INTERNATIONAL TELECOMMUNICATION UNION

TELECOMMUNICATION STANDARDIZATION SECTOR

STUDY PERIOD 2009-2012

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Original: English

Question(s):	9/15

LIAISON STATEMENT

Source:	ITU-T Study Group 15
Title:	Liaison to IEEE 802.1 regarding usage of 802.1Q Encapsulated Addresses Type ’89-10’

LIAISON STATEMENT

For action to:	IEEE 802.1
For comment to:	
For information to:	
Approval:	Agreed to at Question 9/15 meeting (Darmstadt, 1-5 March 2010)
Deadline:	31 May 2010

Contact:	Ghani Abbas Ericsson UK	Tel: +44 7710 370 367 Email: Ghani.Abbas@ericsson.com

Introduction

Work is underway in Question 9 of ITU-T Study Group 15 (Q9/15) on a new draft recommendation G.ptneq (Packet Transport Network Equipment). Several of the encapsulations of Ethernet clients in [1] involve the use of the 802.1Q Encapsulated Addresses Type ‘89-10’. This liaison asks 802.1 for clarification regarding the usage of that Type value outside the context of the Backbone Service Multiplex Entity in clause 6.18 of [2]. Currently, we envisaged the usage of the type value outside of the PBBN within the context of Optical and packet transport networks.

Discussion

The Type value of ‘89-10’ is used in the encapsulations illustrated in Figures 4 and 5 of [1]. We are aware of the intended use of the Type value of ‘89-10’ as described in clause 6.18 of [2] and would like clarification of the Table 6-7 associated note, reproduced below for convenience:

Table 6-7—Encapsulated Addresses type

Name	Value
IEEE 802.1Q Encapsulated Addresses type	89-10

NOTE 3—This Ethertype value is used only internally at the Backbone Service Multiplex Entity and does not appear in any frame on a LAN in the PBBN.

Referring to Figures 4 and 5 of [1], although the frame will appear on an 802.3 interface, the Type value of ‘89-10’ is only visible within the new Packet Transport Network being defined by Q9/15. The type value “89-10” will also appear on frames transported over the OTN or at interfaces within the OTN.

Question

Does 802.1 have any concern with the above usage of the 802.1Q Encapsulated Addresses Type ‘89-10’ by Q9/15?

We would appreciate a response in time for our next meeting on this topic to held May 31 – June 11, 2010.

We look forward to your reply and continued assistance.

References

[1] wd11, *Ethernet Transport Module (ETM-n) frame formats in PTN*, Q9/15 Darmstadt interim March 1-5, 2010 (attached below)

[2] Amendment 7: *Provider Backbone Bridges*, IEEE Std 802.1ah™-2008 (Amendment to IEEE Std 802.1Q™-2005)

Question(s):	9, 10	**Meeting, date:**	Darmstadt, 1 – 5 March 2010
Study Group:	15 **Working Party:** 3	**Intended type of document**:	WD11
Source:	Huawei Technologies Co., Ltd.		
Title:	Ethernet Transport Module (ETM-n) frame formats in PTN layer stack option C		
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Please don't change the structure of this table, just insert the necessary information.

INTRODUCTION

Draft Rec. G.ptneq, version 0.1 (CD01) introduces a number of technology dependent PTN layer stacks in clause 6.8. One of those layer stacks is the one depicted in Figure 6-16/G.ptneq, which is copied below.

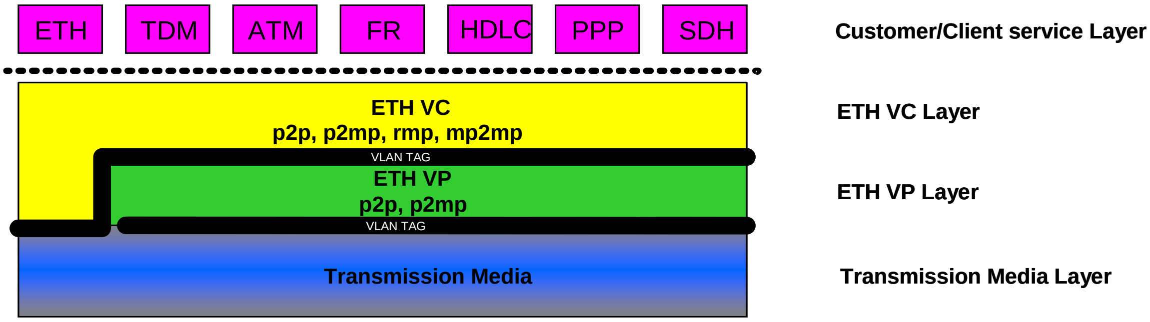

Figure 0-1/G.ptneq – ETH VC only mode with ETH VP

This layer stack may be using an Ethernet based transmission media, which then includes the ETH VS and ETY layer networks as illustrated in Figure 1. The signal at the physical interface port may in this case be referred to as an Ethernet Transport Module (ETM-n) signal.

