International Telecommunication Union

ITU-T G.8010/Y.1306

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Amendment 1

(05/2006)

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

Ethernet over Transport aspects – General aspects

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

Internet protocol aspects – Transport

Architecture of Ethernet layer networks

Amendment 1

ITU-T Recommendation G.8010/Y.1306 (2004) – Amendment 1

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ITU-T Recommendation G.8010/Y.1306

Architecture of Ethernet layer networks

Amendment 1

Summary

This amendment contains additional material to be incorporated into ITU-T Recommendation G.8010/Y.1306. It presents the architectural aspects of Ethernet OAM.

Source

Amendment 1 to ITU-T Recommendation G.8010/Y.1306 (2004) was approved on 22 May 2006 by ITU-T Study Group 15 (2005-2008) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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CONTENTS

ITU-T Recommendation G.8010/Y.1306

Architecture of Ethernet layer networks

Amendment 1

1 Scope

This amendment provides updated material pertaining to the architecture of the Architecture for Ethernet Layer Networks as described in ITU-T Rec. G.8010/Y.1306. It presents the architectural aspects of Ethernet OAM.

2 References

– ITU-T Recommendation G.8010/Y.1306 (2004), *Architecture for Ethernet layer networks*.

3 Conventions

This amendment contains changes to ITU-T Rec. G.8010/Y.1306.

Some of this material is new material, while some represents modifications to existing material in the original Recommendation.

4 Changes to ITU-T Rec. G.8010/Y.1306

The following clauses contain changes to be made to G.8010/Y.1306.

4.1 Clause 1, Scope

Delete the last paragraph in this clause.

4.2 Clause 2, References

Add the following references:

– ITU-T Recommendation G.7710/Y.1701 (2001), *Common equipment management function requirements*.

– ITU-T Recommendation G.8001/Y.1354 (2006), *Terms and definitions for Ethernet frames over Transport(EoT).*

– ITU-T Recommendation G.8011/Y.1307 (2004), *Ethernet over Transport – Ethernet services framework.*

– ITU-T Recommendation G.8021/Y.1341 (2004), *Characteristics of Ethernet transport network equipment functional blocks.*

– ITU-T Recommendation X.731 (1992), *Information technology – Open Systems Interconnection – Systems management: State management function.*

– ITU-T Recommendation Y.1731 (2006), *OAM functions and mechanisms for Ethernet based networks*.

4.3 Clause 3, Definitions

Add the following definitions:

3.3.2 maintenance entity group: A maintenance entity group is defined, for the purpose of fragment/connection monitoring, between a set of flow/connection points within a fragment/connection. This set of flow/connection points may be located at the boundary of one administrative domain or a protection domain, or at the boundaries of two adjacent administrative domains. The maintenance entity group consists of one or more maintenance entities.

3.3.3 maintenance entity: The entity between two of the flow/connection points in a maintenance entity group.

3.3.4 maintenance entity group end point compound sink function: A compound transport processing function which accepts the characteristic information of the layer network at its input, extracts and processes the OAM information related to the maintenance entity group's monitoring, filters the OAM information from within to the maintenance entity group, adapts the information and presents it as the characteristic information of the layer or a client layer at its output, potentially as a (client) layer maintenance signal (e.g., AIS).

3.3.5 maintenance entity group end point compound source function: A compound transport processing function which accepts the characteristic information of the layer or a client layer network at its input, adapts that information, filters it for OAM information interfering with its own OAM information, adds OAM information to allow the maintenance entity group to be monitored and presents the resulting information at its output.

3.3.6 maintenance entity group intermediate point compound function: A compound transport processing function which accepts the characteristic information of the layer network at its input, reacts to OAM information related to the maintenance entity group's on-demand monitoring and presents the characteristic information without the OAM it reacted to at its output.

3.3.7 proactive monitoring: A method to continuously infer the status and performance of a maintenance entity group with the purpose to detect disturbances, faults and degradations immediately after their occurrence in order to verify the service level agreement and/or initiate recovery actions to restore the service to the guaranteed level.

3.3.8 on-demand monitoring: A method to infer a specific status or performance characteristic of a maintenance entity or a set of maintenance entities within a maintenance entity group at a specific point in time with the purpose to obtain a snapshot of the performance, or to diagnose an identified fault condition or performance degradation.

3.3.9 ETH_CI group: A group of ETH_CI signals that is monitored as a single MEG. For this purpose, ETH OAM is added to one of the ETH_CI signals in the group.

3.3.10 ETH path: The highest ETH MEG level in a set of eight MEG levels.

3.3.11 ETH tandem connection: An intermediate ETH MEG level in a set of eight MEG levels.

3.3.12 ETH section: The lowest ETH MEG level in a set of eight MEG levels.

4.4 Clause 4, Abbreviations

a) *Modify the following abbreviation:*

ETH Ethernet ~~MAC~~ layer network

b) *Add the following new abbreviations alphabetically:*

1DM One-way delay measurement

AIS Alarm Indication Signal

APS Automatic Protection Switching

CCM Connectivity Check Message

DA Destination MAC address

DMM Delay Measurement Message

DMR Delay Measurement Reply

EC Ethernet Connection

ETHDe ETH Diagnostic function within ETH*x* MEP

ETHDi ETH Diagnostic function within ETH*x* MIP

ETHG ETH Group

ETH*x* ETH at level *x* (*x* = path, tandem connection, section)

LBM Loopback Message

LBR Loopback Reply

LCK Locked

LMM Loss Measurement Message

LMR Loss Measurement Reply

LTM Link Trace Message

LTR Link Trace Reply

MEG Maintenance Entity Group

MEL Maintenance Entity Group Level

MEP Maintenance entity group End Point

MIP Maintenance entity group Intermediate Point

PDU Protocol Data Unit

SA Source MAC Address

TCS Traffic Conditioning and Shaping

TST Test PDU

4.5 Clause 5, Conventions

a) Change the numbers of Figures 1 and 2 to 5-1 and 5-2.

b) Change the number and the symbol of the unidirectional traffic conditioning function in Figure 3 to a traffic conditioning and shaping function as follows:

The diagrammatic convention for a ~~unidirectional~~ traffic conditioning and shaping function is shown in Figure 5-3. The TCS sink function provides the traffic conditioning process. The TCS source function provides the shaping process.

