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MPLS-TP Identifiers
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Abstract

This document specifies identifiers for MPLS-TP objects. Included are identifiers conformant to existing ITU conventions and identifiers which are compatible with existing IP, MPLS, GMPLS, and Pseudowire definitions.

Status of this Memo

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Table of Contents

1. Introduction

This document specifies identifiers to be used in within the Transport Profile of Multiprotocol Label Switching (MPLS-TP) for point to point connections. The MPLS-TP requirements (RFC 5654) [12] require that the elements and objects in an MPLS-TP environment are able to be configured and managed without a control plane. In such an environment many conventions for defining identifiers are possible. This document defines identifiers for MPLS-TP management and OAM functions suitable to ITU conventions and to IP/MPLS conventions. Applicability of the different identifier schemas to different applications are outside the scope of this document.

Comment [M1]: Identifiers for point to multi point connections are not in this document.

1.1. Terminology

AII: Attachment Interface Identifier

~~AP: Attachment Point~~

Comment [M2]: This abbreviation is not used

ASN: Autonomous System Number

FEC: Forwarding Equivalence Class

GMPLS: Generalized Multi-Protocol Label Switching

ICC: ITU Carrier Code

LSP: Label Switched Path

LSR: Label Switching Router

ME: Maintenance Entity

MEG: Maintenance Entity Group

MEP: Maintenance Entity Group End Point

MIP: Maintenance Entity Group Intermediate Point

MPLS: Multi-Protocol Label Switching

OAM: Operations, Administration and Maintenance

P2MP: Point to Multi-Point

P2P: Point to Point

PW: Pseudowire

RSVP: Resource Reservation Protocol

RSVP-TE: RSVP Traffic Engineering

S-PE: Switching Provider Edge

T-PE: Terminating Provider Edge

1.2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [1].

1.3. Notational Conventions in Backus-Naur Form

All multiple-word atomic identifiers use underscores (_) between the words to join the words. Many of the identifiers are composed of a concatenation of other identifiers. These are expressed using Backus-Naur Form (using double-colon - "::" - notation).

Where the same identifier type is used multiple times in a concatenation, they are qualified by a prefix joined to the identifier by a dash (-). For example Src-Node_ID is the Node_ID of a node referred to as Src (where "Src" is short for "source" in this example).

The ~~notation does not define an implicit~~ ordering of the information elements involved in a concatenated identifier MUST be as defined in this document.

Comment [M3]: The order must be defined to allow processing of the identifiers.

2. Named Entities

In order to configure, operate and manage a transport network based on the MPLS Transport Profile, a number of entities require identification. Identifiers for the follow entities are defined in this document:

- Operator
  - Global_ID
  - ICC
- LSR
- LSP

- o PW
- o Interface
- o MEG
- o MEP
- o MIP
- o Tunnel

Note that we have borrowed the term tunnel from RSVP-TE (RFC 3209) [2] where it is used to describe an entity that provides a ~~connection~~logical association between a source and destination LSR. The tunnel in turn is instantiated by one or more LSPs, where the additional LSPs are used for protection or re-grooming of the tunnel.

Comment [M4]: Use of the term connection implies that the tunnel can directly support user traffic.

3. Uniquely Identifying an Operator

The operator is uniquely identified by the Operator ID which can be in a format that is either ~~Two forms of identification are defined, one that is~~ compatible with IP operational practice called a Global_ID ~~and~~ or one compatible with ITU practice, the ICC. ~~An~~ The Operator ID ~~MAY~~ MUST ~~be~~ use ~~identified~~ either ~~by~~the Global_ID or ~~by~~ the ICC format.

In cases where the unique identifiers are concatenated (e.g. across an interface between operators) each side can select either format for the Operator ID

Comment [M5]: Needs a major revision to fully include the use of the ICC format as well as the Global_ID in the remainder of the document:

Proposed solution, define Operator_ID (as show) and replace Global_ID with Operator_ID in the following sections. Note: This change has not been implemented in these comments.

3.1. The Global ID

RFC 5003 [3] defines a globally unique Attachment Interface Identifier (AII). That AII is composed of three parts, a Global_ID which uniquely identifies a operator, a prefix, and finally and attachment circuit identifier. We have chosen to use that Global ID for MPLS-TP. Quoting from RFC 5003, section 3.2, "The global ID can contain the 2-octet or 4-octet value of the operator's Autonomous System Number (ASN). It is expected that the global ID will be derived from the globally unique ASN of the autonomous system hosting the PEs containing the actual AIIs. The presence of a global ID based on the operator's ASN ensures that the AII will be globally unique."

