International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.8113.1/Y.1372.1

Amendment 1

(08/2013)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Packet over Transport aspects – MPLS over Transport aspects

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

Internet protocol aspects – Transport

Operations, administration and maintenance mechanism for MPLS-TP in packet transport networks

Amendment 1

Recommendation ITU-T G.8113.1/Y.1372.1 (2012) – Amendment 1

ITU-T

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Recommendation ITU-T G.8113.1/Y.1372.1

Operations, administration and maintenance mechanism for MPLS-TP in packet transport networks

Amendment 1

Summary

Amendment 1 to Recommendation ITU-T G.8113.1/Y.1372.1 (2012) updates the abbreviations, acronyms and references, adds text for a route tracing function in clause 7, and adds a new clause 10 on security. The global uniqueness consideration of IDs and the usage of GAL for PW are clarified, respectively, in clauses 8 and 7.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.8113.1/Y.1372.1	2012-11-20	15	11.1002/1000/11323
1.1	ITU-T G.8113.1/Y.1372.1 (2012) Amd. 1	2013-08-29	15	11.1002/1000/12032

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Recommendation ITU-T G.8113.1/Y.1372.1

Operations, administration and maintenance mechanism for MPLS-TP in packet transport networks

Amendment 1

1) Clause 2, References

Add the following reference

[ISO 3166-1] ISO 3166-1:2013 alpha-2, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes.*

2) Add the specification of "Route Tracing" in clause 7

2.1) Table 7-1

Add the on demand "Route Tracing" OAM item in Table 7-1: OAM functions.

7.2 OAM functions specification

Table 7-1 – OAM functions

Application	OAM function	
Fault Management	Pro-active	Continuity check and connectivity verification (CC/CV)
		Remote defect indication (RDI)
		Alarm indication signal (AIS)
		Client signal fail (CSF)[4]
	On-demand	Connectivity verification (CV)
		Route tracing (RT)
		Diagnostic test (DT)
		Locked signal (LCK)[5]
Performance Management	Pro-active	Loss measurement (LM)
		Delay measurement (DM)
	On-demand	Loss measurement (LM)
		Delay measurement (DM)
Other Applications	Automatic protection switching (APS)	
	Management communication channel/Signalling communication channel (MCC/SCC)	
	Vendor-specific (VS)	
	Experimental (EXP)	

[4] Client Signal Fail (CSF) is called Client Failure Indication (CFI) in [IETF RFC 5860].

[5] Locked Signal (LCK) is called Lock Reporting in [IETF RFC 5860].

2.2) Clause 7.2.1.2.3

Add a new clause to specify "Route tracing" in clause 7.2.1.2.

7.2.1.2 On-demand OAM functions for fault management

…

7.2.1.2.3 Route tracing

Route tracing (RT) enables a MEP to discover the ordered sequence of MIPs (if any) and MEP(s) within a MEG.

The Route tracing (RT) OAM function can be implemented using the LBM OAM PDU with the "Discovery ingress/node MEP/MIP" and/or the "Discovery egress MEP/MIP" TLVs in the target MEP/MIP ID TLV which are defined in clause 8.2.2. However detailed procedures for implementing the RT OAM function are for further study in this version of the Recommendation.

3) Clause 8.2

Add the globally uniqueness consideration of IDs used in ITU-T G.8113.1.

8.2 OAM PDU formats based on [ITU-T G.8013]

Insert a new paragraph after the first:

…

This clause describes the use of the CC and ICC based MIP and MEP identifiers. MPLS-TP also supports IP-based formats for MIP and MEP identifiers[6]. The possible mixing of CC and ICC based formats and IP based formats within an operator domain is for further study. The encoding of the IP-based formats is also for further study.

…

8.2.1 Continuity check message (CCM)

…

In order to perform pro-active connectivity verification, the CCM packet contains a globally unique identifier of the source MEP, which is the combination of a globally unique MEG ID with a MEP ID that is unique within the scope of the maintenance entity group.

The generic format for MEG ID is defined in Figure A.1 of [ITU-T G.8013]. Different formats of MEG ID are allowed: the MEG ID format type is identified by the MEG ID Format field.

The formats of both the ICC-based MEG ID, and the CC- and ICC-based global MEG ID are ~~is~~ defined in Annex A of [ITU-T G.8013]. Both of these ~~This~~ formats ~~is~~are applicable to MPLS-TP Sections, LSPs and PWs. If a globally unique MEG ID is required the CC- and ICC-based MEG ID must be used.

