" -- 25 Jan 2002 12:00:00 GMT

DESCRIPTION

"Revision for compilation and work in
progress."

::= { gmplsMIB 4 }

-- Top level components of this MIB.

-- tables, scalars

gmplsTeScalars OBJECT IDENTIFIER

::= { gmplsTeMIB 1 }

gmplsTeObjects OBJECT IDENTIFIER

::= { gmplsTeMIB 2 }

-- traps

gmplsTeNotifications OBJECT IDENTIFIER

::= { gmplsTeMIB 3 }

gmplsTeNotifyPrefix OBJECT IDENTIFIER

::= { gmplsTeNotifications 0 }

-- conformance

gmplsTeConformance OBJECT IDENTIFIER

::= { gmplsTeMIB 4 }

-- GMPLS Tunnel scalars.

Nadeau et al.

Expires July 2002

[Page 19]

gmplsTunnelsConfigured 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 gmplsTunnelRowStatus is active(1)."

::= { gmplsTeScalars 1 }

gmplsTunnelActive 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 gmplsTunnelOperStatus is up(1)."

::= { gmplsTeScalars 2 }

gmplsTunnelTEDistProto 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."

::= { gmplsTeScalars 3 }

gmplsTunnelMaxHops 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."

::= { gmplsTeScalars 4 }

-- End of GMPLS Tunnel scalars.

-- GMPLS tunnel next index.

gmplsTunnelIndexNext OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains the next appropriate value to be used for mplsTunnelIndex when creating entries in gmplsTunnelTable. 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 gmplsTunnelTable 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."

::= { gmplsTeObjects 1 }

-- End GMPLS tunnel next index.

-- Begin gmplsTunnelInstanceNextTable

gmplsTunnelInstanceNextTable OBJECT-TYPE

SYNTAX SEQUENCE OF GmplsTunnelInstanceNextEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains the next available values of gmplsTunnelInstance for all values of gmplsTunnelIndex for a given pair of gmplsTunnelIngressLSRId and gmplsTunnelEgressLSRId."

::= { gmplsTeObjects 2 }

gmplsTunnelInstanceNextEntry OBJECT-TYPE

SYNTAX GmplsTunnelInstanceNextEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents the next available gmpIsTunnelInstance for a

specific value of gmplsTunnelIndex for a given pair of gmplsTunnelIngressLSRId and gmplsTunnelEgressLSRId.
This MIB table is indexed by gmplsTunnelHopListIndex, gmplsTunnelIngressLSRId and gmplsTunnelEgressLSRId."

```
INDEX {
    gmplsTunnelIndex,
    gmplsTunnelIngressLSRId,
    gmplsTunnelEgressLSRId
}
 ::= { gmplsTunnelInstanceNextTable 1 }
```

GmplsTunnelInstanceNextEntry ::= SEQUENCE {
 gmplsTunnelInstanceNextInstance MplsTunnelInstanceIndex
}

gmplsTunnelInstanceNextInstance OBJECT-TYPE
SYNTAX MplsTunnelInstanceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The next available gmplsTunnelInstance for
 the given values of gmplsTunnelIndex,
 gmplsTunnelIngressLSRId and
 gmplsTunnelEgressLSRId. A value of zero
 means that no further entries are
 available."
 ::= { gmplsTunnelInstanceNextEntry 1 }

-- End of gmplsTunnelInstanceNextTable

-- GMPLS tunnel table.

gmplsTunnelTable OBJECT-TYPE
SYNTAX SEQUENCE OF GmplsTunnelEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The gmplsTunnelTable allows new MPLS and
 GMPLS 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 tunnel can thus

have one out-segment originating at this LSR and/or one in-segment terminating at this LSR."

::= { gmplsTeObjects 3 }

gmplsTunnelEntry OBJECT-TYPE

SYNTAX GmplsTunnelEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents an MPLS or GMPLS tunnel.

An entry can be created by a network administrator or by an SNMP agent as instructed by a signaling protocol. Whenever a new entry is created with gmplsTunnelIsIf set to numbered(1) or unnumbered(2), 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 {

gmplsTunnelIndex,
gmplsTunnelInstance,
gmplsTunnelIngressLSRId,
gmplsTunnelEgressLSRId

}

::= { gmplsTunnelTable 1 }

GmplsTunnelEntry ::= SEQUENCE {

gmplsTunnelIndex	MplsTunnelIndex,
gmplsTunnelInstance	MplsTunnelInstanceIndex,
gmplsTunnelIngressLSRId	MplsLsrIdentifier,
gmplsTunnelEgressLSRId	MplsLsrIdentifier,
gmplsTunnelName	DisplayString,
gmplsTunnelDescr	DisplayString,
gmplsTunnelIsIf	INTEGER,
gmplsTunnelIfIndex	InterfaceIndexOrZero,
gmplsTunnelXCPointer	RowPointer,
gmplsTunnelSignallingProto	

	INTEGER,
gmpIsTunnelSetupPrio	Integer32,
gmpIsTunnelHoldingPrio	Integer32,

```
gmplsTunnelAttributes      BITS,
gmplsTunnelOwner           MplsInitialCreationSource,
gmplsTunnelLocalProtectInUse
                           TruthValue,
gmplsTunnelResourcePointer
                           RowPointer,
gmplsTunnelInstancePriority
                           Unsigned32,
gmplsTunnelHopTableIndex
                           MplsPathIndexOrZero,
gmplsTunnelARHopTableIndex
                           MplsPathIndexOrZero,
gmplsTunnelCHopTableIndex
                           MplsPathIndexOrZero,
gmplsTunnelPrimaryInstance
                           MplsTunnelInstanceIndex,
gmplsTunnelPrimaryTimeUp   TimeTicks,
gmplsTunnelPathChanges     Counter32,
gmplsTunnelLastPathChange  TimeTicks,
gmplsTunnelCreationTime    TimeStamp,
gmplsTunnelStateTransitions
                           Counter32,
gmplsTunnelIncludeAnyAffinity
                           MplsTunnelAffinity,
gmplsTunnelIncludeAllAffinity
                           MplsTunnelAffinity,
gmplsTunnelExcludeAnyAffinity
                           MplsTunnelAffinity,
gmplsTunnelPathInUse       MplsPathIndexOrZero,
gmplsTunnelRole            INTEGER,
gmplsTunnelTotalUpTime     TimeTicks,
gmplsTunnelInstanceUpTime  TimeTicks,
gmplsTunnelAdminStatus     INTEGER,
gmplsTunnelOperStatus      INTEGER,
gmplsTunnelRowStatus       RowStatus,
gmplsTunnelStorageType     StorageType,
gmplsTunnelLSPEncoding     INTEGER,
gmplsTunnelSwitchingType   Integer32,
gmplsTunnelLinkProtection  BITS,
gmplsTunnelGPid            Unsigned32,
gmplsTunnelSecondary       TruthValue,
gmplsTunnelDirection       INTEGER,
gmplsTunnelPathComp        INTEGER
}
```

gmplsTunnelIndex OBJECT-TYPE

SYNTAX MplsTunnelIndex

MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 24]

"Uniquely identifies this row."
::= { gmplsTunnelEntry 1 }

gmplsTunnelInstance 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."

::= { gmplsTunnelEntry 2 }

gmplsTunnelIngressLSRId 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 signaling protocol is rsvp(2) this value SHOULD mimic the Extended Tunnel Id field in the SESSION object. When the signaling 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, Internet Draft <[draft-ietf-mpls-rsvp-lsp-tunnel-09.txt](#)>, August 2001.,
- "2. Constraint-Based LSP Setup using LDP, Jamoussi, Internet Draft <[draft-ietf-mpls-cr-ldp-06.txt](#)>, November 2001."

::= { gmplsTunnelEntry 3 }

gmplsTunnelEgressLSRId OBJECT-TYPE

SYNTAX MplsLsrIdentifier

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Specifies the egress LSR ID."

::= { gmplsTunnelEntry 4 }

gmplsTunnelName OBJECT-TYPE

SYNTAX DisplayString

MAX-ACCESS read-create
STATUS current
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 25]

"The canonical name assigned to the tunnel. This name can be used to refer to the tunnel on the LSRs console port. If gmplsTunnelIsIf is set to numbered(1) or unnumbered(2) then the ifName of the interface corresponding to this tunnel should have a value equal to gmplsTunnelName. Also see the description of ifName in [RFC 2863](#)."

REFERENCE

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

::= { gmplsTunnelEntry 5 }

gmplsTunnelDescr 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."

::= { gmplsTunnelEntry 6 }

gmplsTunnelIsIf OBJECT-TYPE

SYNTAX INTEGER {

no (0),

numbered (1),

unnumbered (2)

}

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 numbered (1) or unnumbered(2) then the ifName of the interface corresponding to this tunnel should have a value equal to gmplsTunnelName. Also see the description of ifName in [RFC 2863](#).

If this variable is set to unnumbered(2) the originating LSR adds an LSP_TUNNEL_INTERFACE_ID object to the

outgoing Path message. This object
contains information that is only used by
the terminating LSR."

REFERENCE

"[RFC 2863](#) - The Interfaces Group MIB,
McCloghrie, K., and F. Kastenholtz, June
2000.
[draft-ietf-mpls-crldp-unnum-02.txt](#) -
Signalling Unnumbered Links in CR-LDP,
Kompella, K., Rekhter, Y. and Kullberg, A.,
Sep 2001.
[draft-ietf-mpls-rsvp-unnum-02.txt](#) -
Signalling Unnumbered Links in RSVP-TE,
Kompella, K., and Rekhter, Y., Aug 2001."

DEFVAL { no }

::= { gmplsTunnelEntry 7 }

gmplsTunnelIfIndex OBJECT-TYPE

SYNTAX InterfaceIndexOrZero

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If gmplsTunnelIsIf is set to numbered(1) or
unnumbered(2), 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.
Some implementations may choose to
automatically supply the value of this
object so as to coordinate interface
indexes across all interfaces. In this
case, this object could be implemented as
read-only."