Comment [M6]: 1) This text makes use of the ASN optional: How can we be sure that the global ID is unique?
2) Even if the ASN is used how can we be sure the global ID is unique unless the method of derivation is defined?

When the Global_ID is derived from a 2-octet AS number, the two high-order octets of this 4-octet identifier MUST be set to zero.

Note that this Global_ID is used solely to provide a globally unique context for other MPLS-TP identifiers. It has nothing to do with the use of the ASN in protocols such as BGP.

Comment [M7]: Does this imply that the node will have (at least) two ASNs if it also supports (e.g.) BGP?

3.2. ITU Carrier Code

M.1400 defines the ITU Carrier Code (ICC) assigned to a network operator/service provider and maintained by the ITU-T Telecommunication Standardization Bureau (TSB): www.itu.int/ITU-T/inr/icc/index.html.

ICCs can be assigned both to ITU-T and non-ITU-T members and the referenced local ICC website may contain ICCs of operators of both kinds.

The ICC is a string of one to six characters, each character being either alphabetic (i.e. A-Z) or numeric (i.e. 0-9) characters. Alphabetic characters in the ICC SHOULD be represented with upper case letters.

4. Node and Interface Identifiers

An LSR requires identification of the node itself and of its interfaces. An interface is the ~~Access Point (AP)~~attachment point to a server layer MPLS-TP section or MPLS-TP tunnel.

We call the identifier associated with a node a Node Identifier (Node_ID). The Node_ID is a unique 32-bit value assigned by the operator within the scope of the Global_ID. A LSR can support multiple layers and the Node ID belongs to the multiple layer context i.e. it is applicable to all LSPs or PWs that originate on or transit the node. The structure of the Node ID is operator specific and is outside the scope of this document. The value zero is reserved and MUST NOT be used. Where IPv4 addresses are used for forwarding user traffic, it is convenient to use the Node's IPv4 loopback address as the Node_ID, however the Node_ID does not need to have any association with the IPv4 address space used in the operator's IGP or BGP. Where IPv6 addresses are used exclusively, a ~~domain unique~~ 32- bit value that unique within the scope of the Global ID is assigned

In situations where a Node_ID needs to be globally unique, this is accomplished by prefixing the identifier with the operator's Global_ID. The combination of Global_ID::Node_ID we call an Global Node ID or Global_Node_ID.

Within the context of a particular node, we call the identifier associated with an interface an Interface Number or IF_Num. The IF_Num is a 32-bit unsigned integer assigned by the operator and MUST be unique within the scope of a Node_ID. The IF_Num value 0 has special meaning and MUST NOT be used ~~as the IF_Num into~~ identify an MPLS-TP ~~IF_ID~~interface. An interface has a layer context and IF Num identifies a particular (sub) layer and (sub) layer instance.

An Interface Identifier or IF_ID identifies an interface uniquely within the context of a Global_ID. It is formed by concatenating the Node_ID with the IF_Num. That is an IF_ID is a 64-bit identifier

Comment [M8]: This change aligns this text with use of "attachment point" in the last paragraph of this section. It also avoids the potential for confusion with the term Access Point defined in G.805.

Comment [M9]: To clarify that the Node_ID applies to all layers/sub-layers

Comment [M10]: Clarifies that the definition of the format is out of scope.

Comment [M11]: In a Packet Transport Network a node may only use IPv4 for the DCN and linking this to a data plane identifier may cause problems.

Comment [M12]: Is this the same as the scope of the Global_ID mentioned above

Comment [M13]: The value 0 is used to identify a per node MIP (see 7.3)

Comment [M14]: Clarifies that the IF_Num is per layer not per physical interface.

formed as Node_ID::IF_Num.

This convention was chosen to allow compatibility with GMPLS. GMPLS signaling [4] requires interface identification. GMPLS allows three formats for the Interface_ID. The third format consists of an IPv4 Address plus a 32-bit unsigned integer for the specific interface. The format defined for MPLS-TP is consistent with this format, but uses the Node_ID instead of an IPv4 Address.