~~MPLS-TP supports also IP-based format for MEG ID. These formats are outside the scope of this version of the Recommendation.~~[6]

---

[6] The semantics for IP-based identifiers for MIP and MEP are defined in [b-IETF RFC 6370].

~~[6] The IP-based format for MEG ID is under definition in IETF: see [b-IETF tp-id].~~

…

8.2.2.1 Target and replying MEP/MIP ID TLVs

The format of the target and replying ~~MIP/~~MEP/MIP ID TLVs are shown in Figures 8-6 and 8-7.

<table>
<tr><td></td><td colspan="8">1</td><td colspan="8">2</td><td colspan="8">3</td><td colspan="8">4</td></tr>
<tr><td></td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td colspan="8">Type (33)</td><td colspan="16">Length (25)</td><td colspan="8">ID Sub-Type</td></tr>
<tr><td>5
9
13
17
21
25</td><td colspan="32">MEP/MIP Identifier (format is ID Sub-Type specific)</td></tr>
</table>

Figure 8-6 – Target MEP/MIP ID TLV format

<table>
<tr><td></td><td colspan="8">1</td><td colspan="8">2</td><td colspan="8">3</td><td colspan="8">4</td></tr>
<tr><td></td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>1</td><td colspan="8">Type (34)</td><td colspan="16">Length (25)</td><td colspan="8">ID Sub-Type</td></tr>
<tr><td>5
9
13
17
21
25</td><td colspan="32">MEP/MIP Identifier (format is ID Sub-Type specific)</td></tr>
</table>

Figure 8-7 – Replying MEP/MIP ID TLV format

Different formats of MEP/MIP identifiers can be defined: the format type is described by the MEP/MIP ID sub-type field (see Table 8-4).

Table 8-4 – MEP/MIP identifier sub-type values

ID Sub-Type	MEP/MIP identifier name	MEP/MIP identifier length
0x00	Discovery ingress/node MEP/MIP	0
0x01	Discovery egress MEP/MIP	0
0x02	~~ICC-based~~ MEP ID	2 bytes
0x03	~~ICC-based~~ MIP ID	16 ~~4~~bytes
0x04-0xFF	Reserved	

The "Discovery ingress/node MEP/MIP" and the "Discovery egress MEP/MIP" identifiers can only be used within the LBM PDU (and cannot appear in an LBR PDU) for discovering the identifiers of the MEPs or of the MIPs located at a given TTL distance from the MEP originating the LBM PDU.

The format of the Target MEP/MIP ID TLV carrying a "Discovery ingress/node MEP/MIP" is shown in Figure 8-8.

	1	2	3	4
	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1
1	Type (33)	Length (25)		ID Sub-Type (0x00)
5	All-ZEROs			
9				
13				
17				
21				
25				

Figure 8-8 – Target MEP/MIP ID TLV format for ~~(~~D~~d~~iscovery ingress/node MEP/MIP~~)~~

The format of the Target MEP/MIP ID TLV carrying a "Discovery egress MEP/MIP" is shown in Figure 8-9.

	1	2	3	4
	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1
1	Type (33)	Length (25)		ID Sub-Type (0x01)
5	All-ZEROs			
9				
13				
17				
21				
25				

Figure 8-9 – Target MEP/MIP ID TLV format for ~~(~~D~~d~~iscovery egress MEP/MIP~~)~~

The format of the target or replying MEP/MIP ID TLV carrying a~~n~~ "~~ICC-based~~ MEP ID" is shown in Figure 8-10.

	1	2	3	4
	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1
1	Type	Length (25)		ID Sub-Type (0x02)
5	MEP ID		All-ZEROs	
9				
13				
17				
21				
25				

Figure 8-10 – Target or replying MEP/MIP ID TLV format for ~~(ICC-based~~ MEP ID~~)~~

The MEP ID is a 16-bit integer value identifying the transmitting MEP within the MEG.

The format of the target or replying MEP/MIP ID TLV carrying a~~n~~ "~~ICC-based~~ MIP ID" is shown in Figure 8-11.