REFERENCE

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

::= { gmplsTunnelEntry 8 }

gmplsTunnelXCPointer OBJECT-TYPE

SYNTAX RowPointer

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable points to a row in the
gmplsXCTable. 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., and T. Nadeau, GMPLS Label
    Switching Router Management Information
    Base Using SMIV2, Internet Draft <draft-
    nadeau-ccamp-gmpls-lsr-mib-01.txt>, January
    2002."
 ::= { gmplsTunnelEntry 9 }

gmplsTunnelSignallingProto 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.
    Note that the distinction between the use
    of the MPLS and GMPLS variants of the
    signaling protocols is made through the
    setting of the gmplsTunnelLspEncoding
    object."
DEFVAL { none }
 ::= { gmplsTunnelEntry 10 }

gmplsTunnelSetupPrio OBJECT-TYPE
SYNTAX Integer32 (0..7)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "Indicates the setup priority of this
    tunnel."
REFERENCE
    "1. RSVP-TE: Extensions to RSVP for LSP
    Tunnels, Awduche et al, RFC 3209, December
    2001.,
    2. Constraint-Based LSP Setup using LDP,
    Jamoussi, Internet Draft <draft-ietf-mpls-
    cr-ldp-06.txt>, November 2001."
 ::= { gmplsTunnelEntry 11 }

gmplsTunnelHoldingPrio OBJECT-TYPE
SYNTAX Integer32 (0..7)
```

MAX-ACCESS read-create
STATUS current
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 28]

"Indicates the holding priority for this tunnel."

REFERENCE

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

::= { gmplsTunnelEntry 12 }

gmplsTunnelAttributes OBJECT-TYPE

SYNTAX BITS {

localProtectionDesired (0),
labelRecordingDesired (1),
seStyleDesired (2),
isPersistent (3),
isPinned (4),
recordRoute(5)

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This bitmask indicates optional parameters for this tunnel. Some of these bits map direct to signaled values (for example SESSION_ATTRIBUTES flags in RSVP-TE). Others describe qualities of the tunnel. The following describes these bitfields:

localProtectionDesired

This flag permits transit routers to use a local repair mechanism which may result in violation of the explicit route object. When a fault is detected on an adjacent downstream link or node, a transit router can reroute traffic for fast service restoration.

labelRecordingDesired

This flag indicates that label information should be included when doing a route record. This bit is not valid unless the recordRoute bit is set.

seStyleDesired

This flag indicates that the tunnel ingress

node may choose to reroute this tunnel
without tearing it down.
When signaling uses RSVP, a tunnel egress

node SHOULD use the SE Style when responding with a Resv message.

isPersistent

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

isPinned

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

recordRoute

This flag indicates whether or not the 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 }

::= { gmplsTunnelEntry 13 }

gmplsTunnelOwner OBJECT-TYPE

SYNTAX MplsInitialCreationSource

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Indicates which protocol created and is responsible for managing this tunnel. Values rsvp(4) and crldp(5) should not be used at the head-end of a tunnel since the tunnel will be created through some form of management. The value ldp (3) should never be used."

::= { gmplsTunnelEntry 14 }

gmplsTunnelLocalProtectInUse 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)."
 ::= { gmplsTunnelEntry 15 }
```

gmplsTunnelResourcePointer OBJECT-TYPE

SYNTAX RowPointer

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable represents a pointer to the traffic parameter specification for this tunnel. This value may point at an entry in the gmplsTunnelResourceEntry to indicate which gmplsTunnelResourceEntry 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."

::= { gmplsTunnelEntry 16 }

gmplsTunnelInstancePriority 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 gmplsTunnelIndex in this table, but with a different gmplsTunnelInstance. Tunnel group priorities are used to denote the priority at which a particular tunnel instance will supercede another. Instances of tunnels containing the same gmplsTunnelInstancePriority will be used for load sharing."

DEFVAL { 0 }

::= { gmplsTunnelEntry 17 }

gmplsTunnelHopTableIndex OBJECT-TYPE

SYNTAX MplsPathIndexOrZero

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Index into the gmplsTunnelHopTable entry that specifies the explicit route hops for

```
    this tunnel."  
 ::= { gmplsTunnelEntry 18 }
```

gmplsTunnelARHopTableIndex OBJECT-TYPE
SYNTAX MplsPathIndexOrZero
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Index into the gmplsTunnelARHopTable entry
 that specifies the actual hops traversed by
 the tunnel."
 ::= { gmplsTunnelEntry 19 }

gmplsTunnelCHopTableIndex OBJECT-TYPE
SYNTAX MplsPathIndexOrZero
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Index into the gmplsTunnelCHopTable entry
 that specifies the computed hops traversed
 by the tunnel."
 ::= { gmplsTunnelEntry 20 }

gmplsTunnelPrimaryInstance OBJECT-TYPE
SYNTAX MplsTunnelInstanceIndex
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Specifies the instance index of the primary
 instance of this tunnel."
 ::= { gmplsTunnelEntry 21 }

gmplsTunnelPrimaryTimeUp 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 gmplsTunnelPrimaryInstance."
 ::= { gmplsTunnelEntry 22 }

gmplsTunnelPathChanges OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Specifies the number of times the path has
 changed for this tunnel."

```
::= { gmplsTunnelEntry 23 }
```

```
gmplsTunnelLastPathChange OBJECT-TYPE
```

SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Specifies the time since the last path
 change for this tunnel."
::= { gmplsTunnelEntry 24 }

gmplsTunnelCreationTime 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."
::= { gmplsTunnelEntry 25 }

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

gmplsTunnelIncludeAnyAffinity 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
 "RSVP-TE: Extensions to RSVP for LSP
 Tunnels, Awduche et al, [RFC 3209](#), December
 2001."
::= { gmplsTunnelEntry 27 }

gmplsTunnelIncludeAllAffinity 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

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

::= { gmplsTunnelEntry 28 }

gmplsTunnelExcludeAnyAffinity OBJECT-TYPE

SYNTAX MplsTunnelAffinity

MAX-ACCESS read-create

STATUS current

DESCRIPTION

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

REFERENCE

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

::= { gmplsTunnelEntry 29 }

gmplsTunnelPathInUse 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 the
gmplsTunnelHopTable. This path may not
exactly match the one in the ARHopTable due
to the fact that some CSPF modification may
have taken place. See the gmplsARHopTable
for the actual path being taken by the
tunnel. A value of zero denotes that no
path is currently in use or available."

::= { gmplsTunnelEntry 30 }

gmplsTunnelRole 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."

```
::= { gmplsTunnelEntry 31 }
```

gmplsTunnelTotalUpTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

```
::= { gmplsTunnelEntry 32 }
```

gmplsTunnelInstanceUpTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

```
::= { gmplsTunnelEntry 33 }
```

gmplsTunnelAdminStatus 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."

```
::= { gmplsTunnelEntry 34 }
```

gmplsTunnelOperStatus 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."
::= { gmplsTunnelEntry 35 }
```

```
gmplsTunnelRowStatus 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."
::= { gmplsTunnelEntry 36 }
```

```
gmplsTunnelStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "This variable indicates the storage type
    for this table entry. When set to
    'permanent', the entire row is to be
    stored."
::= { gmplsTunnelEntry 37 }
```

```
gmplsTunnelLSPEncoding OBJECT-TYPE
SYNTAX INTEGER {
    tunnelLspNotGmpls (0),
    tunnelLspPacket (1),
    tunnelLspEthernetV2Dix (2),
    tunnelLspAnsiPdh (3),
    tunnelLspEtsiPdh (4),
```

tunnelLspSdhItutG707 (5),
tunnelLspSonetAnsiT1105 (6),
tunnelLspDigitalWrapper (7),

```
tunnelLspLambda (8),
tunnelLspFiber (9),
tunnelLspEthernet8023 (10),
tunnelLspFiberChannel (11)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "This object indicates the encoding of the
    LSP being requested. It is only required
    when a generalized label request will be
    used for this LSP. A value of 0 in this
    object indicates that a generalized label
    request will not be used to set up this LSP
    which means that MPLS procedures will be
    used.
    Ed Note: Should these be assigned and
    maintained by IANA?"
 ::= { gmplsTunnelEntry 38 }
```

```
gmplsTunnelSwitchingType OBJECT-TYPE
SYNTAX Integer32 (0..2147483647)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "Indicates the type of switching that should
    be performed on a particular link. This
    field is needed for links that advertise
    more than one type of switching capability.
    Values of this field are as the Switching
    Capability field defined in [GMPLS-RTG]
    This object is only used if
    gmplsTunnelLSPEncoding is not set to 0.
    Ed Note: Should these values be assigned
    and maintained by IANA or imported from
    another MIB?
    Currently the following values are valid:
```

```
unknown (0),
psc1 (1),
psc2 (2),
psc3 (3),
psc4 (4),
l2sc (51),
tdm (100),
lsc (150),
```

```
fsc (200)"  
::= { gmplsTunnelEntry 39 }
```

gmplsTunnelLinkProtection OBJECT-TYPE

SYNTAX BITS {

extraTraffic(1),
unprotected(2),
shared (3),
dedicatedOneToOne (4),
dedicatedOnePlusOne(5),
enhanced(6)

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This bitmask indicates the level of link protection required. A value of zero (no bits set) indicates that any protection may be used.

This object is only used if
gmplsTunnelLSPEncoding is not set to 0.
The following describes these bitfields:

extraTraffic

Indicates that the LSP should use links that are protecting other (primary) traffic. Such LSPs may be preempted when the links carrying the (primary) traffic being protected fail.

unprotected

Indicates that the LSP should not use any link layer protection.

shared

Indicates that a shared link layer protection scheme, such as 1:N protection, should be used to support the LSP.

dedicatedOneToOne

Indicates that a dedicated link layer protection scheme, i.e., 1:1 protection, should be used to support the LSP.

dedicatedOnePlusOne

Indicates that a dedicated link layer protection scheme, i.e., 1+1 protection, should be used to support the LSP.

enhanced

Indicates that a protection scheme that is more reliable than Dedicated 1+1 should be

used, e.g., 4 fiber BLSR/MS-SPRING."
 ::= { gmplsTunnelEntry 40 }

gmplsTunnelGPid OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object indicates the payload carried
by the LSP. It is only required when GMPLS
will be used for this LSP.
This object is only used if
gmplsTunnelLSPEncoding is not set to 0.

Ed note: Should IANA maintain these values?
Is there a better way of doing this? Say,
having an enum for these values, plus
another bit mask for the ethertypes and a
flag to tell which to use?

Currently the following values are valid.

unknown(0),
asynchE4(5),
asynchDS3T3(6),
asynchE3(7),
bitsynchE3(8),
bytesynchE3(9),
asynchDS2T2(10),
bitsynchDS2T2(11),
asynchE1(13),
bytesynchE1(14),
bytesynch31ByDS0(15),
asynchDS1T1(16),
bitsynchDS1T1(17),
bytesynchDS1T1(18),
VC11VC12(19),
ds1SFAsynch(22),
ds1ESFAsynch(23),
ds3M23Asynch(24),
ds3CBitParityAsynch(25),
vt(26),
sts(27),
posNoScrambe16BitCrc(28),
posNoScrambe32BitCrc(29),
posScrambe16BitCrc(30),
posScrambe32BitCrc(31),

```
atm(32)
ethernet(33),
sdh(34),
```

```
sonet(35),
digitalwrapper(36),
lambda(37),
etsiPdh (38),
ansiPdh (39),
lapsSdh (40),
fddi (41),
dqdb (42),
fiberChannel3 (43)"
::= { gmplsTunnelEntry 41 }
```

gmplsTunnelSecondary OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Indicates that the requested LSP is a
secondary LSP.

This object is only used if
gmplsTunnelLSPEncoding is not set to 0."

DEFVAL { false }

::= { gmplsTunnelEntry 42 }

gmplsTunnelDirection OBJECT-TYPE

SYNTAX INTEGER {

forward (0),

bidirectional (1)

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Whether this tunnel carries forward data
(is unidirectional) or is bidirectional.
By default, tunnels are unidirectional."

DEFVAL { forward }

::= { gmplsTunnelEntry 43 }

gmplsTunnelPathComp OBJECT-TYPE

SYNTAX INTEGER {

dynamicFull(1),-- CSPF fully computed

explicit(2),-- fully specified path

dynamicPartial(3) -- CSPF partially computed

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This value instructs the source node on how to perform path computation on the explicit route specified by the associated entries

in the gmplsTunnelHopTable.

dynamicFull

The user specifies at least the source and destination of the path and expects that the CSPF will calculate the remainder of the path.

explicit

The user specifies the entire path for the tunnel to take. This path may contain strict or loose hops. Evaluation of the explicit route will be performed hop by hop through the network.

dynamicPartial

The user specifies at least the source and destination of the path and expects that the CSPF will calculate the remainder of the path. The path computed by CSPF is allowed to be only partially computed allowing the remainder of the path to be filled in across the network."

DEFVAL { explicit }

::= { gmplsTunnelEntry 44 }

-- End of gmplsTunnelTable

-- Begin gmplsTunnelHopPathOptionIndexNextTable

gmplsTunnelHopPathOptionIndexNextTable OBJECT-TYPE

SYNTAX SEQUENCE OF

GmplsTunnelHopPathOptionIndexNextEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains the next available values of gmplsTunnelHopPathOptionIndex for all values of gmplsTunnelHopListIndex."

::= { gmplsTeObjects 4 }

gmplsTunnelHopPathOptionIndexNextEntry OBJECT-TYPE

SYNTAX GmplsTunnelHopPathOptionIndexNextEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents the next

available gmplsTunnelHopPathOptionIndex for
a specific value of