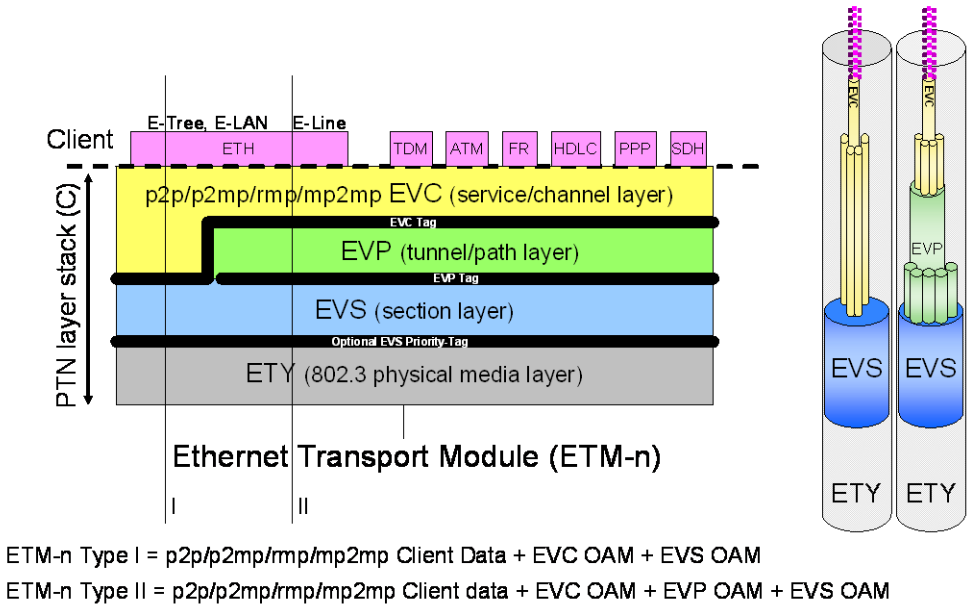

Figure 1 – Ethernet Transport Module (ETM-n) Type I and Type II in PTN layer stack type C

There are two ETM-n signal types, referred to as ETM-n Type I and ETM-n Type II. ETM-n Type I signals have passed through an ETH VC and VS layer. ETM-n Type II signals have passed through an ETH VC, VP and VS layer. The frame formats associated with both ETM-n type signals are presented in this working document.

ETM-n FRAME FORMATS

ETM-n frames may carry

- Client data (including client OAM)
- ETH VC OAM
- ETH VP OAM
- ETH VS OAM.

Synchronous ETM-n interfaces may also carry

- ESMC frames.

Client data frame formats

Non-Ethernet client data is encapsulated before it is applied to the ETH VC layer. The encapsulation for non-Ethernet client signals includes a MAC header containing a Type field, a Source Address (SA) field and Destination Address (DA) field. It may furthermore include a client instance identifier field and further client specific encapsulation fields.

Ethernet client data (ETH_CI) may be encapsulated before it is applied to the ETH VC layer, or may peer with the ETH VC layer. The encapsulation for Ethernet client signals adds a VLAN or Backbone Service Instance Tag and/or a MAC header containing a Type field, a Source Address (SA) field and Destination Address (DA) field.

The *client agnostic part* of these client data frame formats is illustrated in Figures 2 to 5.

NOTE - Refer to WD12 “Ethernet service mapping into Ethernet VC frame formats” and WD13 “Non-Ethernet service mapping into Ethernet VC frame formats” for the client specific aspects of those data frame formats.

Figures 2 and 4 illustrate the frame formats for ETM-n Type I (without ETH VP Tag).

Figures 3 and 5 illustrate the frame formats for ETM-n Type II (with ETH VP Tag).