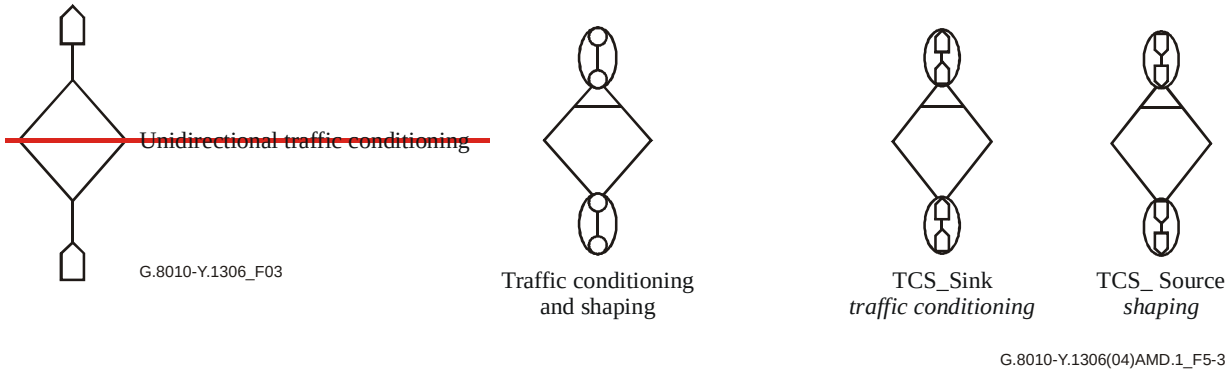

Figure 5-3 – Diagrammatic convention for ~~unidirectional~~ traffic conditioning and shaping function

c) Add the following new conventions:

The diagrammatic convention for a MEG end point (MEP) compound function is shown in Figure 5-4.

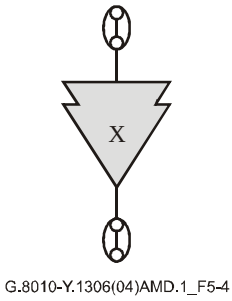

Figure 5-4 – Diagrammatic convention for MEG end point (MEP) compound function

The diagrammatic convention for a MEG intermediate point (MIP) compound function is shown in Figure 5-5.

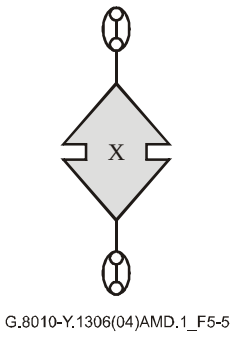

Figure 5-5 – Diagrammatic convention for MEG intermediate point (MIP) compound function

4.6 Clause 6, Functional architecture of Ethernet transport networks

a) Delete the word "MAC" *from the text in 6.2 and from the heading of 6.3.*

b) Modify the second and third paragraphs in 6.3.1 as follows:

~~The ETH_CI traffic unit consists of the following set of signals: Destination Address (DA), Source Address (SA), MAC Service Data Unit (M_SDU) with optional Priority (P).~~

The ETH_CI consists of the following set of signals: ETH_CI Data (D), ETH_CI Priority (P), ETH_CI Drop Eligibility (DE), ETH_CI Server Signal Fail (SSF) and optionally ETH_CI Automatic Protection Switching (APS). The ETH_CI_D signal carries the traffic unit that consists of the following fields: Destination Address (DA), Source Address (SA) and MAC Service Data Unit (M_SDU).

The ETH_CI traffic unit is transported over an ETH FPP Link within a link-specific frame or packet, of which the generic format is depicted in Figure 5. The Priority and Drop Eligibility signals may be transported implicitly or explicitly.

Refer to Appendix IV for further considerations on ETH_CI.

c) Add the following new text at the end of clause 6.3.2.2 ETH flow domain:

NOTE – The description of split-horizon functionality in an ETH flow domain is for further study.

d) Delete in Figure 8 in clause 6.3.2.5.2 and in Figure 9 in clause 6.3.2.5.3 the second ETH_TFP input and output ports on the two top left ETH_FT_So/Sk functions. Each ETH_FT function can have only one ETH_TFP.

e) Replace the text in clause 6.3.4.1 ETH flow termination function by a reference to clause 7.5.1.

f) Modify the text in and title of clause 6.3.4.2 "**ETH traffic conditioning function**" *as follows:*

6.3.4.2 ETH traffic conditioning and shaping function

The bidirectional ETH traffic conditioning and shaping (ETH_TCS) function is performed by a co-located pair of ETH traffic conditioning and shaping source (ETH_TCS_So) and sink (ETH_TCS_Sk) functions.

The ETH_TCS_So function performs the following shaping processes:

– For further study.

The ETH_TCS_Sk function performs the following traffic conditioning processes:

– *Classification*: This process classifies each ETH_CI traffic unit.

– *Metering*: This process meters every ETH_CI traffic unit within its class in order to determine the eligibility of the ETH_CI traffic unit.

– *Marking*: This process ~~and~~ sets the ~~d~~drop ~~precedence~~ eligibility if applicable.

– *Policing*: This process disposes of the ETH_CI traffic unit according to the result from the metering process. There are only two dispositions for an ETH_CI traffic unit, passing to the ETH_FP or discarding.

The ETH_TCS ~~traffic conditioning~~ function is assigned on a per ETH_FPP basis, as shown in Figure ~~2~~7-16. The ETH_FPP may include a single ETH_FP or multiple ETH_FPs.