```
    gmplsTunnelHopListIndex.  
    This MIB table is indexed by  
    gmplsTunnelHopListIndex."  
INDEX { gmplsTunnelHopListIndex }  
::= { gmplsTunnelHopPathOptionIndexNextTable 1 }  
  
GmplsTunnelHopPathOptionIndexNextEntry ::= SEQUENCE {  
    gmplsTunnelHopPathOptionIndexNextIndex  
        MplsPathIndexOrZero  
}  
  
gmplsTunnelHopPathOptionIndexNextIndex OBJECT-TYPE  
SYNTAX MplsPathIndexOrZero  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The next available  
    gmplsTunnelHopPathOptionIndex for the given  
    value of gmplsTunnelHopListIndex. A value  
    of zero means that no further entries are  
    available."  
::= { gmplsTunnelHopPathOptionIndexNextEntry 1 }  
  
-- End of gmplsTunnelHopPathOptionIndexNextTable  
  
-- Begin gmplsTunnelHopIndexNextTable  
  
gmplsTunnelHopIndexNextTable OBJECT-TYPE  
SYNTAX SEQUENCE OF GmplsTunnelHopIndexNextEntry  
MAX-ACCESS not-accessible  
STATUS current  
DESCRIPTION  
    "This table contains the next available  
    values of gmplsTunnelHopIndex for all  
    parings of gmplsTunnelHopListIndex and  
    gmplsTunnelHopPathOptionIndex, that is for  
    all entries in the gmplsTunnelHopTable."  
::= { gmplsTeObjects 5 }  
  
gmplsTunnelHopIndexNextEntry OBJECT-TYPE  
SYNTAX GmplsTunnelHopIndexNextEntry  
MAX-ACCESS not-accessible  
STATUS current  
DESCRIPTION  
    "An entry in this table represents the next  
    available gmplsTunnelHopIndex for a
```

specific paring of gmplsTunnelHopListIndex
and gmplsTunnelHopPathOptionIndex.

```
        This MIB table is indexed by
        gmplsTunnelHopListIndex."
INDEX {
    gmplsTunnelHopListIndex,
    gmplsTunnelHopPathOptionIndex
}
 ::= { gmplsTunnelHopIndexNextTable 1 }

GmplsTunnelHopIndexNextEntry ::= SEQUENCE {
    gmplsTunnelHopIndexNextIndex  MplsPathIndexOrZero
}

gmplsTunnelHopIndexNextIndex OBJECT-TYPE
SYNTAX  MplsPathIndexOrZero
MAX-ACCESS read-only
STATUS  current
DESCRIPTION
    "The next available gmplsTunnelHopIndex for
    the given paring of gmplsTunnelHopListIndex
    and gmplsTunnelHopPathOptionIndex.
    A value of zero means that no further
    entries are available."
 ::= { gmplsTunnelHopIndexNextEntry 1 }

-- End of gmplsTunnelHopIndexNextTable

-- Begin gmplsTunnelHopTable

gmplsTunnelHopListIndexNext OBJECT-TYPE
SYNTAX  MplsPathIndex
MAX-ACCESS read-only
STATUS  current
DESCRIPTION
    "This object contains an appropriate value
    to be used for gmplsTunnelHopListIndex when
    creating entries in the
    gmplsTunnelHopTable.  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
    gmplsTunnelHopListIndex for a new entry in
```

the gmplsTunnelHopTable, the manager issues
a management protocol retrieval operation
to obtain the current value of

gmplsTunnelHopIndex.
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."
::= { gmplsTeObjects 6 }

gmplsTunnelHopTable OBJECT-TYPE
SYNTAX SEQUENCE OF GmplsTunnelHopEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The gmplsTunnelHopTable is used to indicate the explicit labels and hops to be used for an MPLS or GMPLS tunnel defined in gmplsTunnelTable, when it is established using signaling. Each row in this table is indexed by gmplsTunnelHopListIndex. Each row also has a secondary index gmplsTunnelHopIndex 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 gmplsTunnelHopTable.

Note that some rows encode objects that are only valid for GMPLS tunnels."
::= { gmplsTeObjects 7 }

gmplsTunnelHopEntry OBJECT-TYPE
SYNTAX GmplsTunnelHopEntry
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 an ERLSP to be set up by a signaling protocol."
INDEX {
gmplsTunnelHopListIndex,

```
    gmplsTunnelHopPathOptionIndex,  
    gmplsTunnelHopIndex  
}
```

```
::= { gmplsTunnelHopTable 1 }
```

```
GmplsTunnelHopEntry ::= SEQUENCE {
    gmplsTunnelHopListIndex      MplsPathIndex,
    gmplsTunnelHopPathOptionIndex MplsPathIndex,
    gmplsTunnelHopIndex          MplsPathIndex,
    gmplsTunnelHopAddrType       GmplsHopAddrType,
    gmplsTunnelHopIpv4Addr       InetAddressIPv4,
    gmplsTunnelHopIpv4PrefixLen  Unsigned32,
    gmplsTunnelHopIpv6Addr       InetAddressIPv6,
    gmplsTunnelHopIpv6PrefixLen  Unsigned32,
    gmplsTunnelHopAsNumber       Unsigned32,
    gmplsTunnelHopLspId          MplsLSPID,
    gmplsTunnelHopType           INTEGER,
    gmplsTunnelHopIncludeExclude INTEGER,
    gmplsTunnelHopPathOptionName DisplayString,
    gmplsTunnelHopRowStatus      RowStatus,
    gmplsTunnelHopStorageType    StorageType,
    gmplsTunnelHopLabelStatuses  BITS,
    gmplsTunnelHopExplicitLabel  Unsigned32,
    gmplsTunnelHopExplicitReverseLabel
                                Unsigned32,
    gmplsTunnelHopUnnumberedInterface
                                InterfaceIndexOrZero
}
```

```
gmplsTunnelHopListIndex OBJECT-TYPE
SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    "Primary index into this table identifying a
     particular explicit route object."
::= { gmplsTunnelHopEntry 1 }
```

```
gmplsTunnelHopPathOptionIndex 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."
::= { gmplsTunnelHopEntry 2 }
```

```
gmplsTunnelHopIndex OBJECT-TYPE
```

SYNTAX MplsPathIndex
MAX-ACCESS not-accessible
STATUS current

DESCRIPTION

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

::= { gmplsTunnelHopEntry 3 }

gmplsTunnelHopAddrType OBJECT-TYPE

SYNTAX GmplsHopAddrType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Denotes the type of this tunnel hop entry."

DEFVAL { ipv4 }

::= { gmplsTunnelHopEntry 4 }

gmplsTunnelHopIpv4Addr OBJECT-TYPE

SYNTAX InetAddressIPv4

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If gmplsTunnelHopAddrType is set to
ipv4(1), then this value will contain the
IPv4 address of this hop. If
gmplsTunnelHopAddrType is set to lspid(4),
then this value will contain the Ingress
LSR ID of the Tunnel. If
gmplsTunnelHopAddrType is set to
unnumberedIPv4(6) then this value will
contain LSR ID of the router on which the
unnumbered interface resides. This object
is otherwise insignificant and should
contain a value of 0."

::= { gmplsTunnelHopEntry 5 }

gmplsTunnelHopIpv4PrefixLen OBJECT-TYPE

SYNTAX Unsigned32 (0..32)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If gmplsTunnelHopAddrType 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."

::= { gmplsTunnelHopEntry 6 }

gmplsTunnelHopIpv6Addr OBJECT-TYPE

SYNTAX InetAddressIPv6

MAX-ACCESS read-create
STATUS current
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 46]

"If gmplsTunnelHopAddrType is set to ipv6(2), then this value will contain the IPv6 address of this hop. If gmplsTunnelHopAddrType is set to lspidIPv6(5), then this value will contain the Ingress LSR ID of the Tunnel. If gmplsTunnelHopAddrType is set to unnumberedIPv6(7) then this value will contain LSR ID of the router on which the unnumbered interface resides. This object is otherwise insignificant and should contain a value of 0."

::= { gmplsTunnelHopEntry 7 }

gmplsTunnelHopIPv6PrefixLen OBJECT-TYPE

SYNTAX Unsigned32 (0..128)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If gmplsTunnelHopAddrType 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."

::= { gmplsTunnelHopEntry 8 }

gmplsTunnelHopAsNumber OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If gmplsTunnelHopAddrType 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."

::= { gmplsTunnelHopEntry 9 }

gmplsTunnelHopLspId OBJECT-TYPE

SYNTAX MplsLSPID

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If gmplsTunnelHopAddrType is set to lspid(4) or lspidIPv6(5), then this value will contain the LSPID of a tunnel to use for this hop. The 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.
Note that not all signaling protocols
include the facility to signal this type of
explicit hop."
 ::= { gmplsTunnelHopEntry 10 }

gmplsTunnelHopType 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."
DEFVAL { strict }
 ::= { gmplsTunnelHopEntry 11 }

gmplsTunnelHopIncludeExclude 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 }
 ::= { gmplsTunnelHopEntry 12 }

gmplsTunnelHopPathOptionName OBJECT-TYPE
SYNTAX DisplayString
MAX-ACCESS read-create
STATUS current
DESCRIPTION
 "The description of this series of hops as
 they relate to the specified path option."
 ::= { gmplsTunnelHopEntry 13 }

gmplsTunnelHopRowStatus 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."
::= { gmplsTunnelHopEntry 14 }

gmplsTunnelHopStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION
 "This variable indicates the storage type
 for this table entry. When set to
 'permanent', the entire row is to be
 stored."
::= { gmplsTunnelHopEntry 15 }

gmplsTunnelHopLabelStatuses OBJECT-TYPE
SYNTAX BITS {
 forwardPresent (0),
 reversePresent (1)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "This bitmask indicates the presence and
 status of labels indicated by the
 gmplsTunnelHopExplicitLabel and
 gmplsTunnelHopExplicitReverseLabel objects.
 For the Present bits, a set bit indicates
 that a label is present for this hop in the
 route."
::= { gmplsTunnelHopEntry 16 }

gmplsTunnelHopExplicitLabel OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-create
STATUS current
DESCRIPTION
 "Indicates the row entry in the
 gmplsLabelTable that defines the explicit
 label to use in the explicit route as the
 forward path label at this point. This
 value only has meaning if the
 forwardPresent bit of
 gmplsTunnelHopLabelStatuses is set."

This variable is only valid for settings of
gmplsTunnelHopAddrType which may be
associated with a forward path label.

Note that in implementations where the label may be encoded within a 32 bit integer and where gmplsLabelTable is not implemented, this object may directly contain the

label value to use."

::= { gmplsTunnelHopEntry 17 }

gmplsTunnelHopExplicitReverseLabel OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Indicates the row entry in the gmplsLabelTable that defines the explicit label to use in the explicit route as the reverse path label at this point. This value only has meaning if the reversePresent bit of gmplsTunnelHopLabelStatuses is set. This variable is only valid for settings of gmplsTunnelHopAddrType which may be associated with a reverse path label. Note that in implementations where the label may be encoded within a 32 bit integer and where gmplsLabelTable is not implemented, this object may directly contain the label value to use."

::= { gmplsTunnelHopEntry 18 }

gmplsTunnelHopUnnumberedInterface OBJECT-TYPE

SYNTAX InterfaceIndexOrZero

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Indicates the interface index of the unnumbered interface to use when setting up the LSP. Only has value when gmplsTunnelHopAddrType is set to unnumberedIfIPv4(6) or unnumberedIfIPv6(7) in which case the corresponding gmplsTunnelHopIPv4Addr or gmplsTunnelHopIPv6Addr variable must contain an LSR id."

::= { gmplsTunnelHopEntry 19 }

-- End of gmplsTunnelHopTable

-- Begin of gmplsTunnelResourceTable

Nadeau et al.

Expires July 2002

[Page 50]

gmplsTunnelResourceIndexNext OBJECT-TYPE

SYNTAX Unsigned32 (0.. 2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object contains the next appropriate value to be used for gmplsTunnelResourceIndex 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 gmplsTunnelTable is implemented as read-only. To obtain the gmplsTunnelResourceIndex 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."

::= { gmplsTeObjects 8 }

gmplsTunnelResourceTable OBJECT-TYPE

SYNTAX SEQUENCE OF GmplsTunnelResourceEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The gmplsTunnelResourceTable 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."

::= { gmplsTeObjects 9 }

gmplsTunnelResourceEntry OBJECT-TYPE

SYNTAX GmplsTunnelResourceEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents a set of resources for a GMPLS or MPLS tunnel. An entry can be created by a network

administrator or by an SNMP agent as instructed by a signaling protocol."

INDEX{ gmplsTunnelResourceIndex }

::= { gmplsTunnelResourceTable 1 }

GmplsTunnelResourceEntry ::= SEQUENCE {

gmplsTunnelResourceIndex	Unsigned32,
gmplsTunnelResourceMaxRate	MplsBitRate,
gmplsTunnelResourceMeanRate	MplsBitRate,
gmplsTunnelResourceMaxBurstSize	MplsBurstSize,
gmplsTunnelResourceMeanBurstSize	MplsBurstSize,
gmplsTunnelResourceExcessBurstSize	MplsBurstSize,
gmplsTunnelResourceFrequency	INTEGER,
gmplsTunnelResourceWeight	Unsigned32,
gmplsTunnelResourceRowStatus	RowStatus,
gmplsTunnelResourceStorageType	StorageType

}

gmplsTunnelResourceIndex OBJECT-TYPE

SYNTAX Unsigned32 (1..2147483647)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Uniquely identifies this row."

::= { gmplsTunnelResourceEntry 1 }

gmplsTunnelResourceMaxRate OBJECT-TYPE

SYNTAX MplsBitRate

UNITS "bits per second"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The maximum rate in bits/second. Note that setting gmplsTunnelResourceMaxRate, gmplsTunnelResourceMeanRate, and gmplsTunnelResourceMaxBurstSize to 0 indicates best-effort treatment. This object is copied to an instance of gmplsTrafficParamMaxRate in gmplsTrafficParamTable the OID of which is copied into the corresponding gmplsInSegmentTrafficParamPtr."

REFERENCE

"T. Nadeau et al., GMPLS Label Switching Router Management Information Base Using SMIV2, Internet Draft <[draft-nadeau-ccamp-gmpls-lsr-mib-01.txt](#)>, January 2002."

