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**MPLS-TP Identifiers Following ITU-T Conventions**  
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Abstract

This document specifies an extension to the identifiers to be used in the Transport Profile of Multiprotocol Label Switching (MPLS-TP). Identifiers that follow IP/MPLS conventions have already been defined. This memo augments that set of identifiers for MPLS-TP management and Operations, Administration, and Maintenance (OAM) functions to include identifier information in a format typically used by the International Telecommunication Union Telecommunication Standardization Sector (ITU-T).

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## **1. Introduction**

This document augments the initial set of identifiers to be used in the Transport Profile of Multiprotocol Label Switching (MPLS-TP) defined in [[RFC6370](#)].

[RFC6370] defines a set of MPLS-TP transport and management entity identifiers to support bidirectional (co-routed and associated) point-to-point MPLS-TP Label Switched Paths (LSPs), including Pseudowire (PWs) and Sections which follow the IP/MPLS conventions.

This document specifies an alternative way to uniquely identify an operator/service provider based on ITU-T conventions and specifies how this operator/service provider identifier can be used to make the existing set of MPLS-TP transport and management entity identifiers, defined by [[RFC6370](#)], globally unique.

This document solely defines those identifiers. Their use and possible protocols extensions to carry them is out of scope in this document.

In this document, we follow the notational convention laid out in [[RFC6370](#)], which is included in this document for convenience in [Section 1.3](#).

### **1.1. Terminology**

CC: Country Code

ICC: ITU Carrier Code

ITU-T: International Telecommunication Union Telecommunication Standardization Sector

LSP: Label Switched Path

MEG: Maintenance Entity Group

MEP: Maintenance Entity Group End Point

MIP: Maintenance Entity Group Intermediate Point

MPLS: Multi-Protocol Label Switching

PW: Pseudowire

TSB: (ITU-T) Telecommunication Standardization Bureau



UMC: Unique MEG ID Code

### **1.2. Requirements notation**

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 [[RFC2119](#)].

### **1.3. Notational Conventions**

All multiple-word atomic identifiers use underscores (\_) between the words to join the words. Many of the identifiers are composed of a set of other identifiers. These are expressed by listing the latter identifiers joined with 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, A1-Node\_ID is the Node\_ID of a node referred to as A1.

The notation defines a preferred ordering of the fields. Specifically, the designation A1 is used to indicate the lower sort order of a field or set of fields and Z9 is used to indicate the higher sort order of the same. The sort is either alphanumeric or numeric depending on the field's definition. Where the sort applies to a group of fields, those fields are grouped with {...}.

Note, however, that the uniqueness of an identifier does not depend on the ordering, but rather, upon the uniqueness and scoping of the fields that compose the identifier. Further, the preferred ordering is not intended to constrain protocol designs by dictating a particular field sequence or even what fields appear in which objects.

## **2. Named Entities**

This document makes modest changes to the set of identifiers defined in [[RFC6370](#)]. Most changes replace certain parts in the already defined identifiers that are themselves composed of a set of atomic identifiers. The set of identifiers defined in [[RFC6370](#)] are:

- o Global\_ID
- o Node
- o Interface





- o Tunnel
- o LSP
- o PW
- o MEG
- o MEP
- o MIP

The following sections go through this list of identifiers one by one. The structure of this document is loosely aligned with the structure of [[RFC6370](#)].

### **3. Uniquely Identifying an Operator - the ICC\_Operator\_ID**

In [[RFC6370](#)] an operator is uniquely identified by the Global\_ID which is based on the AS number of the operator. The ITU-T however traditionally identifies operators/service providers based on the ITU-T Carrier Code (ICC) as specified in [[M1400](#)].