~~An~~ If an IF_ID needs to be globally unique, this is accomplished by prefixing the identifier with the operator's Global_ID. The combination of Global_ID:: ~~Node_ID::~~IF_~~Num~~ ID we call an Global Interface ID or Global_IF_ID.

The attachment point to an MPLS-TP Tunnel (see section Section 5.1 also needs an interface identifier. A procedure for automatically generating these is contained in that section.

5. MPLS-TP Tunnel and LSP Identifiers

An important construct within MPLS_TP is a service that may be identified by the server to a client, ideally using a single identifier. For example bi-direction service supported by a pair of uni-directional LSPs also ~~Such~~ a service may be provided ~~across a~~by working and ~~a~~ protection LSPs, ~~both~~ all of which should be similarly identified. Within this document we will use the term "MPLS-TP Tunnel" or simply "tunnel" for a (for example) a bi-directional service provided by two uni-directional LSPs or service provided by (for example) ~~a~~ working and protection LSPs. This section defines an MPLS-TP Tunnel_ID to uniquely identify a tunnel and MPLS-TP LSP_IDs within the context of that tunnel.

For the case where multiple LSPs (for example) are used to support a single service with a common set of end-points, using this identifier allows for a trivial mapping between the server and client layers to a common service identifier which may be either defined by, or used by, the client.

Note that this usage is not intended to constrain protection schemes, and may be used to identify any service (protected or un-protected) that may appear to the client as a single service attachment point. Keeping the tunnel number consistent across working and protection LSPs is a useful construct currently employed within GMPLS. However there is no requirement that a protection LSP use the same tunnel number as the working LSP.

Comment [M15]: Clarify that global uniqueness is not always required

Comment [M16]: IF_ID is already defined as Node_ID::IF_Num

Comment [M17]: This also be a bi-directional service in which case the tunnel would contain a pair of unidirectional LSPs.

Comment [M18]: Does this also apply to restoration: If so replace “protection” with “recovery”.

5.1. MPLS-TP Point to Point Tunnel Identifiers

At each endpoint a tunnel is uniquely identified by the endpoint's Node_ID and a locally assigned tunnel number. Specifically a Tunnel_Num is a 16-bit unsigned integer unique within the context of the ~~node~~Node_ID. The motivation for each endpoint having its own tunnel number is to allow a compact form for the MEP-ID. See section Section 7.1.2.1.

~~Having two tunnel-ids also serves to simplify other signaling. For instance an associated bi-directional tunnel could be setup using two unidirectional tunnels signaled via RSVP.~~

The concatenation of the two endpoint identifiers serves as the full identifier. ~~In a signaled situation, the node originating the signaling exchange is called the source and the target node is called the destination. In a configured environment the endpoints could equally be called East and West. Using the signaled convention and abbreviating the endpoint qualifiers to Src and Dst respectively,~~ This concatenation is defined according to the A-Z convention, where the A side is associated with the lower Node ID and the Z side is associated with the higher Node ID the format of the format of a Tunnel_ID is:

~~Src~~A-Node_ID::~~Src~~A-Tunnel_Num::~~Dst~~Z-Node_ID::~~Dst~~Z-Tunnel_Num

Having two tunnel-ids also serves to simplify other signaling. For instance an associated bi-directional tunnel could be setup using two unidirectional tunnels signaled via RSVP.

Where the Tunnel_ID needs to be globally unique, this is accomplished by using globally unique Node_IDs as defined above. Thus a globally unique Tunnel_ID becomes:

Src-Global_Node_ID::Src-Tunnel_Num::Dst-Global_Node_ID::
Dst-Tunnel_Num

When an MPLS-TP Tunnel is configured, it MUST be assigned a unique IF_ID at both the source and destination endpoints. As usual, the IF_ID is composed of the local NODE_ID concatenated with a 32-bit IF_Num. It is RECOMMENDED that the IF_Num be auto-generated by adding 2^31 to the local Tunnel_Num.

5.2. MPLS-TP LSP Identifiers

Within the scope of an MPLS-TP Tunnel_ID an LSP can be uniquely identified by a single LSP number. Specifically an LSP_Num is a 16-bit unsigned integer unique within the Tunnel_ID. Thus the format of a LSP_ID is:

Src-Node_ID::Src-Tunnel_Num::Dst-Node_ID::Dst-Tunnel_Num::LSP_Num

Where the LSP_ID needs to be globally unique, this is accomplished by using globally unique Node_IDs as defined above. Thus a globally unique ~~Tunnel~~LSP_ID becomes:

Comment [M19]: More precise

Comment [M20]: Moved to after Tunnel_ID is defined.