```
::= { gmplsTunnelResourceEntry 2 }
```

```
gmplsTunnelResourceMeanRate OBJECT-TYPE
```

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

"This object is copied into an instance of
gmplsTrafficParamMeanRate in the
gmplsTrafficParamTable. The OID of this
table entry is then copied into the
corresponding
gmplsInSegmentTrafficParamPtr.

When resource allocation is performed as
requested by this TSpec object, it is
copied into an entry in
gmplsTrafficParamTable [[GMPLSLSRMIB](#)]:
gmplsTunnelInMeanRate to
gmplsTrafficParamMeanRate.
The OID of this entry is copied to
gmplsInSegmentTrafficParamPtr of the
corresponding in-segment entry."

REFERENCE

"T. Nadeau et al., GMPLS Label Switching
Router Management Information Base Using
SMIV2, Internet Draft <[draft-nadeau-ccamp-
gmpls-lsr-mib-01.txt](#)>, January 2002."

::= { gmplsTunnelResourceEntry 3 }

gmplsTunnelResourceMaxBurstSize OBJECT-TYPE

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

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

When resource allocation is performed as
requested by this TSpec object, it is
copied into an entry in
gmplsTrafficParamTable [[LSRMIB](#)]:
gmplsTunnelInMaxBurstSize to
gmplsTrafficParamMaxBurstSize. The OID of
this entry is copied to
gmplsInSegmentTrafficParamPtr of the

corresponding in-segment entry."

REFERENCE

"T. Nadeau et al., GMPLS Label Switching

Nadeau et al.

Expires July 2002

[Page 53]

Router Management Information Base Using
SMIV2, Internet Draft <[draft-nadeau-ccamp-gmpls-lsr-mib-01.txt](#)>, January 2002."

::= { gmplsTunnelResourceEntry 4 }

gmplsTunnelResourceMeanBurstSize 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."
::= { gmplsTunnelResourceEntry 5 }

gmplsTunnelResourceExcessBurstSize 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](#)."
::= { gmplsTunnelResourceEntry 6 }

gmplsTunnelResourceFrequency 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](#)."

```
::= { gmplsTunnelResourceEntry 7 }
```

```
gmplsTunnelResourceWeight 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](#)."

::= { gmplsTunnelResourceEntry 8 }

gmplsTunnelResourceRowStatus 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."

::= { gmplsTunnelResourceEntry 9 }

gmplsTunnelResourceStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable indicates the storage type for this table entry. When set to 'permanent', the entire row is to be stored."

::= { gmplsTunnelResourceEntry 10 }

-- End gmplsTunnelResourceTable

-- Tunnel Actual Route Hop table.

gmplsTunnelARHopTable OBJECT-TYPE

SYNTAX SEQUENCE OF GmplsTunnelARHopEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The gmplsTunnelARHopTable is used to indicate the hops, strict or loose, for a GMPLS or MPLS tunnel defined in gmplsTunnelTable, as reported by the signaling protocol, for the outgoing

direction of the tunnel. Each row in this table is indexed by gmplsTunnelARHopListIndex. Each row also

has a secondary index
 gmplsTunnelARHopIndex, 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
 gmplsTunnelARHopTable.

Please note that since the information
 necessary to build entries within this
 table is not provided by some signaling
 protocols, implementation of this table is
 optional. Furthermore, since the
 information in this table is actually
 provided by the 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."

```
::= { gmplsTeObjects 10 }
```

```
gmplsTunnelARHopEntry OBJECT-TYPE
```

```
SYNTAX GmplsTunnelARHopEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS current
```

```
DESCRIPTION
```

```
"An entry in this table represents a tunnel  

  hop. An entry is created by the signaling  

  protocol for a signaled ERLSP set up by the  

  signaling protocol."
```

```
INDEX { gmplsTunnelARHopListIndex, gmplsTunnelARHopIndex  

}
```

```
::= { gmplsTunnelARHopTable 1 }
```

```
GmplsTunnelARHopEntry ::= SEQUENCE {
```

gmplsTunnelARHopListIndex	MplsPathIndex,
gmplsTunnelARHopIndex	MplsPathIndex,
gmplsTunnelARHopAddrType	GmplsHopAddrType,
gmplsTunnelARHopIpv4Addr	InetAddressIPv4,
gmplsTunnelARHopIpv4PrefixLen	Unsigned32,
gmplsTunnelARHopIpv6Addr	InetAddressIPv6,
gmplsTunnelARHopIpv6PrefixLen	Unsigned32,

gmplsTunnelARHopAsNumber	Unsigned32,
gmplsTunnelARHopLspId	MplsLSPID,
gmplsTunnelARHopLabelStatuses	BITS,

```
    gmplsTunnelARHopExplicitLabel    Unsigned32,
    gmplsTunnelARHopExplicitReverseLabel
                                     Unsigned32,
    gmplsTunnelARHopUnnumberedInterface
    InterfaceIndexOrZero,
    gmplsTunnelARHopProtection        BITS
}
```

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

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

```
gmplsTunnelARHopAddrType OBJECT-TYPE
SYNTAX  GmplsHopAddrType
MAX-ACCESS read-only
STATUS  current
DESCRIPTION
    "Denotes the address type of this tunnel
     hop.
     Only the values ipv4(1), ipv6(2),
     unnumberedIfIPv4(6) and unnumberedIfIPv6(7)
     will be seen for this object."
DEFVAL  { ipv4 }
 ::= { gmplsTunnelARHopEntry 3 }
```

```
gmplsTunnelARHopIPv4Addr OBJECT-TYPE
SYNTAX  InetAddressIPv4
MAX-ACCESS read-only
STATUS  current
DESCRIPTION
    "If gmplsTunnelARHopAddrType 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."

```
::= { gmplsTunnelARHopEntry 4 }
```

gmplsTunnelARHopIpv4PrefixLen OBJECT-TYPE

SYNTAX Unsigned32 (0..32)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If gmplsTunnelARHopAddrType 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."

```
::= { gmplsTunnelARHopEntry 5 }
```

gmplsTunnelARHopIpv6Addr OBJECT-TYPE

SYNTAX InetAddressIPv6

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If the gmplsTunnelARHopAddrType 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."

```
::= { gmplsTunnelARHopEntry 6 }
```

gmplsTunnelARHopIpv6PrefixLen OBJECT-TYPE

SYNTAX Unsigned32 (0..128)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If gmplsTunnelARHopAddrType 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."

```
::= { gmplsTunnelARHopEntry 7 }
```

gmplsTunnelARHopAsNumber OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If gmplsTunnelARHopAddrType 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.
Note that not all signaling protocols are
capable of recording this information."

```
::= { gmplsTunnelARHopEntry 8 }
```

gmplsTunnelARHopLspId OBJECT-TYPE

SYNTAX MplsLSPID

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"If gmplsTunnelARHopAddrType is set to lspid(4) or lspidIPv6(5), then this value will contain the LSPID of a tunnel used for this hop. The tunnel being reported has been tunneled through this hop (using label stacking). This object is otherwise insignificant and should contain a value of 0 to indicate this fact.

Note that not all signaling protocols are capable of recording this information."

```
::= { gmplsTunnelARHopEntry 9 }
```

gmplsTunnelARHopLabelStatuses OBJECT-TYPE

SYNTAX BITS {

forwardPresent (0),
reversePresent (1),
forwardGlobal (2),
reverseGlobal (3)

}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This bitmask indicates the presence and status of labels indicated by the gmplsTunnelARHopExplicitLabel and gmplsTunnelARHopExplicitReverseLabel objects.

For the Present bits, a set bit indicates that a label is present for this hop in the route.

For the Global bits, a set bit indicates that the label comes from the Global Label Space. A clear bit indicates that this is a Per-Interface label. A Global bit only has meaning if the corresponding Present bit is set."