Figures 2 and 3 illustrate the client agnostic part of the frame for non-Ethernet clients and for Ethernet clients of which the encapsulation does not add a MAC header. For non-Ethernet clients the DA and SA fields will carry the network DA and SA values associated with the UNI-N ports. For Ethernet clients the DA and SA fields will carry the customer DA and SA values (e.g. C- or S-Tagged LANs) or backbone DA and SA values (I- or B-Tagged LANs).

The encapsulated client data is furthermore extended with a (yellow) Ethernet VC Tag header, a (green) Ethernet VP Tag header (ETM-n Type II only) and a (blue) Ethernet VS priority Tag header (optional). These VC, VP and VS Tag headers consist of a 16-bit TPID, a 3-bit PCP, a 1-bit LI (Leaf Indicator) and a 12-bit ID field.

Figures 4 and 5 illustrate the client agnostic part of the frame for Ethernet clients of which the encapsulation adds a MAC header. The addition of a MAC header is advantages for the case of E-Tree and E-LAN services supported by rooted-multipoint ETH VC connections and multipoint-to-multipoint ETH VC connections. It improves the MAC learning scalability within the ETH VC bridging functions, as fewer individual MAC addresses have to be learned. Those frames are generated within UNI-N ports and carry the EUI-48 value of the physical subsystem hosting the UNI-N port functions as source MAC address.

0 1 2	3	4 5 6 7	8 9 10 11 12 13 14 15	16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
				PA
PA				
PA			SFD	C-DA or B-DA or N-DA
C-DA or B-DA or N-DA				
C-SA or B-SA or N-SA				
C-SA or B-SA or N-SA				TPID
PCP	(1)	ETH VS ID = 0		TPID
PCP	(1)	ETH VC ID		TYPE
client specific MAC service data unit				
PAD (optional)				
FCS				

(1) On IaDI this could be a CFI, DEI or LI bit. On IrDI this is a LI bit.

DA: Individual MAC address or Group MAC address or Broadcast MAC address

SA: Individual MAC address

Individual MAC address refers to EUI-48 value of a physical subsystem of Customer (C-xA, B-xA), or of UNI-N port (N-xA.)

LI: Leaf Indicator. Default value is "0". The value can be set to "1" in the ETH VC Tag by a leaf endpoint of a rooted-multipoint ETH VCC with more then one root port.

Figure 2 – Client data frame format in ETM-n Type I (with EVC and EVS Tags)

0 1 2	3	4 5 6 7	8 9 10 11 12 13 14 15	16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
				PA
PA				
PA			SFD	C-DA or B-DA or N-DA
C-DA or B-DA or N-DA				
C-SA or B-SA or N-SA				
C-SA or B-SA or N-SA				TPID
PCP	(1)	ETH VS ID = 0		TPID
PCP	(1)	ETH VP ID		TPID
PCP	(1)	ETH VC ID		TYPE
client specific MAC Service Data Unit				
PAD (optional)				
FCS				

(1) On IaDI this could be a CFI, DEI or LI bit. On IrDI this is a LI bit.

DA: Individual MAC address or Group MAC address or Broadcast MAC address

SA: Individual MAC address

Individual MAC address refers to EUI-48 value of a physical subsystem of Customer (C-xA, B-xA) or of UNI-N port (N-xA)

LI: Leaf Indicator. Default value is "0". The value can be set to "1" in the ETH VC Tag by a leaf endpoint of a rooted-multipoint ETH VCC with more then one root port.

Figure 3 – Client data frame format in ETM-n Type II (with EVC, EVP and EVS Tags)

Bits 0–2	3	4–7	8–15	16–31
				PA
PA				
PA			SFD	N-DA
N-DA				
N-SA				
N-SA				TPID
PCP	(1)	ETH VS ID = 0		TPID
PCP	(1)	ETH VC ID		TYPE = 89-10
C-DA or B-DA				
C-DA or B-DA				C-SA or B-SA
C-SA or B-SA				
TYPE				
Ethernet client specific MAC Service Data Unit				
PAD (optional)				
FCS				

(1) On IaDI this could be a CFI, DEI or LI bit. On IrDI this is a LI bit.