Comment [M21]: This convention is confusing since it use using a control plane concept in the data plane, an unambiguous ordered convention is preferable. If this proposal is accepted then Src and Dst should be changed to A and Z in the remainder of the document.

Comment [M22]: The Tunnel_ID is unique without this, suggest deletion of this element from the Tunnel_ID

Comment [M23]: How do we get the second Tunnel_ID? This contradicts the statement at the begining of section 5. Should tunnel-id be replaced with Tunnel_Num?

Comment [M24]: How are tunnels for co-routed bidirectional LSPs named?

Comment [M25]: This makes three Tunnel_IDs. Please explain

Comment [M26]: Comments [m23], [m24] and [m25] originate from the lack of clarity in the text about the differences between the data plane Tunnel concept (as defined in section 2) and the RSVP-TE Tunnel concept (as defined in RFC 3209) in the control plane.

Proposed resolution: Replace this paragraph with: "Having two tunnel numbers also serves to simplify other signalling (e.g., setup of associated bi-directional tunnels as described in section 5.3)". The text could then be restored to the original location

It is also proposed that section 5.3 is enhanced describing the RSVP_TE setup for both co-routed and associated bidirectional tunnels.

Comment [M27]: Should be LSP

Src-Global_Node_ID::Src-Tunnel_Num::Dst-Global_Node_ID::
Dst-Tunnel_Num::LSP_Num

The corresponding ICC-based version of this identifier would be:

Src-ICC::Src-Node_ID::Src-Tunnel_Num::Dst-ICC::Dst-Tunnel_Num::LSP_Num

Comment [M28]: The Node_ID is missing. If the proposal to change of Global_ID to Operator_ID is adopted this paragraph can be deleted.

5.3. Mapping to GMPLS Signalling

Comment [M29]: Based on a previous comment, this section needs further improvement to describe the GMPLS signalling of both co-routed and associated bidirectional LSPs.

This section defines the mapping from an MPLS-TP LSP_ID to GMPLS. At this time, GMPLS has yet to be extended to accommodate Global_IDs. Thus a mapping is only made for the network unique form of the LSP_ID.

GMPLS signaling [5] uses a 5-tuple to uniquely identify an LSP within a operator's network. This tuple is composed of a Tunnel Endpoint Address, Tunnel_ID, Extended Tunnel ID, and Tunnel Sender Address and (GMPLS) LSP_ID.

In situations where a mapping to the GMPLS 5-tuple is required, the following mapping is used.

- Tunnel Endpoint Address = Dst-Node_ID
- Tunnel_ID = Src-Tunnel_Num
- Extended Tunnel_ID = Src-Node_ID
- Tunnel Sender Address = Src-Node_ID
- LSP_ID = LSP_Num

6. Pseudowire Path Identifiers

Comment [M30]: The section needs to distinguish between data plane and control plane identifiers for a PW (as in section 5 for LSP identifiers).

Pseudowire signaling (RFC 4447 [6]) defines two FECs used to signal pseudowires. Of these, FEC Type 129 along with AII Type 2 as defined in RFC 5003 [3] fits the identification requirements of MPLS-TP.

In an MPLS-TP environment, a PW is identified by a set of identifiers which can be mapped directly to the elements required by FEC 129 and AII Type 2. To distinguish this identifier from other Pseudowire Identifiers, we call this a Pseudowire Path Identifier or PW_Path_Id.

Comment [M31]: It is not clear why other PW FEC types (e.g., FEC 128) are not allowed/supported in MPLS-TP

The AII Type 2 is composed of three fields. These are the Global_ID, the Prefix, and the AC_ID. The Global_ID used in this document is identical to the Global_ID defined in RFC 5003. The Node_ID is used as the Prefix. The AC_ID is as defined in RFC 5003.