```
::= { gmplsTunnelARHopEntry 10 }
```

gmplsTunnelARHopExplicitLabel OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only
STATUS current
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 59]

"Indicates the row entry in the gmplsLabelTable that defines the label used in the path as forward path at this point. This value only has meaning if the forwardPresent bit of gmplsTunnelARHopLabelStatuses is set. Note that in implementations where the label may be encoded within a 32 bit integer and where gmplsLabelTable is not implemented, this object may directly contain the label value to use."

::= { gmplsTunnelARHopEntry 11 }

gmplsTunnelARHopExplicitReverseLabel OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Indicates the row entry in the gmplsLabelTable that defines the label used in the path as reverse path at this point. This value only has meaning if the reversePresent bit of gmplsTunnelARHopLabelStatuses is set. Note that in implementations where the label may be encoded within a 32 bit integer and where gmplsLabelTable is not implemented, this object may directly contain the label value to use."

::= { gmplsTunnelARHopEntry 12 }

gmplsTunnelARHopUnnumberedInterface OBJECT-TYPE

SYNTAX InterfaceIndexOrZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Indicates the interface index of the unnumbered interface used when setting up the LSP. Only has value when gmplsTunnelARHopAddrType is set to unnumberedIfIPv4(6) or unnumberedIfIPv6(7) in which case the corresponding gmplsTunnelARHopIPv4Addr or gmplsTunnelARHopIPv6Addr variable must contain an LSR id."

::= { gmplsTunnelARHopEntry 13 }

gmplsTunnelARHopProtection OBJECT-TYPE
SYNTAX BITS {

```
        localAvailable (0),
        localInUse (1)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Availability and usage of protection on the
        reported link.

        localAvailable indicates that the link
        downstream of this node is protected via a
        local repair mechanism. This flag can only
        be set if the localProtectionDesired bit
        was set in gmplsTunnelAttributes for this
        tunnel.

        localInUse indicates that a 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)."
    ::= { gmplsTunnelARHopEntry 14 }

-- End of mplsTunnelARHopTable

-- Tunnel Computed Hop table.

gmplsTunnelCHopTable OBJECT-TYPE
SYNTAX SEQUENCE OF GmplsTunnelCHopEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    "The gmplsTunnelCHopTable is used to
    indicate the hops, strict or loose, for a
    GMPLS or MPLS tunnel defined in
    gmplsTunnelTable, as computed by a
    constraint-based routing protocol, based on
    the gmplsTunnelHopTable for the outgoing
    direction of the tunnel. Each row in this
    table is indexed by
    gmplsTunnelCHopListIndex. Each row also
    has a secondary index gmplsTunnelCHopIndex,
    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 gmplsTunnelCHopTable.

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."

::= { gmplsTeObjects 11 }

gmplsTunnelCHopEntry OBJECT-TYPE

SYNTAX GmplsTunnelCHopEntry

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 gmplsTunnelHopTable."

INDEX { gmplsTunnelCHopListIndex, gmplsTunnelCHopIndex }

::= { gmplsTunnelCHopTable 1 }

GmplsTunnelCHopEntry ::= SEQUENCE {

gmplsTunnelCHopListIndex	MplsPathIndex,
gmplsTunnelCHopIndex	MplsPathIndex,
gmplsTunnelCHopAddrType	GmplsHopAddrType,
gmplsTunnelCHopIpv4Addr	InetAddressIPv4,
gmplsTunnelCHopIpv4PrefixLen	Unsigned32,
gmplsTunnelCHopIpv6Addr	InetAddressIPv6,
gmplsTunnelCHopIpv6PrefixLen	Unsigned32,
gmplsTunnelCHopAsNumber	Unsigned32,
gmplsTunnelCHopLspId	MplsLSPID,
gmplsTunnelCHopType	INTEGER,
gmplsTunnelCHopLabelStatuses	BITS,
gmplsTunnelCHopExplicitLabel	Unsigned32,
gmplsTunnelCHopExplicitReverseLabel	Unsigned32,
gmplsTunnelCHopUnnumberedInterface	InterfaceIndexOrZero

}

gmplsTunnelCHopListIndex OBJECT-TYPE
SYNTAX MplsPathIndex
MAX-ACCESS not-accessible

STATUS current
DESCRIPTION
 "Primary index into this table identifying a
 particular computed hop list."
::= { gmplsTunnelCHopEntry 1 }

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

gmplsTunnelCHopAddrType OBJECT-TYPE
SYNTAX GmplsHopAddrType
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Denotes the address type of this tunnel
 hop."
DEFVAL { ipv4 }
::= { gmplsTunnelCHopEntry 3 }

gmplsTunnelCHopIpv4Addr OBJECT-TYPE
SYNTAX InetAddressIPv4
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "If gmplsTunnelCHopAddrType is set to
 ipv4(1), then this value contains the IPv4
 address of this hop.
 If gmplsTunnelCHopAddrType is set to
 lspid(4), then this value contains the
 Ingress LSR ID of the Tunnel. If
 gmplsTunnelCHopAddrType is set to
 unnumberedIPv4(6) then this value contains
 LSR ID of the router on which the
 unnumbered interface resides.
 This object is otherwise insignificant and
 contains a value of 0."
::= { gmplsTunnelCHopEntry 4 }

gmplsTunnelCHopIpv4PrefixLen OBJECT-TYPE
SYNTAX Unsigned32 (0..32)
MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If gmplsTunnelCHopAddrType is ipv4(1), then

the prefix length for this hop's IPv4 address is contained herein. This object is otherwise insignificant and contains a value of 0."

::= { gmplsTunnelCHopEntry 5 }

gmplsTunnelCHopIpv6Addr OBJECT-TYPE

SYNTAX InetAddressIPv6

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If gmplsTunnelCHopAddrType is set to ipv6(2), then this value contains the IPv6 address of this hop. If gmplsTunnelCHopAddrType is set to lspidIPv6(5), then this value contains the Ingress LSR ID of the Tunnel. If gmplsTunnelCHopAddrType is set to unnumberedIPv6(7) then this value contains LSR ID of the router on which the unnumbered interface resides. This object is otherwise insignificant and contains a value of 0."

::= { gmplsTunnelCHopEntry 6 }

gmplsTunnelCHopIpv6PrefixLen OBJECT-TYPE

SYNTAX Unsigned32 (0..128)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

::= { gmplsTunnelCHopEntry 7 }

gmplsTunnelCHopAsNumber OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If gmplsTunnelCHopAddrType is set to asNumber(3), then this value contains the AS number of this hop. This object is otherwise insignificant and contains a value of 0 to indicate this fact."

```
::= { gmplsTunnelCHopEntry 8 }
```

```
gmplsTunnelCHopType 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."
 ::= { gmplsTunnelCHopEntry 9 }

gmplsTunnelCHopLspId OBJECT-TYPE
SYNTAX  MplsLSPID
MAX-ACCESS read-only
STATUS   current
DESCRIPTION
    "If gmplsTunnelCHopAddrType is set to
    lspid(4) or lspidIPv6(5), then this value
    will contain the LSPID of a tunnel to use
    for this hop. The 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.
    Note that not all signaling protocols
    include the facility to signal this type of
    explicit hop."
 ::= { gmplsTunnelCHopEntry 10 }

gmplsTunnelCHopLabelStatuses OBJECT-TYPE
SYNTAX  BITS {
    forwardPresent (0),
    reversePresent (1)
}
MAX-ACCESS read-only
STATUS   current
DESCRIPTION
    "This bitmask indicates the presence and
    status of labels indicated by the
    gmplsTunnelCHopExplicitLabel and
    gmplsTunnelCHopExplicitReverseLabel
    objects.
    For the Present bits, a set bit indicates
    that a label is present for this hop in the
    route."
 ::= { gmplsTunnelCHopEntry 11 }
```

gmplsTunnelCHopExplicitLabel OBJECT-TYPE
SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Indicates the row entry in the gmplsLabelTable that defines the explicit label to use in the explicit route as the forward path label at this point. This value only has meaning if the forwardPresent bit of gmplsTunnelCHopLabelStatuses is set. This variable is only valid for settings of gmplsTunnelCHopAddrType which may be associated with a forward path label. Note that in implementations where the label may be encoded within a 32 bit integer and where gmplsLabelTable is not implemented, this object may directly contain the label value to use."

::= { gmplsTunnelCHopEntry 12 }

gmplsTunnelCHopExplicitReverseLabel OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Indicates the row entry in the gmplsLabelTable that defines the explicit label to use in the explicit route as the reverse path label at this point. This value only has meaning if the reversePresent bit of gmplsTunnelCHopLabelStatuses is set. This variable is only valid for settings of gmplsTunnelCHopAddrType which may be associated with a forward path label. Note that in implementations where the label may be encoded within a 32 bit integer and where gmplsLabelTable is not implemented, this object may directly contain the label value to use."

::= { gmplsTunnelCHopEntry 13 }

gmplsTunnelCHopUnnumberedInterface OBJECT-TYPE

SYNTAX InterfaceIndexOrZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Indicates the interface index of the
unnumbered interface to use when setting up
the LSP.

Only has value when gmplsTunnelCHopAddrType
is set to unnumberedIfIPv4(6) or
unnumberedIfIPv6(7) in which case the
corresponding gmplsTunnelCHopIPv4Addr or
gmplsTunnelCHopIPv6Addr variable contains
an LSR id."
::= { gmplsTunnelCHopEntry 14 }

-- End of gmplsTunnelCHopTable

-- GMPLS Tunnel Performance Table.

gmplsTunnelPacketPerfTable OBJECT-TYPE
SYNTAX SEQUENCE OF GmplsTunnelPacketPerfEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "This table provides per-tunnel packet
 performance information."
::= { gmplsTeObjects 12 }

gmplsTunnelPacketPerfEntry OBJECT-TYPE
SYNTAX GmplsTunnelPacketPerfEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "An entry in this table is created by the
 LSR for every tunnel where packets are
 visible to the LSR.
 Its is an extension to gmplsTunnelEntry."
AUGMENTS { gmplsTunnelEntry }
::= { gmplsTunnelPacketPerfTable 1 }

GmplsTunnelPacketPerfEntry ::= SEQUENCE {
 gmplsTunnelPacketPerfPackets Counter32,
 gmplsTunnelPacketPerfHCPackets Counter64,
 gmplsTunnelPacketPerfErrors Counter32,
 gmplsTunnelPacketPerfBytes Counter32,
 gmplsTunnelPacketPerfHCBytes Counter64,
 gmplsTunnelPacketPerfRvsPackets Counter32,
 gmplsTunnelPacketPerfRvsHCPackets Counter64,
 gmplsTunnelPacketPerfRvsErrors Counter32,
 gmplsTunnelPacketPerfRvsBytes Counter32,
 gmplsTunnelPacketPerfRvsHCBytes Counter64
}

gmplsTunnelPacketPerfPackets OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only

Nadeau et al.

Expires July 2002

[Page 67]

STATUS current
DESCRIPTION
 "Number of packets forwarded on the tunnel."
::= { gmplsTunnelPacketPerfEntry 1 }

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

gmplsTunnelPacketPerfErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Number of errored packets received on the
 tunnel."
::= { gmplsTunnelPacketPerfEntry 3 }

gmplsTunnelPacketPerfBytes OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Number of bytes forwarded on the tunnel."
::= { gmplsTunnelPacketPerfEntry 4 }

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

gmplsTunnelPacketPerfRvsPackets OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Number of packets forwarded on the tunnel
 in the reverse direction if it is

```
        bidirectional."  
 ::= { gmplsTunnelPacketPerfEntry 6 }
```

gmplsTunnelPacketPerfRvsHCPackets OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "High capacity counter for number of packets
 forwarded on the tunnel in the reverse
 direction if it is bidirectional."
 ::= { gmplsTunnelPacketPerfEntry 7 }

gmplsTunnelPacketPerfRvsErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Number of errored packets received on the
 tunnel in the reverse direction if it is
 bidirectional."
 ::= { gmplsTunnelPacketPerfEntry 8 }

gmplsTunnelPacketPerfRvsBytes OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Number of bytes forwarded on the tunnel in
 the reverse direction if it is
 bidirectional."
 ::= { gmplsTunnelPacketPerfEntry 9 }

gmplsTunnelPacketPerfRvsHCBytes OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "High capacity counter for number of bytes
 forwarded on the tunnel in the reverse
 direction if it is bidirectional."
 ::= { gmplsTunnelPacketPerfEntry 10 }

-- End of gmplsTunnelPacketPerfTable

-- GMPLS Tunnel Error Table.

gmplsTunnelErrorTable OBJECT-TYPE
SYNTAX SEQUENCE OF GmplsTunnelErrorEntry
MAX-ACCESS not-accessible

STATUS current
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 69]

"This table provides per-tunnel information about errors. Errors may be detected locally or reported through the signaling protocol."