~~The ETH traffic conditioning function may also be assigned to a group of ETH_FPs. This configuration allows the possibility of traffic conditioning based on the ETH_CI traffic units of multiple ETH_FPs. This is for further study.~~

a) *Add* ", source address" *to the second dash item in 6.5.1.1 between* "protocol ID" *and* "and destination". *Add* "– Generate the Priority and Drop Eligibility signals." *between the second and third dash items.*

b) *Add two extra dash items* "– Insert the source address and destination address." *and* "– Generate the Priority and Drop Eligibility signals." *between the first and second dash item in 6.5.1.2.*

c) *Add a new clause 6.5.1.3 as follows:*

6.5.1.3 ETH/MPLS and ETH/T-MPLS

The bidirectional ETH/MPLS adaptation (ETHP/MPLS_A) function is performed by a co-located pair of ETH/MPLS adaptation source (ETHP/MPLS_A_So) and sink (ETHP/MPLS_A_Sk) functions.

The bidirectional ETH/T-MPLS adaptation (ETHP/TM_A) function is performed by a co-located pair of ETH/T-MPLS adaptation source (ETHP/TM_A_So) and sink (ETHP/TM_A_Sk) functions.

NOTE – The server-specific processes for both functions are the same. The client-specific processes differ.

The ETHP/MPLS_A_So and ETHP/TM_A_So perform the following server-specific processes between its input and output:

– Type field encapsulation (0x8847 for unicast, per RFC 3032).

– Insert the source address and destination address.

– Generate the priority and drop eligibility signals.

– Output the frame towards the ETH_FT.

The ETHP/MPLS_A_Sk and ETHP/TM_A_Sk perform the following server-specific processes between its input and output:

– Verify that the DA field within a traffic unit contains the value of the local MAC address; otherwise discard the traffic unit.

– Remove the type field encapsulation.

6.5.2 Server/ETH adaptation

Modify the text in clause 6.5.2, **Server/ETH adaptation,** *function as follows:*

a) *Add the following sentence at the end of the second paragraph:*

The server-specific processes are associated with the aggregate stream of traffic units.

b) *Extend the last sentence of the first paragraph after Figure 15 as follows:*

. . . or an ETH*x* (*x* = P, T, S) flow termination or adaptation function as introduced in 7.5 and specified in ITU-T Rec. G.8021/Y.1341.

c) *After Figure 16, add the following new paragraph:*

NOTE – The SRV/ETH-m_A function may be expanded into a SRV/ETH_A, ETH*x*_FT and ETH*x*/ETH-m_A function when the aggregate (all-to-one) signal requires fragment/connection monitoring. An SRV/ETH-m adaptation function is *not* capable of originating and terminating proactive ETH OAM signals and of originating, responding to and terminating on-demand ETH OAM signals. It is deployed for the case where all-to-one fragment/connection monitoring is not applicable.

d) *Add between the first and second bullet item in 6.5.2, the following additional bullet item:*

• For the case of the Srv/ETH_A_So function, insert a Priority-Tag to encode the ETH_CI_P and ETH_CI_DE information as appropriate.

e) *Delete the bullet item* "• Optionally generate and insert IEEE 802.3 protocol (e.g., PAUSE) ETH_CI traffic units."

f) *Add the following sentence at the end of the fifth bullet item in 6.5.2:*

This may include the optional generation and insertion of IEEE 802.3 protocol (e.g., PAUSE) ETH_CI traffic units.

g) *Add the following sentence at the end of the sixth bullet item in 6.5.2:*

"This may include the optional termination and processing of IEEE 802.3 protocol ETH_CI traffic units (e.g., PAUSE)."

h) *Delete the bullet item* "• Optionally terminate IEEE 802.3 protocol ETH_CI traffic units. (e.g., PAUSE)".

i) *Add before the last bullet item in 6.5.2 the following additional bullet item:*

"• On detection of a Signal Fail condition, block the ETH_CI traffic units and insert the ETH-AIS signal at the client's MEG level. ETH-AIS insertion can be disabled; e.g., when the client MEG is under control of a spanning tree protocol."

j) *Add between "*ETH_CI*" and "*traffic unit*" in the last bullet item in subclause 6.5.2 the words "*or ETH-AIS*".*

k) *Add before the first bullet item in 6.5.2.1.1 the following additional bullet item:* "– Optionally generate and insert IEEE 802.3 protocol (e.g., PAUSE) traffic units."

l) *Add after the last bullet item in 6.5.2.1.1 the following additional bullet item:* "– Optionally terminate IEEE 802.3 protocol traffic units."

m) *Replace (twice) the words* "the appropriate Recommendation" *in the text in 6.5.2.2.1* SDH Path/ETH adaptation by "ITU-T Rec. G.8012/Y.1308".

n) *Replace (twice) the references to G.7041/Y.1303 in the text in 6.5.2.2.2 OTN Path/ETH adaptation by* "G.8012/Y.1308".

o) *Modify the text in 6.5.2.2.3 MPLS Path/ETH adaptation as follows:*

6.5.2.2.3 MPLS path/ETH and T-MPLS/ETH adaptation

The adaptation to the MPLS and T-MPLS path layer networks is performed in MPLS/ETH and T-MPLS/ETH adaptation (MPLS/ETH_A, TM/ETH_A) functions. The MPLS/ETH_A and TM/ETH_A ~~is~~are considered to consist of two types of processes: client-specific processes and server-specific processes. The description of the server-specific processes for MPLS/ETH adaptation is outside the scope of this Recommendation. The description of the server-specific processes for T-MPLS/ETH adaptation is specified in ITU-T Rec. G.8110.1/Y.1370.1.

The bidirectional MPLS/ETH and T-MPLS/ETH adaptation function is performed by a co-located pair of source and sink MPLS/ETH and T-MPLS/ETH adaptation functions.

The MPLS/ETH and T-MPLS/ETH adaptation source (MPLS/ETH_A_So, TM/ETH_A_So) function performs (in addition to the server layer non-specific processes as described in 6.5.2) the following server-layer related specific processes:

– Map the ETH_CI traffic unit in the ETH over MPLS specific frame as specified in ITU-T Rec. G.8012/Y.1308.

– Map the ETH over MPLS link specific frame in the payload of the MPLS packet.

The MPLS/ETH and T-MPLS/ETH adaptation sink (MPLS/ETH_A_Sk, TM/ETH_A_Sk) function performs (in addition to the server-layer non-specific processes as described in 6.5.2) the following server-layer related specific process:

– Extract ETH_CI traffic units from the MPLS or T-MPLS payload field.