To complete the FEC 129, all that is required is a Attachment Group Identifier (AGI). That field is exactly as specified in RFC 4447. FEC 129 has a notion of Source AII (SAII) and Target AII (TAII). These terms are used relative to the direction of the signaling. In a purely configured environment when referring to the entire PW, this distinction is not critical. That is a FEC 129 of AGIa::AIIb::AIIc is equivalent to AGIa::AIIc::AIIb. We note that in a signaled environment, the required convention in RFC 4447 is that at a particular endpoint, the AII associated with that endpoint comes first. The complete PW_Path_Id is:

```
AGI::Src-Global_ID::Src-Node_ID::Src-AC_ID::Dst-Global_ID::
Dst-Node_ID::Dst-AC_ID.
```

The corresponding ICC-based version for this identifier would be:

```
AGI::Src-ICC::Src-Node_ID::Src-AC_ID::Dst-ICC::Dst-Node_ID::
Dst-AC_ID
```

7. Maintenance Identifiers

In MPLS-TP a Maintenance Entity Group (MEG) represents an Entity that requires management and defines a relationship between a set of maintenance points. A maintenance point is either Maintenance Entity Group End-point (MEP) or a Maintenance Entity Group Intermediate Point (MIP). Maintenance points are uniquely associated with a MEG. Within the context of a MEG, MEPs and MIPs must be uniquely identified. This section defines a means of uniquely identifying Maintenance Entity Groups, Maintenance Entities and uniquely defining MEPs and MIPs within the context of a Maintenance Entity Group.

Note that depending on the requirements of a particular OAM interaction, the MPLS-TP maintenance entity ~~context~~ group may be provided either explicitly using the MEG_IDs described above or implicitly by the label of the received OAM message.

7.1. Maintenance Entity Group Identifiers

Maintenance Entity Group Identifiers (MEG_IDs) are required for MPLS-TP LSPs and Pseudowires. Two classes of MEG_IDs are defined, one that follows the IP compatible identifier defined above as well as the ICC-format. One of these formats MUST be used.

7.1.1. ICC-based MEG Identifiers

MEG_ID for MPLS-TP LSPs and Pseudowires MAY use the globally unique ICC-based format.

Comment [M32]: As in the LSP case, an ordered naming convention would be preferable and unambiguous (e.g., A and Z sides).

Comment [M33]: Why is the AGI needed to identify the PW?

Comment [M34]: Not sure what "context" means

Comment [M35]: Current text implies that both are optional.

In this case, the MEG_ID is a string of up to thirteen characters, each character being either alphabetic (i.e. A-Z) or numeric (i.e. 0-9) characters. It consists of two subfields: the ICC (as defined in section 3) followed by a unique MEG code (UMC). The UMC MUST be unique within the organization identified by the ICC.

The ICC MEG_ID may be applied equally to a single MPLS-TP LSP or Pseudowires. Note that when encoded in a protocol such as in a TLV, a different type needs to be defined for LSP and PWs as the OAM capabilities may be different.

7.1.2. IP Compatible MEG_IDs

7.1.2.1. MPLS-TP LSP MEG_IDs

Since a MEG pertains to a single MPLS-TP LSP, IP compatible MEG_IDs for MPLS-TP LSPs are simply the corresponding LSP_IDs. We note that while the two identifiers are syntactically identical, they have different semantics. This semantic difference needs to be made clear. For instance if both a MPLS-TP LSP_ID and MPLS-TP LSP MEG_IDs are to be encoded in TLVs different types need to be assigned for these two identifiers.

7.1.2.2. Pseudowire MEG_IDs

For Pseudowires a MEG pertains to a single PW. The IP compatible MEG_ID for a PW is simply the corresponding PW_Path_ID. We note that while the two identifiers are syntactically identical, they have different semantics. This semantic difference needs to be made clear. For instance if both a PW_Path_ID and a PW_MEG_ID is to be encoded in TLVs different types need to be assigned for these two identifiers.

7.2. MEP_IDs

7.2.1. ICC-based MEP Identifiers

ICC-based MEP_IDs for MPLS-TP LSPs and Pseudowires are formed by appending a unique number to the MEG_ID defined in section Section 7.1.1 above. Within the context of a particular MEG, we call the identifier associated with a MEP the MEP Index (MEP_Index). The MEP_Index is administratively assigned. It is encoded as a 16-bit unsigned integer and MUST be unique within the MEG. An ICC-based MEP_ID is:

```
MEG_ID::MEP_Index
```

An ICC-based MEP ID is globally unique by construction given the ICC-based MEG_ID global uniqueness.