::= { gmplsTeObjects 13 }

gmplsTunnelErrorEntry OBJECT-TYPE

SYNTAX GmplsTunnelErrorEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table is created by the LSR for every tunnel where error information is visible to the LSR.

Its is an extension to gmplsTunnelEntry."

AUGMENTS { gmplsTunnelEntry }

::= { gmplsTunnelErrorTable 1 }

GmplsTunnelErrorEntry ::= SEQUENCE {

gmplsTunnelErrorLastError	INTEGER,
gmplsTunnelErrorLastTime	TimeStamp,
gmplsTunnelErrorReporterType	INTEGER,
gmplsTunnelErrorReporterIpv4Addr	InetAddressIPv4,
gmplsTunnelErrorReporterIpv6Addr	InetAddressIPv6,
gmplsTunnelErrorProtocolCode	Unsigned32,
gmplsTunnelErrorProtocolSubcode	Unsigned32,
gmplsTunnelErrorHelpString	DisplayString

}

gmplsTunnelErrorLastError OBJECT-TYPE

SYNTAX INTEGER {

noError (0),
unknown (1),
localProtocol (2),
remoteProtocol (3),
configuration (4),
pathComputation (5),
localResources (6)

}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The nature of the last error.

Protocol errors encompass all errors that may be reported through the protocol and give a wider set of error codes than those provided here. It may be useful for an

implementation to report locally detected errors using the codes provided by the signaling protocols to give a better

diagnosis of the error.
Values in excess of 32767 are reserved for
implementation-specific error codes."
::= { gmplsTunnelErrorEntry 1 }

gmplsTunnelErrorLastTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The time at which the last error occurred.
This is presented as the value of SysUpTime
when the error occurred or was reported to
this node.

If gmplsTunnelErrorLastError has the value
noError (0), then this object is ignored."

::= { gmplsTunnelErrorEntry 2 }

gmplsTunnelErrorReporterType OBJECT-TYPE

SYNTAX INTEGER {

noError (0),

unknown (1),

localNode (2),

localIPv4 (3),

remoteIPv4 (4),

localIPv6 (5),

remoteIPv6 (6)

}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The reporter of the last error recorded.
This object is used principally to aid in
interpretation of
gmplsTunnelErrorReporterIPv4Addr and
gmplsTunnelErrorReporterIPv6Addr. Where
the error has been locally generated and
there is no requirement to associate the
error with any specific local address (such
as an interface), the value localNode (2)
may be used.

When gmplsTunnelErrorLastError has the
value noError (0), then this object should
have the value noError (0) and should be
ignored."

::= { gmplsTunnelErrorEntry 3 }

gmpIsTunnelErrorReporterIpv4Addr OBJECT-TYPE
SYNTAX InetAddressIPv4
MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The address of the node reporting the last error, or the address of the resource (such as an interface) associated with the error. This object only has meaning if the object gmplsTunnelErrorReporterType has value localIPv4 (3) or remoteIPv4 (4). Otherwise the object should contain the value zero."

::= { gmplsTunnelErrorEntry 4 }

gmplsTunnelErrorReporterIpv6Addr OBJECT-TYPE

SYNTAX InetAddressIPv6

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The address of the node reporting the last error, or the address of the resource (such as an interface) associated with the error. This object only has meaning if the object gmplsTunnelErrorReporterType has value localIPv4 (3) or remoteIPv4 (4). Otherwise the object should contain the value zero."

::= { gmplsTunnelErrorEntry 5 }

gmplsTunnelErrorProtocolCode OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The primary error code associated with the last error and the protocol used to signal this tunnel.

The relevant protocol is indicated by the gmplsTunnelSignallingProto object."

::= { gmplsTunnelErrorEntry 6 }

gmplsTunnelErrorProtocolSubcode OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The secondary error code associated with the last error and the protocol used to signal this tunnel.

The relevant protocol is indicated by the gmplsTunnelSignallingProto object."

```
::= { gmplsTunnelErrorEntry 7 }
```

```
gmplsTunnelErrorHelpString OBJECT-TYPE
```

SYNTAX DisplayString

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A textual string containing information about the last error, recovery actions and support advice. If there is no help string this object contains a zero length string."

::= { gmplsTunnelErrorEntry 8 }

-- CR-LDP Tunnel Resource Table

gmplsTunnelCRLDPResTable OBJECT-TYPE

SYNTAX SEQUENCE OF GmplsTunnelCRLDPResEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

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

::= { gmplsTeObjects 14 }

gmplsTunnelCRLDPResEntry OBJECT-TYPE

SYNTAX GmplsTunnelCRLDPResEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table represents a set of resources for tunnel established using CRLDP (gmplsTunnelSignallingProto 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 { gmplsTunnelResourceIndex }

::= { gmplsTunnelCRLDPResTable 1 }

GmplsTunnelCRLDPResEntry ::= SEQUENCE {
 gmplsTunnelCRLDPResFlags BITS,

```
    gmpIsTunnelCRLDPResRowStatus    RowStatus,  
    gmpIsTunnelCRLDPResStorageType StorageType  
}
```

gmplsTunnelCRLDPResFlags OBJECT-TYPE

```
SYNTAX BITS {  
    pdrNegotiable (0),  
    pbsNegotiable (1),  
    cdrNegotiable (2),  
    cbsNegotiable (3),  
    ebsNegotiable (4),  
    weightNegotiable (5)  
}
```

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of the Flags conveyed as part of the traffic parameters during the establishment of the CRLSP. Each flag is a Negotiable Flag corresponding to a Traffic Parameter. The Negotiable Flag value zero denotes Not Negotiable and value one denotes Negotiable."

REFERENCE

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

DEFVAL { 0 }

::= { gmplsTunnelCRLDPResEntry 1 }

gmplsTunnelCRLDPResRowStatus 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."

::= { gmplsTunnelCRLDPResEntry 2 }

gmplsTunnelCRLDPResStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This variable indicates the storage type for this table entry. When set to 'permanent', the entire row is to be stored."

::= { gmplsTunnelCRLDPResEntry 3 }

-- End of gmplsTunnelCRLDPreTable

-- Notifications.

gmplsTunnelTrapEnable OBJECT-TYPE

SYNTAX GmplsTrapEnable

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object controls the generation of gmplsTunnelUp and gmplsTunnelDown notifications. If set to disabled (0), these notifications are not emitted. If set to oneAtATime (1), each notification may only carry information about a single Tunnel that has changed state. If set to rangeAllowed (2), each notification MAY carry information about a contiguous range of Tunnels that have changed state, but note that implementations may send multiple individual notifications even when rangeAllowed is selected."

DEFVAL { disabled }

::= { gmplsTeObjects 15 }

gmplsTunnelUp NOTIFICATION-TYPE

OBJECTS {

gmplsTunnelAdminStatus,
gmplsTunnelOperStatus

}

STATUS current

DESCRIPTION

"This notification is generated when a gmplsTunnelOperStatus 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 gmplsTunnelOperStatus."

::= { gmplsTeNotifyPrefix 1 }

gmplsTunnelDown NOTIFICATION-TYPE

OBJECTS {

gmplsTunnelAdminStatus,
gmplsTunnelOperStatus

}

STATUS current

DESCRIPTION

"This notification is generated when a
gmpIsTunnelOperStatus object for one of the
configured tunnels is about to enter the

```
        down state from some other state (but not
        from the notPresent state). This other
        state is indicated by the included value of
        gmplsTunnelOperStatus."
 ::= { gmplsTeNotifyPrefix 2 }
```

```
gmplsTunnelRerouted NOTIFICATION-TYPE
```

```
OBJECTS {
    gmplsTunnelAdminStatus,
    gmplsTunnelOperStatus
}
```

```
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."
```

```
 ::= { gmplsTeNotifyPrefix 3 }
```

```
gmplsTunnelReoptimized NOTIFICATION-TYPE
```

```
OBJECTS {
    gmplsTunnelAdminStatus,
    gmplsTunnelOperStatus
}
```

```
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."
```

```
 ::= { gmplsTeNotifyPrefix 4 }
```

```
-- End of notifications.
```

```
-- Module compliance.
```

```
gmplsTeGroups
```

```
    OBJECT IDENTIFIER ::= { gmplsTeConformance 1 }
```

```
gmplsTeCompliances
```

```
    OBJECT IDENTIFIER ::= { gmplsTeConformance 2 }
```

```
gmplsTeModuleCompliance MODULE-COMPLIANCE
```

STATUS current
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 76]

```
"Compliance statement for agents that
  support the GMPLS TE MIB."
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 {
    gmplsTunnelGroup,
    gmplsTunnelScalarGroup
}

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

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

```
GROUP gmplsTunnelIsNotIntfcGroup
DESCRIPTION
    "This group is mandatory for devices which
    support tunnels that are not interfaces, in
    addition to gmplsTunnelGroup. The
    following constraints apply:
    gmplsTunnelIsIf must at least be read-only
    returning no(0)."
```