4.7 Additions to Clause 7, Ethernet network management

Replace the text in clause 7 with:

This clause describes network management for the Ethernet transport network. In particular, it describes the maintenance entities, maintenance entity supervision techniques and layer network management requirements for fault, performance and configuration management, management communications and client/server interaction management.

Generic fault, configuration and performance management

The Ethernet transport network shall provide support for fault, configuration and performance management end-to-end and also within and between administrative boundaries.

It shall provide a means of detection and notification in the event of a misconnection.

The Ethernet transport network shall provide facilities to detect faults, isolate faults and initiate recovery actions where applicable. The Ethernet transport network shall provide facilities for single-ended maintenance.

In the event of a signal within the server layer being interrupted, upstream and downstream network entities in the server layer shall be notified.

The Ethernet transport network shall be able to detect performance degradations to avoid failures and verify quality of service.

Generic management communications

The Ethernet transport network shall support communications between:

– OSs and remote NEs;

– craft terminals and local or remote NEs.

These forms of communication may also be supported externally to the Ethernet transport network.

4.8 Additions to subclause 7.1, Ethernet maintenance entities

Modify the title of subclause 7.1 as follows:

7.1 Ethernet maintenance entit~~ies~~**y groups**

Modify 7.1 as follows:

The ETH layer network may contain multiple administrative domains: e.g., user, service provider and one or more network operator domains. Each of these administrative domains has an associated maintenance entity group located between a ~~pair~~ set of ETH flow points at the boundaries of that ETH layer network administrative domain. Maintenance entit~~ies~~y groups also exist between a ~~pair~~ set of ETH flow points at the boundary of two adjacent ETH layer network administrative domains. Figures ~~23~~ 7-1 (top left, bottom) and ~~24~~ 7-2 illustrate such ETH layer network administrative domain maintenance entities and maintenance entity groups for the point-to-point and multipoint connection/fragment cases.

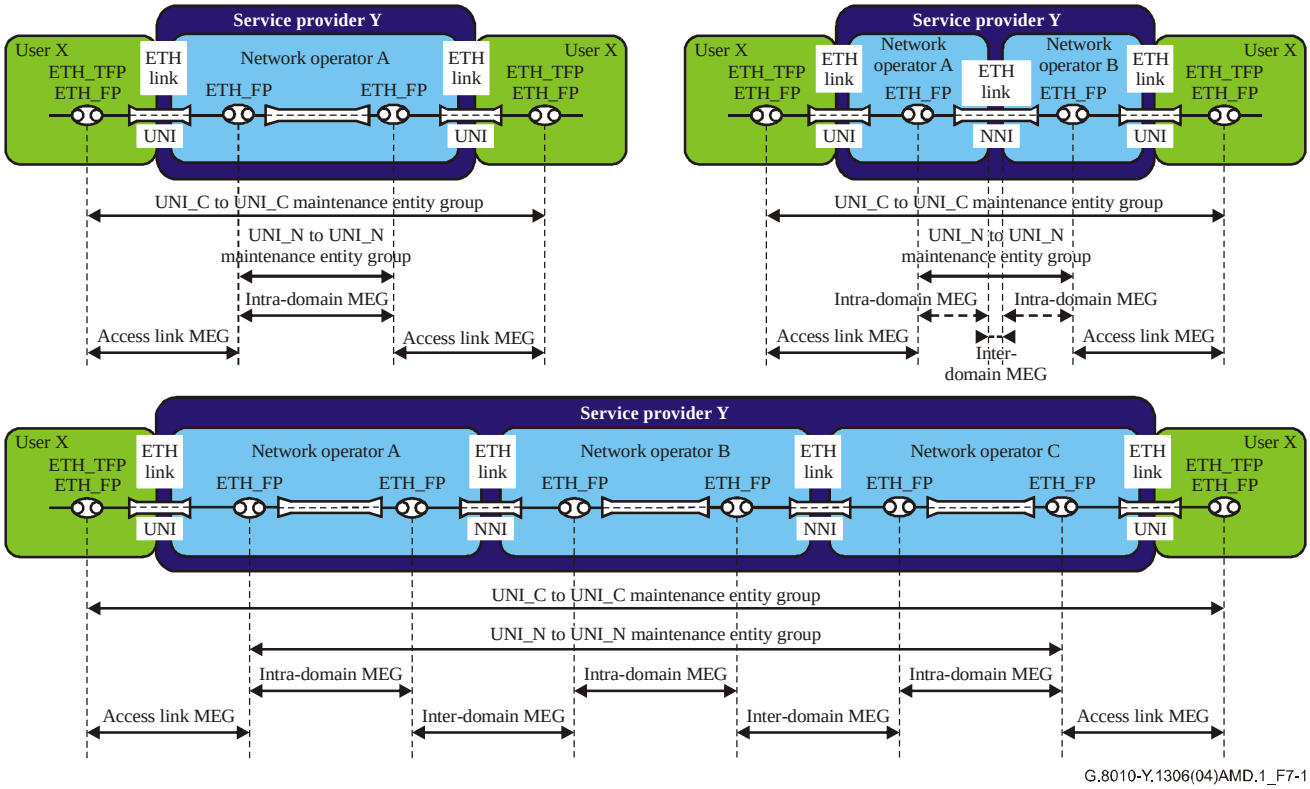

Figure ~~23~~7-1 – Point-to-point administrative domain associated ETH maintenance entity groups