7.2.2. IP based MEP_IDs

7.2.2.1. MPLS-TP LSP_MEP_ID

In order to automatically generate MEP_IDs for MPLS-TP LSPs, we use the elements of identification that are unique to an endpoint. This ensures that MEP_IDs are unique for all LSPs within a operator. When Tunnels or LSPs cross operator boundaries, these are made unique by pre-pending them with the operator's Global_ID.

The MPLS-TP LSP_MEP_ID is

Node_ID::Tunnel_Num::LSP_Num,

where the Node_ID is the node in which the MEP is located and Tunnel_Num is the tunnel number unique to that node.

In situations where global uniqueness is required this becomes:

Src-Global_ID::Src-Node_ID::Src-Tunnel_Num::LSP_Num

7.2.2.2. MEP_IDs for Pseudowires

Like MPLS-TP LSPs, Pseudowire endpoints (T-PEs) require MEP_IDs. In order to automatically generate MEP_IDs for PWs, we simply use the AGI plus the AII associated with that end of the PW. Thus a MEP_ID used in end-to-end for an Pseudowire T-PE takes the form

AGI:Src-Global_ID::Src-Node_ID::Src-AC_ID,

where the Node_ID is the node in which the MEP is located and ~~Tunnel_Num~~AC_ID is the ~~tunnel~~ AC number unique to that node.

7.2.2.3. Endpoint IDs Pseudowire Segments

In some OAM communications, messages are originated by the node at one end of a PW segment and relayed to the other end of that same segment by setting the TTL of the PW label to one (1). For a multi-segment pseudowire, TTL could be set to any value that would cause OAM messages to reach the target segment end-point (up to and including 255).

The MEP_ID ~~Is~~ is ~~Formed~~ formed by a combination of a PW MEP_ID and the identification of the local node. At an S-PE, there are two PW segments. We distinguish the segments by using the MEP_ID which is upstream of the PW segment in question. To complete the

Comment [M36]: Should be AC_ID

Comment [M37]: Please align with the OAM framework - S-PE can only support a MIP

Comment [M38]: editorial

identification we suffix this with the identification of the local node.

```
   +--------+         +--------+         +--------+         +--------+
   |        |         |        |         |        |         |        |
   |       A|---------|B      C|---------|D      E|---------|F       |
   |        |         |        |         |        |         |        |
   +--------+         +--------+         +--------+         +--------+
    (T)PE1             (S)PE2             (S)PE3             (T)PE4
```

Pseudowire Maintenance Points

For example, suppose that in the above figure all of the nodes have Global_ID GID1; the node are represented as named in the figure; and The identification for the Pseudowire is:

```
AGI           = AGI1
Src-Global_ID = GID1
Src-Node_ID   = PE1
Src-AC_ID     = AII1
Dst-Global_ID = GID1
Dst-Node_ID   = PE4
Dst-AC_ID     = AII4
```

The PW segment endpoint MEP_ID at point A would be -

AGI1::GID1::PE1::AII1

The MP_ID at point C would be -

AGI1::GID1::PE1::AII1::GID1::PE2

7.3. MIP Identifiers

At a cross-connect point, in order to automatically generate MIP_IDs for MPLS-TP, we simply use the IF_IDs of the two interfaces which are cross-connected via the label bindings of the MPLS-TP LSP. This allows, two MIPs to be independently identified in one node where a per-interface MIP model is used. If ~~only~~a per node MIP model is used then one MIP is configured~~, then~~. In this case the MIP_ID is formed using the Node_ID and an IF_Num of 0. ~~In some contexts, such as LSP Ping[13], the Node_ID alone may be used as the MIP_ID.~~

Comment [M39]: This change aligns the text with the models defined in the OAM framework

The MPLS-TP LSP MIP ID is

Node_ID::IF_Num

In situations where global uniqueness is required this becomes:

Global_Node_ID::IF_Num

8. IANA Considerations

There are no IANA actions resulting from this document.

9. Security Considerations

This document describes an information model and, as such, does not introduce security concerns. Protocol specifications that describe use of this information model - however - may introduce security risks and concerns about authentication of participants. For this reason, the writers of protocol specifications for the purpose of describing implementation of this information model need to describe security and authentication concerns that may be raised by the particular mechanisms defined and how those concerns may be addressed.

10. References

10.1. Normative References

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