```
GROUP gmplsTunnelIsIntfcGroup
DESCRIPTION
    "This group is mandatory for devices which
    support tunnels that are interfaces, in
```

addition to gmplsTunnelGroup. The following constraints apply:
gmplsTunnelIsIf must at least be read-only

returning numbered(1)."

GROUP gmplsTunnelOptionalGroup

DESCRIPTION

"Objects in this group are optional."

GROUP gmplsTunnelCRLDPResOptionalGroup

DESCRIPTION

"Objects in this group are optional."

GROUP gmplsTeNotificationControlGroup

DESCRIPTION

"This group is mandatory for devices which support some or all of the defined notifications within this MIB."

GROUP gmplsTeNotificationGroup

DESCRIPTION

"This group is optional. If this group is supported then gmplsTeNotificationControlGroup is mandatory."

-- GMPLS Tunnel scalars.

OBJECT gmplsTunnelsConfigured

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelActive

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelTEDistProto

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelMaxHops

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

-- gmplsTunnelTable

OBJECT gmplsTunnelName

MIN-ACCESS read-only
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 78]

"Write access is not required."

OBJECT gmplsTunnelDescr

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelIsIf

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelIfIndex

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelXCPointer

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelSignallingProto

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelSetupPrio

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelHoldingPrio

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelAttributes

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelOwner

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelLocalProtectInUse

MIN-ACCESS read-only
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 79]

"Write access is not required."

OBJECT gmplsTunnelResourcePointer

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelInstancePriority

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelHopTableIndex

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelARHopTableIndex

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelCHopTableIndex

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelPrimaryInstance

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelPrimaryTimeUp

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelPathChanges

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelLastPathChange

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelCreationTime

MIN-ACCESS read-only
DESCRIPTION

Nadeau et al.

Expires July 2002

[Page 80]

"Write access is not required."

OBJECT gmplsTunnelStateTransitions

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelIncludeAnyAffinity

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelIncludeAllAffinity

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelExcludeAnyAffinity

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelPathInUse

MIN-ACCESS read-only

DESCRIPTION

"Read-only support is required."

OBJECT gmplsTunnelRole

SYNTAX INTEGER { head(1) }

MIN-ACCESS read-only

DESCRIPTION

"Only support for head is required."

OBJECT gmplsTunnelTotalUpTime

MIN-ACCESS read-only

DESCRIPTION

"Read-only support is required."

OBJECT gmplsTunnelInstanceUpTime

MIN-ACCESS read-only

DESCRIPTION

"Read-only support is required."

OBJECT gmplsTunnelAdminStatus

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

MIN-ACCESS read-only

DESCRIPTION

"Only up and down states must be supported."

Write access is not required."

Nadeau et al.

Expires July 2002

[Page 81]

OBJECT gmplsTunnelOperStatus
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 gmplsTunnelRowStatus
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 gmplsTunnelStorageType
SYNTAX INTEGER { other(1) }
MIN-ACCESS read-only
DESCRIPTION
 "Only other (1) needs to be supported."

OBJECT gmplsTunnelLSPEncoding
SYNTAX INTEGER {
 tunnelLspNotGmpls (0),
 tunnelLspPacket (1),
 tunnelLspEthernetV2Dix (2),
 tunnelLspAnsiPdh (3),
 tunnelLspEtsiPdh (4),
 tunnelLspSdhItutG7071996 (5),
 tunnelLspSonetAnsiT11051995 (6),
 tunnelLspDigitalWrapper (7),
 tunnelLspLambda (8),
 tunnelLspFiber (9),
 tunnelLspEthernet8023 (10),
 tunnelLspSdhItutG7072000 (11),
 tunnelLspSonetAnsiT11052000 (12)
}
MIN-ACCESS read-only
DESCRIPTION
 "Only tunnelLspNotGmpls (0) is required."

OBJECT gmplsTunnelLinkProtection

MIN-ACCESS read-only

DESCRIPTION

"Read-only support is required."

Nadeau et al.

Expires July 2002

[Page 82]

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

OBJECT gmplsTunnelSecondary
SYNTAX TruthValue
MIN-ACCESS read-only
DESCRIPTION
    "Only false is required."

OBJECT gmplsTunnelDirection
SYNTAX TruthValue
MIN-ACCESS read-only
DESCRIPTION
    "Only false is required."

OBJECT gmplsTunnelPathComp
SYNTAX INTEGER {
    dynamicFull(1),-- CSPF fully computed
    explicit(2),-- fully
    dynamicPartial(3) -- CSPF partially computed
}
MIN-ACCESS read-only
DESCRIPTION
    "Only explicit (2) is required."

-- gmplsTunnelHopTable

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

OBJECT gmplsTunnelHopIpv4Addr
MIN-ACCESS read-only
DESCRIPTION
    "Write access is not required."

OBJECT gmplsTunnelHopIpv4PrefixLen
MIN-ACCESS read-only
DESCRIPTION
    "Write access is not required."

OBJECT gmplsTunnelHopIpv6Addr
MIN-ACCESS read-only
DESCRIPTION
```

"Write access is not required."

Nadeau et al.

Expires July 2002

[Page 83]

OBJECT gmplsTunnelHopIpv6PrefixLen
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

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

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

OBJECT gmplsTunnelHopType
SYNTAX INTEGER { strict(1) }
MIN-ACCESS read-only
DESCRIPTION
 "loose(2) need not be supported. Write
 access is not required."

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

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

OBJECT gmplsTunnelHopRowStatus
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 gmplsTunnelHopStorageType
SYNTAX INTEGER { other(1) }
MIN-ACCESS read-only

DESCRIPTION

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

Nadeau et al.

Expires July 2002

[Page 84]

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

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

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

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

-- gmplsTunnelResourceTable

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

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

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

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

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

OBJECT gmplsTunnelResourceFrequency
MIN-ACCESS read-only

Nadeau et al.

Expires July 2002

[Page 85]

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelResourceWeight

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelResourceRowStatus

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 gmplsTunnelResourceStorageType

SYNTAX INTEGER { other(1) }

MIN-ACCESS read-only

DESCRIPTION

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

-- gmplsCRLDPResourceTable

OBJECT gmplsTunnelCRLDPResFlags

SYNTAX Unsigned32 (0..63)

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelCRLDPResRowStatus

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 gmplsTunnelCRLDPResStorageType
SYNTAX INTEGER { other(1) }

MIN-ACCESS read-only
DESCRIPTION
 "Only other (1) needs to be supported."

-- gmplsTunnelARHopTable

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

OBJECT gmplsTunnelARHopIpv4Addr
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

OBJECT gmplsTunnelARHopIpv4PrefixLen
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

OBJECT gmplsTunnelARHopIpv6Addr
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

OBJECT gmplsTunnelARHopIpv6PrefixLen
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

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

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

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

OBJECT gmplsTunnelARHopExplicitLabel
MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

Nadeau et al.

Expires July 2002

[Page 87]

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

-- glmpsTunnelCHopTable

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

OBJECT gmplsTunnelCHopIpv4Addr
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

OBJECT gmplsTunnelCHopIpv4PrefixLen
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

OBJECT gmplsTunnelCHopIpv6Addr
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

OBJECT gmplsTunnelCHopIpv6PrefixLen
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

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

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

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

OBJECT gmplsTunnelCHopLabelStatuses
MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelCHopExplicitLabel

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelCHopExplicitReverseLabel

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelCHopUnnumberedInterface

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

-- gmplsTunnelPerfTable

OBJECT gmplsTunnelPacketPerfPackets

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelPacketPerfHCPackets

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelPacketPerfErrors

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelPacketPerfBytes

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelPacketPerfHCBytes

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT gmplsTunnelPacketPerfRvsPackets

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

Nadeau et al.

Expires July 2002

[Page 89]

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

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

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

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

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

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

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

OBJECT gmplsTunnelErrorReporterIpv4Addr
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

OBJECT gmplsTunnelErrorReporterIpv6Addr
MIN-ACCESS read-only
DESCRIPTION
 "Write access is not required."

OBJECT gmplsTunnelErrorProtocolCode
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

Nadeau et al.

Expires July 2002

[Page 90]

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

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

-- gmpls Notification control

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

::= { gmplsTeCompliances 1 }

-- Units of conformance.

gmplsTunnelGroup OBJECT-GROUP
OBJECTS {
 gmplsTunnelIndexNext,
 gmplsTunnelName,
 gmplsTunnelDescr,
 gmplsTunnelXCPointer,
 gmplsTunnelOwner,
 gmplsTunnelResourcePointer,
 gmplsTunnelInstancePriority,
 gmplsTunnelIfIndex,
 gmplsTunnelHopTableIndex,
 gmplsTunnelARHopTableIndex,
 gmplsTunnelCHopTableIndex,
 gmplsTunnelPrimaryInstance,
 gmplsTunnelPrimaryTimeUp,
 gmplsTunnelCreationTime,
 gmplsTunnelStateTransitions,
 gmplsTunnelPathInUse,
 gmplsTunnelRole,
 gmplsTunnelRowStatus,
 gmplsTunnelTotalUpTime,
 gmplsTunnelInstanceUpTime,
 gmplsTunnelAdminStatus,
 gmplsTunnelOperStatus,
 gmplsTunnelStorageType,
 gmplsTunnelDirection,

gmplsTunnelPacketPerfPackets,
gmplsTunnelPacketPerfHCPackets,
gmplsTunnelPacketPerfErrors,

```
    gmplsTunnelPacketPerfBytes,
    gmplsTunnelPacketPerfHCBytes,
    gmplsTunnelPacketPerfRvsPackets,
    gmplsTunnelPacketPerfRvsHCPackets,
    gmplsTunnelPacketPerfRvsErrors,
    gmplsTunnelPacketPerfRvsBytes,
    gmplsTunnelPacketPerfRvsHCBytes,
    gmplsTunnelErrorLastError,
    gmplsTunnelErrorLastTime,
    gmplsTunnelErrorReporterType,
    gmplsTunnelErrorReporterIpv4Addr,
    gmplsTunnelErrorReporterIpv6Addr,
    gmplsTunnelErrorProtocolCode,
    gmplsTunnelErrorProtocolSubcode,
    gmplsTunnelErrorHelpString
}
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: gmplsTunnelManualGroup
    and/or gmplsTunnelSignaledGroup,
    gmplsTunnelIsNotIntfcGroup and/or
    gmplsTunnelIsIntfcGroup."
::= { gmplsTeGroups 1 }
```

```
gmplsTunnelManualGroup OBJECT-GROUP
OBJECTS { gmplsTunnelSignallingProto }
STATUS current
DESCRIPTION
    "Object(s) needed to implement manually
    configured tunnels."
::= { gmplsTeGroups 2 }
```

```
gmplsTunnelSignaledGroup OBJECT-GROUP
OBJECTS {
    gmplsTunnelSignallingProto,
    gmplsTunnelSetupPrio,
    gmplsTunnelHoldingPrio,
    gmplsTunnelAttributes,
    gmplsTunnelLocalProtectInUse,
    gmplsTunnelPathChanges,
    gmplsTunnelLastPathChange,
```

```
gmplsTunnelIncludeAnyAffinity,  
gmplsTunnelIncludeAllAffinity,  
gmplsTunnelExcludeAnyAffinity,
```

```
    gmplsTunnelRole,
    gmplsTunnelLSPEncoding,
    gmplsTunnelSwitchingType,
    gmplsTunnelLinkProtection,
    gmplsTunnelGPid,
    gmplsTunnelSecondary,
    gmplsTunnelPathComp,
    gmplsTunnelHopPathOptionIndexNextIndex,
    gmplsTunnelHopIndexNextIndex,
    gmplsTunnelHopListIndexNext,
    gmplsTunnelHopAddrType,
    gmplsTunnelHopIpv4Addr,
    gmplsTunnelHopIpv4PrefixLen,
    gmplsTunnelHopIpv6Addr,
    gmplsTunnelHopIpv6PrefixLen,
    gmplsTunnelHopAsNumber,
    gmplsTunnelHopLspId,
    gmplsTunnelHopType,
    gmplsTunnelHopIncludeExclude,
    gmplsTunnelHopPathOptionName,
    gmplsTunnelHopRowStatus,
    gmplsTunnelHopStorageType,
    gmplsTunnelHopLabelStatuses,
    gmplsTunnelHopExplicitLabel,
    gmplsTunnelHopExplicitReverseLabel,
    gmplsTunnelHopUnnumberedInterface
}
```

STATUS current

DESCRIPTION

"Objects needed to implement signaled
tunnels."

::= { gmplsTeGroups 3 }

gmplsTunnelScalarGroup OBJECT-GROUP

OBJECTS {

```
    gmplsTunnelsConfigured,
    gmplsTunnelActive,
    gmplsTunnelTEDistProto,
    gmplsTunnelMaxHops
```

}

STATUS current

DESCRIPTION

"Scalar objects needed to implement MPLS
tunnels."