The ITU-T Telecommunication Standardization Bureau (TSB) maintains a list of assigned ICCs [[ICC-list](#)]. Note that ICCs can be assigned to both, ITU-T members as well as non-members, all of which are referenced at [[ICC-list](#)]. The national regulatory authorities act as an intermediary between the ITU/TSB and operators/service providers. Amongst the things that the national authorities are responsible for in the process of assigning an ICC is to ensure that the Carrier Codes are unique within their country. This uniqueness assumption is the basis for creating a globally unique ICC-based operator ID.

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

Global uniqueness is assured by concatenating the ICC with a Country Code (CC). The Country Code (alpha-2) is a string of two alphabetic characters represented with upper case letters (i.e., A-Z). The Country Code format is defined in ISO 3166-1 [[ISO3166-1](#)]. Together, the CC and the ICC form the ICC\_Operator\_ID as:

CC::ICC



### **3.1. Use of the ICC\_Operator\_ID**

The ICC\_Operator\_ID is used as a replacement for the Global\_ID as specified in [\[RFC6370\]](#), i.e. its purpose is to provide a globally unique context for other MPLS-TP identifiers.

As an example, an Interface Identifier (IF\_ID) in [\[RFC6370\]](#) is specified as the concatenation of the Node\_ID (a unique 32-bit value assigned by the operator) and the Interface Number (IF\_Num, a 32-bit unsigned integer assigned by the operator that is unique within the scope of a Node\_ID). To make this IF\_ID globally unique the Global\_ID is prefixed. This memo specifies the ICC\_Operator\_ID as an alternative format which, just like the Global\_ID, is prefixed to the

IF\_ID. Using the notation from [RFC 6370](#) [\[RFC6370\]](#):

Global\_ID::Node\_ID::IF\_Num

is functionally equivalent to:

ICC\_Operator\_ID::Node\_ID::IF\_Num

The same substitution procedure applies to all identifiers specified in [\[RFC6370\]](#) with the exception of the MEG ID, MEP ID and MIP ID. MEG, MEP and MIP identifiers are redefined in this document (see [Section 7.1](#), [Section 7.2](#) and [Section 7.3](#) respectively).

## **4. Node and Interface Identifiers**

The format of the node and interface identifiers are not changed by this memo except for the case when global uniqueness is required.

[\[RFC6370\]](#) defines the node identifier (Node\_ID) as a unique 32-bit value assigned by the operator within the scope of a Global\_ID. The structure of the Node\_ID itself is not defined as it is left to the operator to choose an appropriate value. The value zero however is reserved and MUST NOT be used.

This draft does not change the above definition. However, in case global uniqueness is required, the Node\_ID is prefixed with the ICC\_Operator\_ID as defined in [Section 3](#).

[\[RFC6370\]](#) further defines interface numbers (IF\_Num) as 32-bit unsigned integers which can be freely assigned by the operator and must be unique in the scope of the respective Node\_ID. The IF\_Num value 0 has a special meaning and therefore it MUST NOT be used to identify an MPLS-TP interface.



An interface identifier (IF\_ID) identifies an interface uniquely within the context of an ICC\_Operator\_ID. It is formed by concatenating the Node\_ID with the IF\_Num to result in a 64-bit identifier formed as Node\_ID::IF\_Num.

Global uniqueness of the IF\_ID, if needed, can be assured by prefixing the identifier with the ICC\_Operator\_ID.

## **5. MPLS-TP Tunnel and LSP Identifiers**

This document does not change the definition for local tunnel and LSP

IDs. When global uniqueness is needed, the format of these identifiers is as described in [Section 5.1](#) and [Section 5.2](#) below.