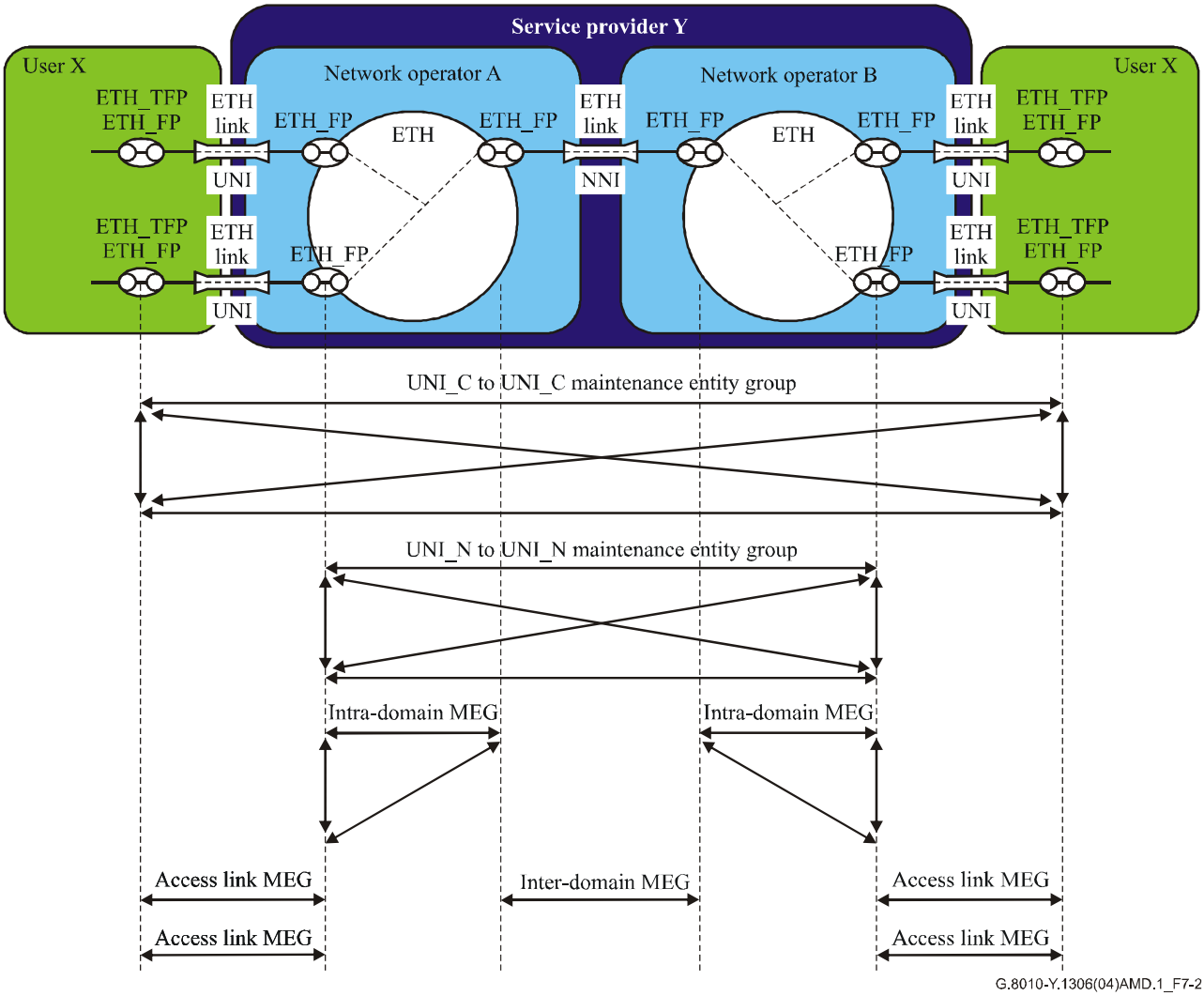

Figure ~~24~~7-2 – Multipoint administrative domain associated ETH maintenance entity groups

Renumber "Figure 25" *as* "Figure 7-3".

4.9 Additions to subclause 7.2, Ethernet maintenance entity supervision techniques

a) *Modify* "maintenance entity" *in the title and body of 7.2 and body of 7.2.1 into* "maintenance entity group". *Modify* "maintenance entities" *in the body of subclause 7.2 and body of subclause 7.2.1 into* "maintenance entity groups".

b) *Modify the text in 7.2.3 as follows:*

~~For further study.~~ For the diagnostic tests of certain parameters (e.g., throughput) an intrusive measurement has to be performed that interrupts the user data traffic in the diagnosed entity. The diagnostic tests can be performed as unidirectional or bidirectional tests (loopback). In case of unidirectional tests the user data traffic in one direction is interrupted. In case of bidirectional tests the user data traffic in both directions is interrupted. A LCK signal is inserted for the immediate client MEG at the egress of the interrupted entity.

This technique is restricted to the set-up, or intermittent testing.

c) Modify the text in 7.2.4 as follows:

Additional OAM is added to the original characteristic information such that the maintenance entity group of interest can be directly monitored by a (connectionless) trail created in a sublayer. With this technique all parameters can be tested directly. This scheme can provide for nested sublayer (connectionless) trail monitored maintenance entit~~ies~~y groups.

ETH layer network maintenance entit~~ies~~y groups may be directly monitored by means of insertion of ~~segment monitoring~~ETH OAM at the ingress of the maintenance entity group and extraction and processing of this OAM at the egress of the maintenance entity group. Insertion, extraction and processing of this ~~segment monitoring~~ETH OAM is functionally performed in ETH ~~segment~~ tandem connection or section flow termination functions ETH~~S~~*x*_FT, which establish ETH connectionless ~~segment~~ tandem connection (*x* = T) or section (*x* = S) trails. For this purpose, the ETH_FP is expanded into an ETH_FP, ETH~~S~~*x*/ETH_A function, ETH~~S~~*x*_AP, ETH~~S~~*x*_FT and ETH_TFP as illustrated in Figure ~~26~~7-4.

NOTE – ETH OAM requirements are defined in ITU-T Rec. Y.1730. ETH OAM mechanisms are defined in ITU-T Rec. Y.1731~~for further study~~. Refer to Appendix VI for an overview of the allocation of Y.1731 ETH OAM messages to G.8010 atomic functions.