	1 (8 7 6 5 4 3 2 1)	2 (8 7 6 5 4 3 2 1)	3 (8 7 6 5 4 3 2 1)	4 (8 7 6 5 4 3 2 1)
1	Type	Length (25)		ID Sub-Type (0x03)
5	ITUCarrier Code (ICC)			
9			Node_ID	
13	Node_ID		IF_Num	
17	IF_Num		Country Code (CC)	
21	All-ZEROs			
25				

Figure 8-11 – Target or replying MEP/MIP ID TLV format for ~~(ICC-based~~ MIP ID~~)~~

The ITU~~-T~~ Carrier Code (ICC) is a code assigned to a network operator/service provider and maintained by the ITU-T Telecommunication Standardization Bureau (TSB) as per [ITU-T M.1400]. The ITU field in Figure 8-11 consists of between 1 and 6 left-justified characters with trailing NULLs completing the ICC field.

For backward compatibility, in cases where global uniqueness is not required, the CC field may be All ZEROs.

The Node_ID is a numeric identifier of the node where the MIP is located. Its assignment is a matter for the organization to which the ICC has been assigned, provided that uniqueness within that organization is guaranteed.

The IF_Num is a numeric identifier of the access point (AP) toward the server layer trail, which can be either an MPLS-TP or a non-MPLS-TP server layer, where a per-interface MIP is located. Its assignment is a matter for the node the MIP is located, provided that uniqueness within that node is guaranteed. Note that the value 0 for IF_Num is reserved to identify per-node MIPs.

~~MPLS-TP supports also IP-based format for MIP and MEP identifiers. These formats are outside the scope of this version of the Recommendation.~~~~[7]~~

The Country Code (alpha-2) is a string of 2 alphabetic characters represented with upper case letters (i.e., A-Z). The Country Code format is defined in [ISO 3166-1].

8.2.2.2 Requesting MEP ID TLV

…

~~The MEP ID and MEG ID carry the globally unique MEP ID as defined in clause 8.2.1.~~

The globally unique identifier for a MEP can be provided by the combination of a globally unique MEG ID with a MEP ID as defined in clause 8.2.1.

4) Bibliography

Replace

[b-IETF tp-id] IETF draft-ietf-mpls-tp-identifiers-04 (2013), *MPLS-TP Identifiers following ITU-T Conventions*.
http://tools.ietf.org/html/draft-ietf-mpls-tp-itu-t-identifiers-04

with

[b-IETF RFC 6370] IETF RFC 6370 (2011), *MPLS-TP Identifiers*.

~~[7] The IP-based format for MIP and MEP identifiers are under definition in IETF: see [b-IETF tp-id]~~

Add the following bibliographic entry:

[b-IETF RFC 6423] IETF RFC 6423 (2011), *Using the Generic Associated Channel Label for Pseudowire in the MPLS Transport Profile (MPLS-TP)*.

5) Clause 10, Security

Add a new clause 10 to describe security considerations.

10 Security

According to clause 6.3 of this Recommendation packets originating outside the MEG are encapsulated by the MEP at the ingress and transported transparently through the MEG. This encapsulation significantly reduces the risk of an attack from outside the MEG. The MEP at the egress also prevents OAM packets from leaving a MEG.

The use of the CV tool improves network integrity by ensuring traffic is not misconnected or mismerged between LSPs. The expected MEP ID is provisioned at the sink MEP. This allows the received MEP ID to be verified with a high degree of certainty, which significantly reduces the possibility of an attack.

The use of globally unique identifiers for MEPs by the combination of a globally unique MEG ID with a MEP ID provides an absolute authoritative detection of persistent misconnection between LSPs. A globally unique MEG ID should be used when an LSP between the networks of different national operators crosses national boundaries since non-uniqueness can result in undetected misconnection in a scenario where two LSPs use a common MEG-ID.

For the use of any other OAM tools it is assumed that MEPs and MIPs that start using the tools verify the integrity of the path and the identity of the source MEP. If a misconnection is detected the tool in use shall be disabled immediately.

6) Usage of GAL for PW – Modify the text in clause 7.1.2

7.1.2 GAL

A G-ACh alert label (GAL) is used to flag the G-ACh. Specifically, the GAL is used to indicate that a packet contains an ACH followed by a non-service payload (i.e., the G-ACh packet payload), thus generalizing the associated control channel mechanism to LSPs, Sections, PWs and tandem connections.

The GAL provides an alert based exception mechanism to:

- Differentiate G-ACh packets (e.g., OAM, DCC, APS, etc.) from those of user traffic packets
- Indicate that the ACH appears immediately after the bottom of the label stack.