### **5.1. MPLS-TP Point-to-Point Tunnel Identifiers**

Tunnel IDs (Tunnel\_ID) are based on the end points' Node\_IDs and locally assigned tunnel numbers (Tunnel\_Num) which identify the tunnel at each end point. The tunnel number is a 16-bit unsigned integer unique within the context of the Node\_ID. A full tunnel ID is represented by the concatenation of these two end point-specific identifiers. Using the A1/Z9 convention, the format of a Tunnel\_ID is:

A1-`{Node_ID::Tunnel_Num}`::Z9-`{Node_ID::Tunnel_Num}`

Where global uniqueness is required, using ITU-T conventions, the ICC\_Operator\_ID is prefixed to the Tunnel\_IDs. Thus, a globally unique Tunnel\_ID becomes:

A1-`{ICC_Operator_ID::Node_ID::Tunnel_Num}`:: Z9-  
`{ICC_Operator_ID::Node_ID::Tunnel_Num}`

As per [[RFC6370](#)], when an MPLS-TP Tunnel is configured, it MUST be assigned a unique IF\_ID at each end point as defined in [Section 4](#).

### **5.2. MPLS-TP LSP Identifiers**

The following sub-sections define identifiers for MPLS-TP co-routed bidirectional and associated bidirectional LSPs. Since MPLS-TP Sub-Path Maintenance Entities (SPMEs) are also LSPs, they use the same form of IDs.

#### **5.2.1. MPLS-TP Co-Routed Bidirectional LSP Identifiers**

The LSP identifier (LSP\_ID) for a co-routed bidirectional LSP is formed by adding a 16-bit unsigned integer LSP number (LSP\_Num) to



the tunnel ID. Consequently, the format of an MPLS-TP co-routed bidirectional LSP\_ID is:

A1-{Node\_ID::Tunnel\_Num}::Z9-{Node\_ID::Tunnel\_Num}::LSP\_Num

[RFC6370] notes that, the "uniqueness of identifiers does not depend on the A1/Z9 sort ordering".

A co-routed bidirectional LSP is provisioned or signaled as a single entity and therefore a single LSP\_Num is used for both unidirectional LSPs. These can be referenced by the following identifiers:

A1-Node\_ID::A1-Tunnel\_Num::LSP\_Num::Z9-Node\_ID and

Z9-Node\_ID::Z9-Tunnel\_Num::LSP\_Num::A1-Node\_ID, respectively.

Global uniqueness is accomplished by using globally unique Node\_IDs. A globally unique LSP\_ID consequently becomes:

A1-{ICC\_Operator\_ID::Node\_ID::Tunnel\_Num}::  
Z9-{ICC\_Operator\_ID::Node\_ID::Tunnel\_Num}::LSP\_Num

### **5.2.2. MPLS-TP Associated Bidirectional LSP Identifiers**

Associated bidirectional LSPs need an LSP\_Num for each unidirectional

LSP it consists of. The LSP number is again a 16-bit unsigned integer which needs to be unique within the scope of the ingress' Tunnel\_Num. Consequently, the format of an MPLS-TP associated bidirectional LSP\_ID is:

A1-{Node\_ID::Tunnel\_Num::LSP\_Num}::  
Z9-{Node\_ID::Tunnel\_Num::LSP\_Num}

Each of the unidirectional LSPs of which the associated bidirectional

LSP consists of may be referenced by one of the following identifiers:

A1-Node\_ID::A1-Tunnel\_Num::A1-LSP\_Num::Z9-Node\_ID and

Z9-Node\_ID::Z9-Tunnel\_Num::Z9-LSP\_Num::A1-Node\_ID, respectively.

A globally unique LSP\_ID is constructed using the globally unique Node\_IDs as defined before. Consequently, a globally unique LSP\_ID is formulated as:

A1-{ICC\_Operator\_ID::Node\_ID::Tunnel\_Num::LSP\_Num}::  
Z9-{ICC\_Operator\_ID::Node\_ID::Tunnel\_Num::LSP\_Num}