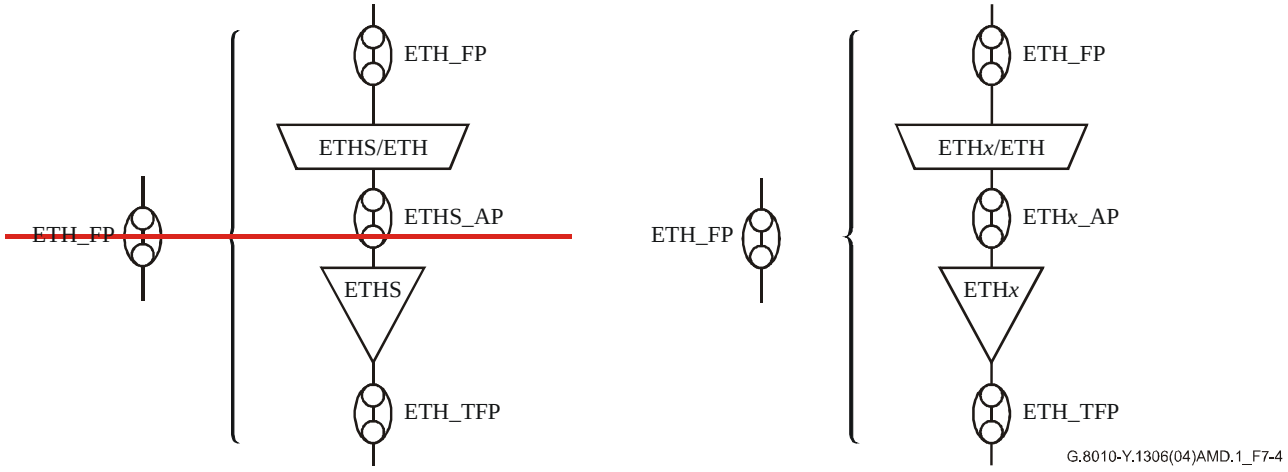

Figure ~~26~~7-4 – Creating an ETH sublayer by expansion of an ETH_FP

d) Modify the 2nd paragraph in 7.2.5 as follows:

ETH network flows may be directly monitored by means of insertion of ~~connection monitoring~~ETH OAM at the ingress of the ETH connectionless trail and extraction and processing of this OAM at the egress of the connectionless trail. Insertion and extraction and processing of this ~~connection monitoring~~ETH OAM is functionally performed in ETH flow termination functions ETH*x*_FT (*x* = P), which establish ETH connectionless trails.

NOTE – ETH OAM requirements are defined in ITU-T Rec. Y.1730. ETH OAM functions and mechanisms are ~~for further study~~defined in ITU-T Rec. Y.1731. Refer to Appendix VI for an overview of the allocation of Y.1731 ETH OAM messages to G.8010 atomic functions.

e) Add new clauses 7.2.6 to 7.2.8:

7.2.6 Maintenance entity group levels

Ethernet OAM has defined eight fragment/connection monitoring maintenance entity group (MEG) levels: one path, up to six tandem connection and one section level as defined in Table 7-1. The section level may also be deployed as a seventh tandem connection level.

Maintenance entity group (MEG) levels can be nested, such that MEG level k encompasses MEG levels k–1 to 0. Overlapping is not supported.

Table 7-1 – MEG level and allocation

MEG level	Fragment/connection monitoring MEG
7	Path
6	Tandem connection 6
5	Tandem connection 5
4	Tandem connection 4
3	Tandem connection 3
2	Tandem connection 2
1	Tandem connection 1
0	Section [or Tandem connection 0]

The ETH layer network supports the addition of one or two VLAN tags to the ETH characteristic information for the purpose of ETH_CI aggregation. The addition of the VLAN tag encapsulates, amongst others, the client MEG OAM flows within the aggregated ETH_CI signals. After such encapsulation, another set of eight MEG levels is available for potential use by applications (Figure 7-5).

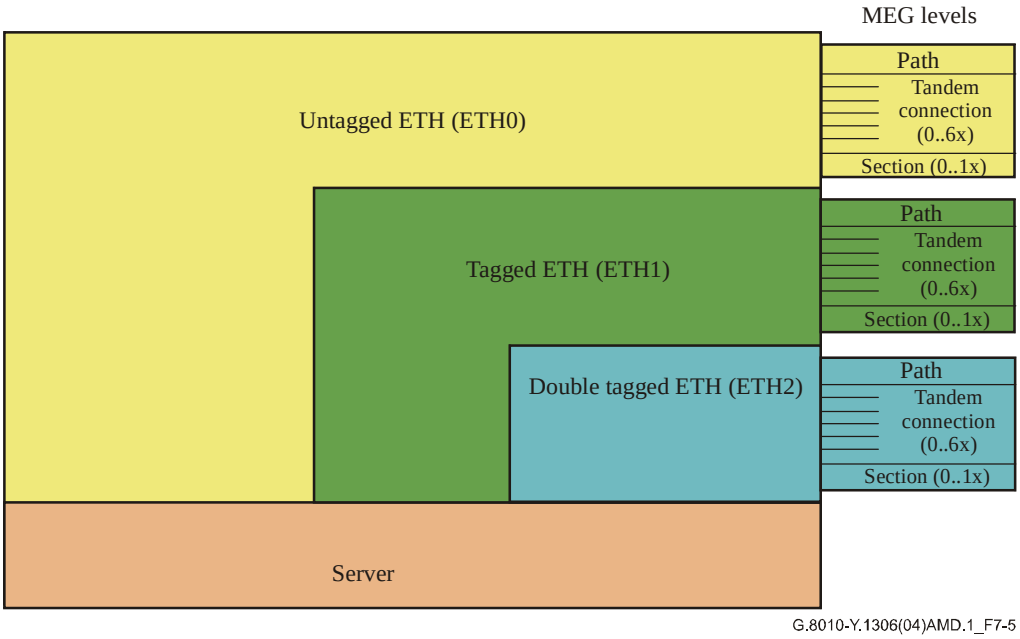

Figure 7-5 – Multiple sets of Ethernet MEG levels

VLAN tags may be added to all ETH_CI signals being aggregated, or to a subset of those signals. In the latter case, one or more ETH_CI signals will be a member of the "untagged set" as defined in IEEE 802.1Q, and no new set of eight MEG levels will be available; the client and the server share one set of eight MEG levels. With three sets of eight MEG levels, four modes are available (Figure 7-6):

a) Independent mode: ETH0, ETH1, ETH2 each have their own set of eight MEG levels;

b) Mixed mode 0-1: ETH0 and ETH1 share one set of eight MEG levels, while ETH2 has its own set of eight MEG levels;

c) Mixed mode 1-2: ETH0 has its own set of eight MEG levels, while ETH1 and ETH2 share one set of eight MEG levels;

d) Dependent mode: ETH0, ETH1, ETH2 all share one set of eight MEG levels.