N-DA: Individual MAC address or Group MAC address or Broadcast MAC address, N-SA: Individual MAC address. Individual MAC address refers to EUI-48 value of physical subsystem of UNI-N port

C-DA/B-DA: Individual MAC address or Group MAC address or Broadcast MAC address, C-SA/B-SA: Individual MAC address. Individual MAC address refers to EUI-48 value of a physical subsystem of Customer or UNI-N port (ETH MIP)

LI: Leaf Indicator. Default value is "0". The value can be set to "1" in the ETH VC Tag by a leaf endpoint of a rooted-multipoint ETH VCC with more then one root port.

Figure 4 – Ethernet client data frame format in ETM-n Type I (with EVC and EVS Tags and Network MAC addresses)

Bits 0–2	3	4–7	8–15	16–31
				PA
PA				
PA			SFD	N-DA
N-DA				
N-SA				
N-SA				TPID
PCP	(1)	ETH VS ID = 0		TPID
PCP	(1)	ETH VP ID		TPID
PCP	(1)	ETH VC ID		TYPE = 89-10
C-DA or B-DA				
C-DA or B-DA				C-SA or B-SA
C-SA or B-SA				
TYPE				
Ethernet client specific MAC service data unit				
PAD (optional)				
FCS				

(1) On IaDI this could be a CFI, DEI or LI bit. On IrDI this is a LI bit.

N-DA: Individual MAC address or Group MAC address or Broadcast MAC address, N-SA: Individual MAC address. Individual MAC address refers to EUI-48 value of physical subsystem of UNI-N port

C-DA/B-DA: Individual MAC address or Group MAC address or Broadcast MAC address, C-SA/B-DA: Individual MAC address. Individual MAC address refers to EUI-48 value of a physical subsystem of Customer or UNI-N port (ETH MIP)

LI: Leaf Indicator. Default value is “0”. The value can be set to “1” in the ETH VC Tag by a leaf endpoint of a rooted-multipoint ETH VCC with more then one root port.

Figure 5 – Ethernet client data frame format in ETM-n Type II (with EVC, EVP and EVS Tags and Network MAC addresses)

EVC, EVP, EVS Tag TPID

The EVC, EVP and EVS Tags include a TPID field, which identifies these Tags.

On Intra Domain Interfaces (IaDI) operators are deploying today a proprietary EtherType value to identify these tags. Equipment is required to support configuration of those TPID values.

To guarantee interworking on Inter Domain Interfaces (IrDI) it is necessary to use a standardized TPID value. The same TPID value may be used for the EVC, EVP and EVS Tags. Such value should be specified in G.8012 or in G.ptneq. An option is to use a Transport VLAN Tag. Such Transport VLAN Tag is a VLAN Tag optimized for deployment in transport networks, in which control of the setup, modification and tear down of connections is performed via NMS and/or GMPLS. The Transport VLAN Tag is therefore not supporting the traditional IEEE 802.1Q control plane protocols (like xSTP, xVRP), which allows to stack those Transport VLAN Tags as often as necessary in the networks.

EVC, EVP, EVS Identifiers

The 12-bit ETH VC and VP ID fields have a link local ID value, which allows identification of up to 4094 ETH VC signals on an ETM-n Type I interface and up to 16 760 836 ETH VC signals on an ETM-n Type II interface. The ETH VS ID field value is 0, indicating that it is used as a priority tag.

Leaf Indicator

http://www.ietf.org/id/draft-delord-pwe3-cw-bit-etree-01.txt and http://www.ietf.org/id/draft-key-l2vpn-vpls-etree-01.txt identify an issue with respect to the filtering rules within a rooted-multipoint Ethernet VC with more then one root port. This issue is not specific to Ethernet VC (VPLS) over MPLS, it is generic. The proposed solution is to introduce a Leaf indicator bit into the control word and to use this bit as part of the extended filtering rule set. A similar Leaf Indicator bit can be used in the Ethernet VC Tag header, and this bit can be located in the CFI/DEI bit location of the Tag. This leaves the 3-bit PCP field in the Tag header to carry the priority and drop_eligible information. This is sufficient for the PTN application, as there are only 3 or 4 queues in the NNI ports of the PTN and the drop_eligible information can be encoded in the 3-bit PCP together with the 3 or 4 priority levels. Refer to the Annex in WD27 for further considerations.

Ethernet VC OAM frame formats

ETH VC OAM frames are present in the ETM-n Types I and II. Those frames are generated within an ETH VC MEP or MIP function and carry the EUI-48 value of the physical subsystem hosting the ETH VC MEP or MIP (typically one of the UNI-N or NNI ports) as source MAC address. The frame formats are illustrated in Figures 6 and 7.