## **6. Pseudowire Path Identifiers**

The PW Path Identifier (PW\_Path\_ID) is structured in a similar manner

as the PW\_Path\_ID described in [section 6 of \[RFC6370\]](#). Instead of the Global\_ID used in [\[RFC6370\]](#) this document uses the ICC\_Operator\_ID to make the PW\_Path\_ID globally unique. In this document the Attachment Individual Identifier (AII) is composed of three fields. These are the ICC\_Operator\_ID, the Node\_ID and the AC\_ID. The AC-ID is as defined in [\[RFC5003\]](#). The complete globally unique PW\_Path\_ID is formulated as:

```
A1-{ICC_Operator_ID::Node_ID::AC_ID}::  
Z9-{ICC_Operator_ID::Node_ID::AC_ID}
```

## **7. Maintenance Identifiers**

The following sub-sections define the identifiers for the various maintenance-related groups and entities as defined in [\[RFC6371\]](#). In contrast to the IDs defined in [\[RFC6370\]](#), this document does not define separate maintenance identifiers for sections, PWs and LSPs.

### **7.1. MEG Identifiers**

MEG\_IDs for MPLS-TP Sections, LSPs and Pseudowires following ITU-T conventions are based on the globally unique ICC\_Operator\_ID. In this case, the MEG\_ID is a string of up to 15 characters and consists

of three subfields: the Country Code (as described in [Section 3](#)), the

ICC (as described in [Section 3](#)) which together form the ICC\_Operator\_ID, followed by a Unique MEG ID Code (UMC) as defined in

[\[Y.1731\\_cor1\]](#).

The resulting MEG\_ID is:

```
CC::ICC::UMC
```

To avoid the potential for the concatenation of a short (i.e. less than 6 Character) ICC with a UMC not being unique the UMC MUST start with the "/" character which is not allowed in the ICC itself. This way, the MEG\_ID can also be easily decomposed into its individual components by a receiver.

The UMC MUST be unique within the organization identified by the combination of CC and ICC.

The ICC\_Operator\_ID-based MEG\_ID may be applied equally to a single MPLS-TP Section, LSP or Pseudowire.



## **7.2. MEP Identifiers**

ICC\_Operator\_ID-based MEP\_IDs for MPLS-TP Sections, LSPs and Pseudowires are formed by appending a 16-bit index to the MEG\_ID defined in [Section 7.1](#) 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\_Operator\_ID-based MEP\_ID is structured as:

```
MEG_ID::MEP_Index
```

An ICC\_Operator\_ID-based MEP ID is globally unique by construction given the ICC\_Operator\_ID-based MEG\_ID's global uniqueness.

## **7.3. MIP Identifiers**

ICC\_Operator\_ID-based MIP\_IDs for MPLS-TP Sections, LSPs and Pseudowires are formed by a global IF\_ID that is obtained by prefixing the identifier of the interface the MIP resides with the ICC\_Operator\_ID as described in [Section 3.1](#). This allows MIPs to be independently identified in nodes where a per-interface MIP model is used.

If only a per-node MIP model is used, one MIP is configured. In this case, the MIP\_ID is formed by using the Node\_ID and an IF\_Num of 0.

## **8. Security Considerations**

This document extends an existing naming scheme and does not introduce new security concerns. But, as mentioned in the security considerations section of [[RFC6370](#)] protocol specifications that describe use of this naming scheme may introduce security risks and concerns about authentication of participants. For this reason, these protocol specifications need to describe security and authentication concerns that may be raised by the particular mechanisms defined and how those concerns may be addressed.

## **9. IANA Considerations**

There are no IANA actions resulting from this document.

## **10. References**



## **10.1. Normative References**

- [IS03166-1] "Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes", ISO 3166-1.
- [M1400] "Designations for interconnections among operators' networks", ITU-T Recommendation M.1400, July 2006, <<http://www.itu.int/rec/T-REC-M.1400-200607-I/en>>.
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## **10.2. Informative References**

- [ICC-list] "List of ITU Carrier Codes (ICCs)", <<http://www.itu.int/oth/T0201>>.
- [RFC6371] Busi, I. and D. Allan, "Operations, Administration, and Maintenance Framework for MPLS-Based Transport Networks", [RFC 6371](#), September 2011.

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