When ETH_CI signals are aggregated in the Ethernet transport network, it is recommended adding a VLAN tag to all the client signals being aggregated. This maximizes the ETH OAM transparency for the ETH_CI client signals.

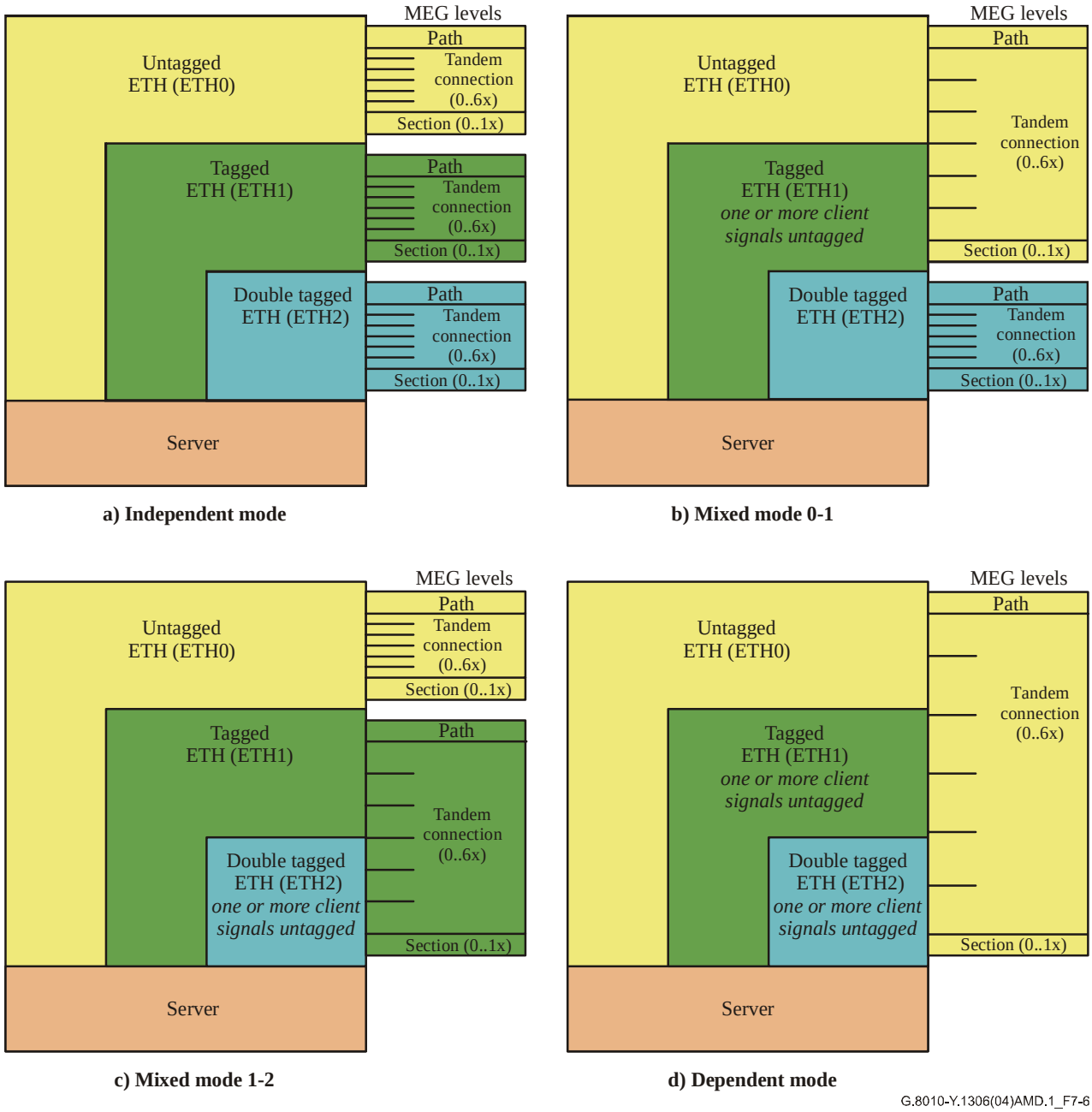

Figure 7-6 – Four ETH OAM MEG level alternatives

Maintenance Entity Group level allocation

When the network provides an EC service, the ETH MEG levels are allocated to the ownership roles in the EC. The allocation is specified in the service level agreement of the EC service.

Two basic fragment/connection monitoring relationships can be distinguished:

– "client/server";

– "peering".

In the "client/server" fragment/connection monitoring relationship, client and server each have eight maintenance entity group levels. In the "peering" fragment/connection monitoring relationship, client and server share eight maintenance entity group levels.

The recommended fragment/connection monitoring relationships are:

– customer/network: "client/server"

– service provider/network operator: "peering"

Some default allocation examples are presented in Appendix V.

7.2.7 Maintenance entity group level filtering

ETH maintenance entity group end point source compound functions (MEP_So) add their ETH connection monitoring Ethernet OAM to the incoming ETH_CI. At ETH tandem connection and section level MEP_So compound functions, the incoming ETH_CI may contain ETH_CI traffic units carrying Ethernet OAM for one or more MEG levels.

To secure the operation of the local ETH tandem connection or section, the ETH MEP source compound function prevents that Ethernet OAM at its own or lower MEG level (k, k–1, .., 0) from entering its maintenance entity group. Ethernet OAM of higher MEG levels (7,..,k+1) only is transparently passed through. See example in Figure 7-7. The ETH tandem connection or section MEP sink compound function prevents that Ethernet OAM at its own, or a lower MEG level, from leaving the maintenance entity group.