<table>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th><th>25</th><th>26</th><th>27</th><th>28</th><th>29</th><th>30</th><th>31</th></tr>
<tr><td colspan="16"></td><td colspan="16">PA</td></tr>
<tr><td colspan="32">PA</td></tr>
<tr><td colspan="8">PA</td><td colspan="8">SFD</td><td colspan="16">N-DA</td></tr>
<tr><td colspan="32">N-DA</td></tr>
<tr><td colspan="32">N-SA</td></tr>
<tr><td colspan="16">N-SA</td><td colspan="16">TPID</td></tr>
<tr><td colspan="3">PCP</td><td>(1)</td><td colspan="12">ETH VS ID = 0</td><td colspan="16">TPID</td></tr>
<tr><td colspan="3">PCP</td><td>(1)</td><td colspan="12">ETH VC ID</td><td colspan="16">TYPE = 89-02</td></tr>
<tr><td colspan="3">MEL</td><td colspan="5">Version</td><td colspan="8">OpCode</td><td colspan="8">Flags</td><td colspan="8">TLV Offset</td></tr>
<tr><td colspan="32">OAM function specific (Y.1731)</td></tr>
<tr><td colspan="24"></td><td colspan="8">End TLV</td></tr>
<tr><td colspan="32">PAD (optional)</td></tr>
<tr><td colspan="32">FCS</td></tr>
</table>

N-DA: Individual MAC address of EVC MEP or MIP or OAM Group MAC address

N-SA: Individual MAC address of EVC MEP or MIP

(1) On IaDI this could be a CFI, DEI or LI bit. On IrDI this is a LI bit.

LI: Leaf Indicator. Default value is “0”. The value can be set to “1” in the ETH VC Tag by a leaf endpoint of a rooted-multipoint ETH VCC with more then one root port.

Figure 6 – Ethernet VC OAM frame format in ETM-n Type I (with EVC and EVS Tags)

<table>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th><th>25</th><th>26</th><th>27</th><th>28</th><th>29</th><th>30</th><th>31</th></tr>
<tr><td colspan="16"></td><td colspan="16">PA</td></tr>
<tr><td colspan="32">PA</td></tr>
<tr><td colspan="8">PA</td><td colspan="8">SFD</td><td colspan="16">N-DA</td></tr>
<tr><td colspan="32">N-DA</td></tr>
<tr><td colspan="32">N-SA</td></tr>
<tr><td colspan="16">N-SA</td><td colspan="16">TPID</td></tr>
<tr><td colspan="3">PCP</td><td>(1)</td><td colspan="12">ETH VS ID = 0</td><td colspan="16">TPID</td></tr>
<tr><td colspan="3">PCP</td><td>(1)</td><td colspan="12">ETH VP ID</td><td colspan="16">TPID</td></tr>
<tr><td colspan="3">PCP</td><td>(1)</td><td colspan="12">ETH VC ID</td><td colspan="16">TYPE = 89-02</td></tr>
<tr><td colspan="3">MEL</td><td colspan="5">Version</td><td colspan="8">OpCode</td><td colspan="8">Flags</td><td colspan="8">TLV Offset</td></tr>
<tr><td colspan="32">OAM function specific (Y.1731)</td></tr>
<tr><td colspan="24"></td><td colspan="8">End TLV</td></tr>
<tr><td colspan="32">PAD (optional)</td></tr>
<tr><td colspan="32">FCS</td></tr>
</table>

N-DA: Individual MAC address of EVC MEP or MIP or OAM Group MAC address

N-SA: Individual MAC address of EVC MEP or MIP

(1) On IaDI this could be a CFI, DEI or LI bit. On IrDI this is a LI bit.

LI: Leaf Indicator. Default value is “0”. The value can be set to “1” in the ETH VC Tag by a leaf endpoint of a rooted-multipoint ETH VCC with more then one root port.

Figure 7 – Ethernet VC OAM frame format in ETM-n Type II (with EVC, EVP and EVS Tags)

Ethernet VP OAM frame format

ETH VP OAM frames are present in the ETM-n Type II. Those frames are generated within an ETH VP MEP or MIP function and carry the EUI-48 value of the physical subsystem hosting the ETH VP MEP or MIP (typically one of the NNI ports) as source MAC address. The frame format is illustrated in Figure 8.