One of the reserved label values defined in [IETF RFC 3032] is assigned for this purpose: the reserved label value assigned is 13. ~~The GAL must always be at the bottom of the label stack (i.e., S bit set to 1).~~ The format of the GAL is specified in clause 8.1 in alignment with [IETF RFC 5586].

NOTE – Using GAL for PW in MPLS-TP is specified in [b-IETF RFC 6423]. In MPLS-TP, the GAL MUST be used with packets on a G-Ach on LSPs, Sections, and tandem connections, and MAY be used with PWs.

7) Update abbreviations and acronyms

7.1) Clause 4

Delete the single-character abbreviation of "A","C", "N", "O", "P", "S" in clause 4.

Delete the abbreviation of "IO", "IP".

7.2) Figure I.1

Add the description of "C", "IO", "IP", "O", "P" in Figure I.1.

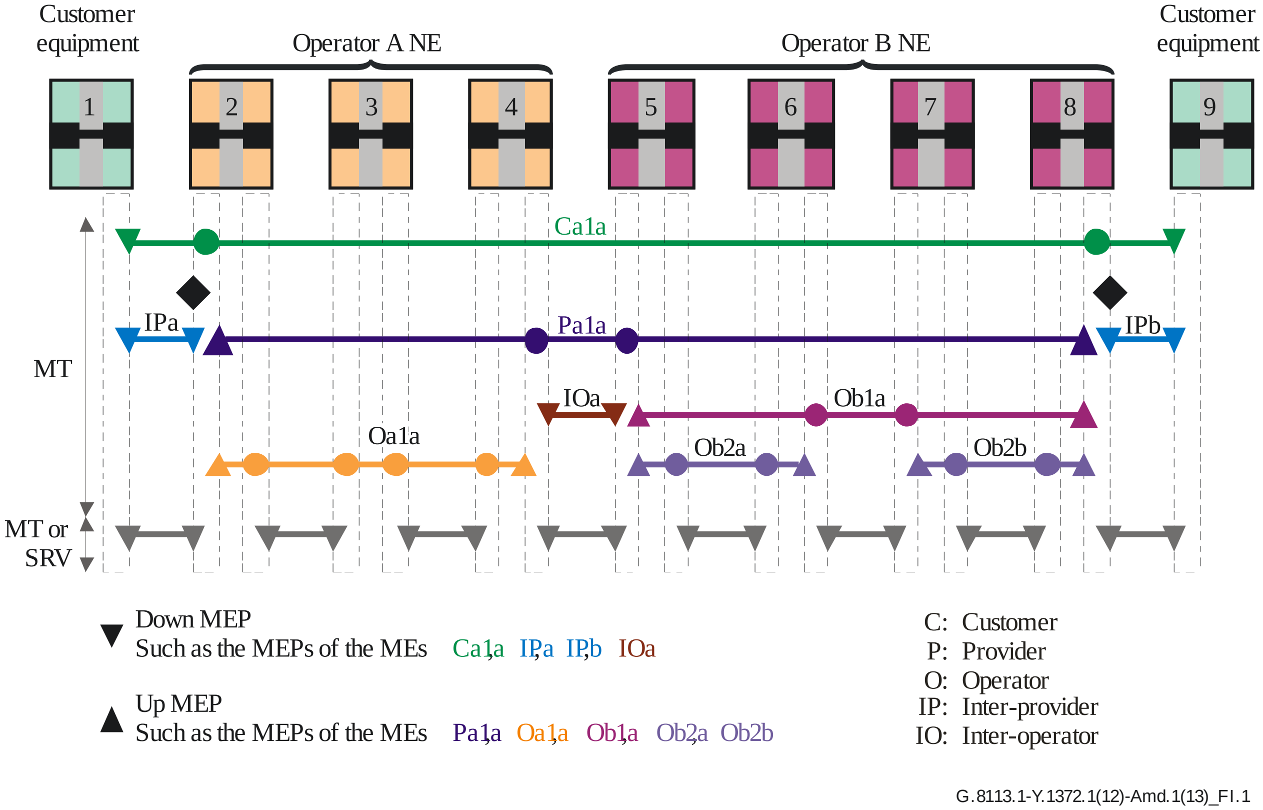

Figure I.1 – Example MEG nesting

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