::= { gmplsTeGroups 4 }

gmplsTunnelIsIntfcGroup OBJECT-GROUP

OBJECTS { gmplsTunnelIsIf }
STATUS current
DESCRIPTION

```
    "Objects needed to implement tunnels that
      are interfaces."
 ::= { gmplsTeGroups 5 }
```

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

```
gmplsTunnelOptionalGroup OBJECT-GROUP
OBJECTS {
    gmplsTunnelResourceIndexNext,
    gmplsTunnelResourceMaxRate,
    gmplsTunnelResourceMeanRate,
    gmplsTunnelResourceMaxBurstSize,
    gmplsTunnelResourceMeanBurstSize,
    gmplsTunnelResourceExcessBurstSize,
    gmplsTunnelResourceFrequency,
    gmplsTunnelResourceWeight,
    gmplsTunnelResourceRowStatus,
    gmplsTunnelResourceStorageType,
    gmplsTunnelARHopAddrType,
    gmplsTunnelARHopIpv4Addr,
    gmplsTunnelARHopIpv4PrefixLen,
    gmplsTunnelARHopIpv6Addr,
    gmplsTunnelARHopIpv6PrefixLen,
    gmplsTunnelARHopAsNumber,
    gmplsTunnelARHopLspId,
    gmplsTunnelARHopLabelStatuses,
    gmplsTunnelARHopExplicitLabel,
    gmplsTunnelARHopExplicitReverseLabel,
    gmplsTunnelARHopUnnumberedInterface,
    gmplsTunnelARHopProtection,
    gmplsTunnelCHopAddrType,
    gmplsTunnelCHopIpv4Addr,
    gmplsTunnelCHopIpv4PrefixLen,
    gmplsTunnelCHopIpv6Addr,
    gmplsTunnelCHopIpv6PrefixLen,
    gmplsTunnelCHopAsNumber,
    gmplsTunnelCHopLspId,
    gmplsTunnelCHopType,
    gmplsTunnelCHopLabelStatuses,
    gmplsTunnelCHopExplicitLabel,
    gmplsTunnelCHopExplicitReverseLabel,
```

```
    gmplsTunnelCHopUnnumberedInterface
}
STATUS current
```

DESCRIPTION

"The objects in this group are optional."
::= { gmplsTeGroups 7 }

gmplsTunnelCRLDPResOptionalGroup OBJECT-GROUP

OBJECTS {
 gmplsTunnelCRLDPResFlags,
 gmplsTunnelCRLDPResRowStatus,
 gmplsTunnelCRLDPResStorageType
}

STATUS current

DESCRIPTION

"Set of objects implemented for resources
 applicable for tunnels signaled using CR-
 LDP."
::= { gmplsTeGroups 8 }

gmplsTeNotificationControlGroup OBJECT-GROUP

OBJECTS {
 gmplsTunnelTrapEnable
}

STATUS current

DESCRIPTION

"Set of objects implemented for control of
 notifications."
::= { gmplsTeGroups 9 }

gmplsTeNotificationGroup NOTIFICATION-GROUP

NOTIFICATIONS {
 gmplsTunnelUp,
 gmplsTunnelDown,
 gmplsTunnelRerouted,
 gmplsTunnelReoptimized
}

STATUS current

DESCRIPTION

"Set of notifications implemented in this
 module. None is mandatory, but if this
 group is included, the
 gmplsTeNotificationControlGroup is
 mandatory."
::= { gmplsTeGroups 10 }

END

[13.](#) 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.

There are a number of managed objects in this MIB that may contain information that may be sensitive from a business perspective, in that they represent a customer's interface to the MPLS network.

Allowing uncontrolled access to these objects could result in malicious and unwanted disruptions of network traffic or incorrect configurations for these customers. There are no objects that are particularly sensitive in their own right, such as passwords or monetary amounts.

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.

At this writing, no security holes have been identified beyond those that SNMP Security [SNMPArch] is itself intended to address. These relate to primarily controlled access to sensitive information and the ability to configure a device - or which might result from operator error, which is beyond the scope of any security architecture.

SNMPv1 or SNMPv2 are by themselves not a secure environment. Even if the network itself is secure (for example by using IPsec [IPSEC]), 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 [SNMPv3USM] and the View-based Access Control [SNMPv3VACM] 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.

14. Acknowledgments

Nadeau et al.

Expires July 2002

[Page 96]

This draft is based heavily on [[TEMIB](#)]. The authors would like to express their gratitude to all those who worked on that earlier MIB.

Thanks also to Tony Zinicola and Jeremy Crossen for their valuable contributions.

[15.](#) References

[15.1.](#) Normative References

- [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.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Textual Conventions for SMIV2", STD 58, [RFC 2579](#), April 1999.
- [RFC2863] McCloghrie, K. and F. Kastenholtz, "The Interfaces Group MIB", [RFC 2863](#), June 2000.
- [RFC3032] Rosen, E., Rekhter, Y., Tappan, D., Farinacci, D., Federokow, G., Li, T., and A. Conta, "MPLS Label Stack Encoding", [RFC 3032](#), January 2001.
- [RFC3036] Anderson, L., Doolan, P., Feldman, N., Fredette, A., and B. Thomas, "LDP Specification", [RFC 3036](#), January 2001.
- [RSVPTE] 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.
- [CRLDP] Jamoussi, B., Aboul-Magd, O., Andersson, L., Ashwood-Smith, P., Hellstrand, F.,

Sundell, K., Callon, R., Dantu, R., Wu, L.,
Doolan, P., Worster, T., Feldman, N.,

Fredette, A., Girish, M., Gray, E., Halpern, J., Heinanen, J., Kilty, T., Malis, A., and P. Vaananen, "Constraint-Based LSP Setup using LDP", [draft-ietf-mpls-cr-ldp-06.txt](#), November 2001, work in progress."

- [GMPLSArch] Ashwood-Smith, P., Awduche, D., Banerjee, A., Basak, D., Berger, L., Bernstein, G., Drake, J., Fan, Y., Fedyk, D., Grammel, D., Kompella, K., Kullberg, A., Lang, J., Liaw, F., Papadimitriou, D., Pendarakis, D., Rajagopalan, B., Rekhter, Y., Saha, D., Sandick, H., Sharma, V., Swallow, G., Tang, Z., Yu, J., Zinin, A., Nadeau, T., Mannie, E., Generalized Multiprotocol Label Switching (GMPLS) Architecture, Internet Draft <[draft-many-gmpls-architecture-01.txt](#)>, March 2001, work in progress.
- [GMPLSSig] Ashwood-Smith, P., Awduche, D., Banerjee, A., Basak, D., Berger, L., Bernstein, G., Drake, J., Fan, Y., Fedyk, D., Grammel, D., Kompella, K., Kullberg, A., Lang, Rajagopalan, B., Rekhter, Y., Saha, D., Sharma, V., Swallow, G., Bo Tang, Z., Generalized MPLS - Signaling Functional Description, <[draft-ietf-mpls-generalized-signaling-04.txt](#)>, May 2001, work in progress.
- [GMPLSCRLDP] Ashwood-Smith, P., Awduche, D., Banerjee, A., Basak, D., Berger, L., Bernstein, G., Drake, J., Fan, Y., Fedyk, D., Grammel, D., Kompella, K., Kullberg, A., Lang, Rajagopalan, B., Rekhter, Y., Saha, D., Sharma, V., Swallow, G., Bo Tang, Z., Generalized MPLS Signaling - CR-LDP Extensions, Internet Draft <[draft-ietf-mpls-generalized-cr-ldp-03.txt](#)>, May 2001, work in progress.
- [GMPLSRVPTE] Ashwood-Smith, P., Awduche, D., Banerjee, A., Basak, D., Berger, L., Bernstein, G., Drake, J., Fan, Y., Fedyk, D., Grammel, D., Kompella, K., Kullberg, A., Lang, Rajagopalan, B., Rekhter, Y., Saha, D.,

Sharma, V., Swallow, G., Bo Tang, Z.,
Generalized MPLS Signaling - RSVP-TE
Extensions, Internet Draft <[draft-ietf-mpls-](#)

generalized-rsvp-te-03.txt>, May 2001, work in progress.

- [GMPLSSonetSDH] Mannie, E., Ansorge, S., Ashwood-Smith, P., Banerjee, A., Berger, L., Bernstein, G., Chiu, A., Drake, J., Fan, Y., Fontana, M., Grammel, G., Heiles, J., Katukam, S., Kompella, K., Lang, J. P., Liaw, F., Lin, Z., Mack-Crane, B., Papadimitriou, D., Pendarakis, D., Raftelis, M., Rajagopalan, B., Rekhter, Y., Saha, D., Sharma, V., Swallow, G., Bo Tang, Z., Varma, E., Vischers, M., Xu, Y., GMPLS Extensions for SONET and SDH Control, Internet Draft <[draft-ietf-ccamp-gmpls-sonet-sdh-00.txt](#)>, May 2001, work in progress.
- [TCMIB] Nadeau, T., Cucchiara, J., Srinivasan, C, Viswanathan, A. and H. Sjostrand, "Definition of Textual Conventions and OBJECT-IDENTITIES for Multiprotocol Label Switching (MPLS) Management", Internet Draft <[draft-ietf-mpls-tc-mib-03.txt](#)>, January 2002, work in progress.
- [TEMIB] Nadeau, T., Srinivasan, C, Viswanathan, A., "Multiprotocol Label Switching (MPLS) Traffic Engineering Management Information Base", Internet Draft <[draft-ietf-mpls-te-mib-08.txt](#)>, January 2002, work in progress.
- [LSRMIB] Srinivasan, C., Viswanathan, A. and T. Nadeau, "MPLS Label Switching Router Management Information Base Using SMiv2", Internet Draft <[draft-ietf-mpls-lsr-mib-08.txt](#)>, January 2002, work in progress.
- [LABELMIB] Nadeau, T., Srinivasan, C., Farrel, A., Hall, T., and Harrison, E., "Generalized Multiprotocol Label Switching (GMPLS) Label Management Information Base", [draft-nadeau-ccamp-gmpls-label-mib-01.txt](#), January 2002, work in progress.
- [GMPLSLSRMIB] Nadeau, T., Srinivasan, C., A., Farrel, A., Hall, T., and Harrison, E., "Generalized

Multiprotocol Label Switching (GMPLS) Label
Switching Router Management Information
Base", [draft-nadeau-ccamp-gmpls-lsr-mib-](#)

01.txt, January 2002, work in progress.

15.2. Informational References

- [RFC1155] Rose, M., and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based Internets", [RFC 1155](#), May 1990.
- [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.
- [RFC2514] Noto, et. al., "Definitions of Textual Conventions and OBJECT-IDENTITIES for ATM Management", [RFC 2514](#), Feb. 1999
- [RFC2515] K. Tesink, "Definitions of Managed Objects for ATM Management", [RFC 2515](#), Feb. 1999
- [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.
- [RFC2580] McCloghrie, K., Perkins, D., Schoenwaelder,
J., Case, J., Rose, M., and S. Waldbusser,
"Conformance Statements for SMIv2", STD 58,
[RFC 2580](#), April 1999.
- [RFC3031] Rosen, E., Viswanathan, A., and R. Callon,
"Multiprotocol Label Switching
Architecture", [RFC 3031](#), August 1999.
- [RFC3034] Conta, A., Doolan, P., Malis, A., "Use of
Label Switching on Frame Relay Networks
Specification", [RFC 3034](#), January 2001.
- [RFC3035] Davie, B., Lawrence, J., McCloghrie, K.,
Rosen, E., Swallow, G., Rekhter, Y., and P.
Doolan, "MPLS using LDP and ATM VC
switching", [RFC 3035](#), January 2001.
- [IANAFamily] Internet Assigned Numbers Authority (IANA),
ADDRESS FAMILY NUMBERS.

16. Authors' Addresses

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

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

Nadeau et al.

Expires July 2002

[Page 101]

Cheenu Srinivasan
Parama Networks, Inc.
1030 Broad Street
Shrewsbury, NJ 07702
Phone: +1-732-544-9120 x731
Email: cheenu@paramanet.com
Adrian Farrel
Movaz Networks, Inc.
7926 Jones Branch Drive, Suite 615
McLean VA, 22102 USA
Phone: +1-703-847-9847
Email: afarrel@movaz.com

Tim Hall
Data Connection Ltd.
100 Church Street
Enfield, Middlesex
EN2 6BQ, UK
Phone: +44 20 8366 1177
Email: timhall@dataconnection.com

Edward Harrison
Data Connection Ltd.
100 Church Street
Enfield, Middlesex
EN2 6BQ, UK
Phone: +44 20 8366 1177
Email: eph@dataconnection.com

17. Full Copyright Statement

Copyright (C) The Internet Society (2002). 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.