<table>
<tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td></tr>
<tr><td colspan="16"></td><td colspan="16">PA</td></tr>
<tr><td colspan="32">PA</td></tr>
<tr><td colspan="8">PA</td><td colspan="8">SFD</td><td colspan="16">N-DA</td></tr>
<tr><td colspan="32">N-DA</td></tr>
<tr><td colspan="32">N-SA</td></tr>
<tr><td colspan="16">N-SA</td><td colspan="16">TPID</td></tr>
<tr><td colspan="3">PCP</td><td>(1)</td><td colspan="12">ETH VS ID = 0</td><td colspan="16">TPID</td></tr>
<tr><td colspan="3">PCP</td><td>(1)</td><td colspan="12">ETH VP ID</td><td colspan="16">TYPE = 89-02</td></tr>
<tr><td colspan="3">MEL</td><td colspan="5">Version</td><td colspan="8">OpCode</td><td colspan="8">Flags</td><td colspan="8">TLV Offset</td></tr>
<tr><td colspan="24" rowspan="2">OAM function specific (Y.1731)</td><td colspan="8"></td></tr>
<tr><td colspan="8">End TLV</td></tr>
<tr><td colspan="32">PAD (optional)</td></tr>
<tr><td colspan="32">FCS</td></tr>
</table>

N-DA: Individual MAC address of EVP MEP or MIP or OAM Group MAC address

N-SA: Individual MAC address of EVP MEP or MIP

(1) On IaDI this could be a CFI, DEI or LI bit. On IrDI this is a LI bit.

LI: Leaf Indicator. Default value is “0”. The value can be set to “1” in the ETH VC Tag by a leaf endpoint of a rooted-multipoint ETH VCC with more then one root port.

Figure 8 – Ethernet VP OAM frame format in ETM-n Type II (with EVP and EVS Tags)

Ethernet VS OAM frame format

ETH VS OAM frames are present in the ETM-n Types I and II. Those frames are generated within an ETH VS MEP or MIP function and carry the EUI-48 value of the physical subsystem hosting the ETH VS MEP or MIP (typically one of the NNI ports). The frame format is illustrated in Figure 9.

<table>
<tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td></tr>
<tr><td colspan="16"></td><td colspan="16">PA</td></tr>
<tr><td colspan="32">PA</td></tr>
<tr><td colspan="8">PA</td><td colspan="8">SFD</td><td colspan="16">N-DA</td></tr>
<tr><td colspan="32">N-DA</td></tr>
<tr><td colspan="32">N-SA</td></tr>
<tr><td colspan="16">N-SA</td><td colspan="16">TPID</td></tr>
<tr><td colspan="3">PCP</td><td>(1)</td><td colspan="12">ETH VS ID = 0</td><td colspan="16">TYPE = 89-02</td></tr>
<tr><td colspan="3">MEL</td><td colspan="5">Version</td><td colspan="8">OpCode</td><td colspan="8">Flags</td><td colspan="8">TLV Offset</td></tr>
<tr><td colspan="24" rowspan="2">OAM function specific (Y.1731)</td><td colspan="8"></td></tr>
<tr><td colspan="8">End TLV</td></tr>
<tr><td colspan="32">PAD (optional)</td></tr>
<tr><td colspan="32">FCS</td></tr>
</table>

N-DA: Individual MAC address of EVS MEP or MIP or OAM Group MAC address

N-SA: Individual MAC address of EVS MEP or MIP

(1) On IaDI this could be a CFI, DEI or LI bit. On IrDI this is a LI bit.

LI: Leaf Indicator. Default value is “0”. The value can be set to “1” in the ETH VC Tag by a leaf endpoint of a rooted-multipoint ETH VCC with more then one root port.

Figure 9 – Ethernet VS frame format in ETM-n Type I and Type II (with EVS Tag)

PROPOSAL

It is proposed to add the ETM-n frame formats into G.8012 or an annex of G.ptneq.

It is furthermore proposed to extend the ETH_FF specification in G.8021 with leaf indicator support as described in the Annex and to add an ETH adaptation function capable to insert a MAC header to incoming client ETH_CI traffic units to G.8021. Such adaptation function has been proposed in WD38 (Q.9/15, Sept. 2008) and is currently on the living list of G.8021.

ANNEX G.8021 ETH_FF PROCESS ENHANCEMENT: LEAF INDICATOR

An example of multiple root rooted-multipoint ETH VC connection is illustrated in Figure 10.

```
  R1                                   R2
   |                                    |
+-----+f2          +-----+f3          +-----+
| FF1 |-----------| FF2 |------------| FF3 |
+-----+          f1+-----+          f2+-----+
 | | |              | | |              | | |
 L1L2L3             L4L5L6             L7L8L9
```

Figure 10 - example of rmp ETH VCC with two roots, nine leafs and three ETH_FF processes

The ETH VC link connection between FF1 and FF2 and the link connection between FF2 and FF3 will have to carry root-to-root (r2r), root-to-leaf (r2l) and leaf-to-root (l2r) traffic. As part of this traffic there are the ETH OAM frames, e.g. the CCM frames. Those e.g. CCM frames should go from R1-to-R2/L1/..L9, R2-to-R1/L1/../L9 and Li-to-R1/R2 (i=1..9). These e.g. CCM frames should however not go from Li-to-Lj (i,j=1..9).

The rooted-multipoint related frame forwarding behaviour is established by grouping leafs into port groups and by preventing frames received on an input port of such port group to be forwarded to an output port of such port group. But in this multi-root case, it is not possible to make e.g. port f2 a member of the leaf port group including also L1,L2 and L3.

> Note that if such would have been done, then frames from R2 (received via f2) towards e.g. L1 will not reach L1.

The proposed solution in the internet drafts is to introduce a Leaf indicator bit into the control word and to use this bit as part of the extended filtering rule set. A similar Leaf Indicator bit can be used in the Ethernet VC Tag header, and this bit can be located in the 'CFI/DEI bit location' of the Tag. This leaves the 3-bit PCP field in the Tag header to carry the priority and drop_eligible information. This is sufficient for the Ethernet based PTN application, as there are only 3 or 4 queues in the NNI ports and the drop_eligible information can be encoded in the 3-bit PCP together with the 3 or 4 priority levels.

The Ethernet VC Tag header format will then be as follows:

```
           16-bit             3   1      12-bit
+---------------------------+---+--+--------------+
| TPID = Transport VLAN Tag |PCP|LI|  Eth VC ID   |
+---------------------------+---+--+--------------+
```

Figure 11 – Transport VLAN Tag with Leaf Indicator (LI) bit

The main item is the extension of the filtering rules for rooted-multipoint Ethernet VCCs (VLANs) with two or more roots, which must take into account the LI bit.

```
  R1                                   R2
   |                                    |
+-----+f2.0   f1.0+-----+f3.0    f2.0+-----+
| FF1 |-+-------+-| FF2 |-+--------+-| FF3 |
|     |-+       +-|     |-+        +-|     |
+-----+f2.1   f1.1+-----+f3.1    f2.1+-----+
 | | |              | | |              | | |
 L1L2L3             L4L5L6             L7L8L9
```

Figure 12 – figure 10 with additional ETH_FPs

The LI bit in the Tag allows us to expand the functional model of this example with some additional ETH_FPs; e.g. the ETH_FP 'f2' can now be split into an ETH_FP 'f2.0' and 'f2.1' (see Figure 12). ETH_FP 'f2.0' carries all frames that have LI=0. ETH_FP 'f2.1' carries all frames that have LI=1. With this split, it is now possible to group the leaf ports L1,L2,L3 with f2.1 into one port group. The connectivity in FF1 will then be:

R1 → L1/L2/L3/f2
L1/L2/L3 → R1/f2
f2.0 → R1/L1/L2/L3
f2.1 → R1

The connectivity in FF2 will be:

f1.0 → f3/L4/L5/L6
f3.0 → f1/L4/L5/L6
L4/L5/L6 → f1/f3
f1.1 → f3
f3.1 → f1

The default value of this LI bit is 0.

In the ETH_CI definition we will have to include an ETH_CI_leaf_indicator signal. This ETH_CI_leaf_indicator signal is set to 0 by default, and can be set to 1 in an ETH MEP_So function under control of a new ETH/ETH_A_So_MI_leaf_port configuration signal. The ETH_CI_leaf_indicator signal is transparently passed through the ETH_FT and ETH_C functions, and is encoded into the LI bit of the Transport VLAN Tag (and vice versa).

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