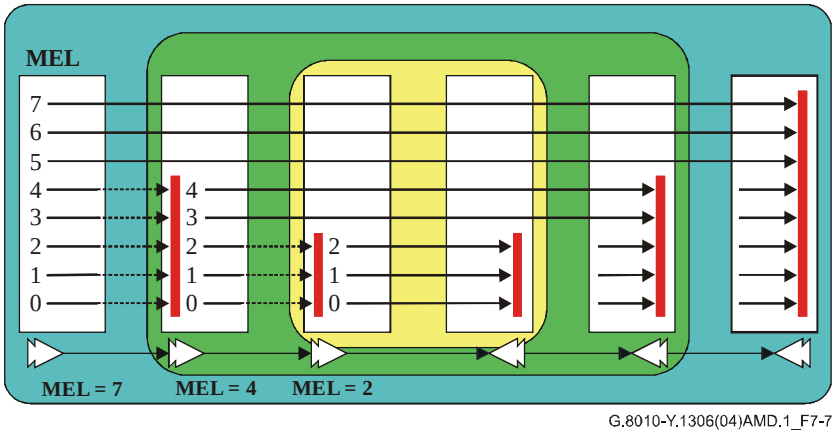

Figure 7-7 – OAM filtering example

ETH path level MEP source compound functions, which encapsulate and optionally multiplex its client signal(s), pass through all ETH OAM within its client signal(s) (Figure 7-8). The function is the start of an additional set of eight maintenance entity group levels.

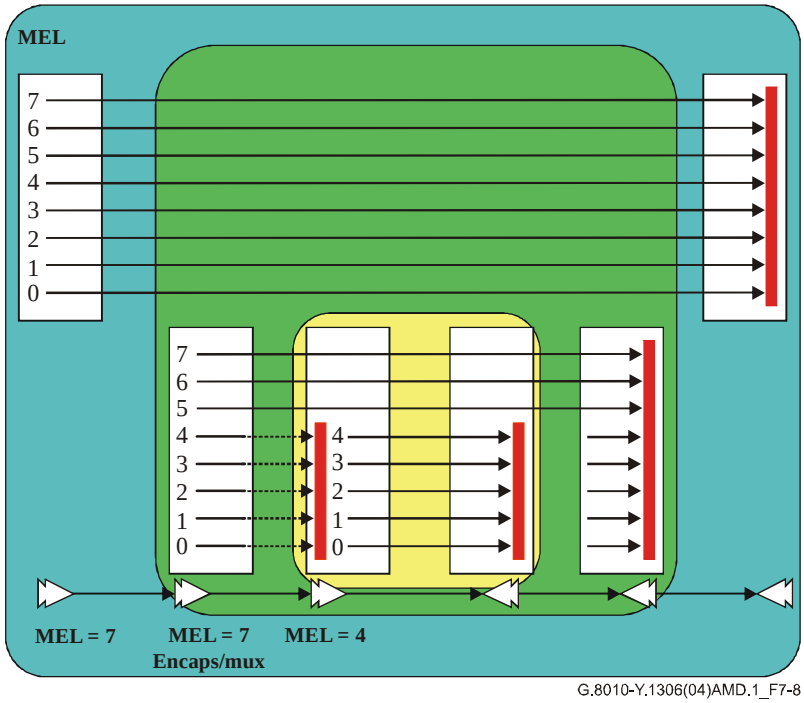

Figure 7-8 – OAM filtering example

7.2.8 ETH maintenance entity group monitoring

7.2.8.1 ETH MEG proactive monitoring

ETH maintenance entity groups may be proactively monitored by means of insertion of ETH OAM at the ingress of the ETH maintenance entity group and extraction and processing of this ETH OAM at the egress of the ETH maintenance entity group. Results (alarm, threshold report, 15 min/24 h performance counts) are autonomously reported to network management as part of the fault management and performance monitoring applications (refer to clauses 7 and 10 of ITU-T Rec. G.7710/Y.1701).

An ETH maintenance entity group may operate at the path (maintenance entity group level 7), tandem connection (maintenance entity group levels 6 to 1) or section (maintenance entity group level 0).

Insertion and extraction and processing of this ETH OAM is functionally performed in an ETH path (P), tandem connection (T) or section (S) flow termination function ETH*x*_FT (*x*: P, T, S). (Refer to 7.5.1). Refer to 7.5.2 for a description of the ETH adaptation functions.

The ETH*x*_FT function at the ingress/egress of an N point ETH maintenance entity group terminates the maintenance entity group and N–1 point-to-point maintenance entities.

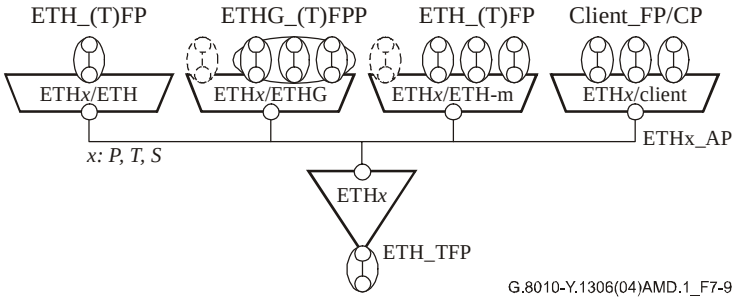

Figure 7-9 – ETH MEG proactive monitoring functions

7.2.8.2 ETH MEG group monitoring

A group of ETH signals may be proactively monitored by means of insertion of ETH OAM at the ingress of the ETH MEG group maintenance entity group, and by extraction and processing of this ETH OAM at the egress of the ETH MEG group maintenance entity group.

Insertion, extraction and processing of this ETH OAM is functionally performed in ETH group flow termination functions ETHG_FT. Refer to 7.5.1.

For this purpose, the ETH_FPP is expanded into an ETH_FPP, ETHG/ETH_A function, ETHG_APP, ETHG_FT and ETH_TFPP as illustrated in Figure 7-10.

The ETH MEG group connection monitoring may be deployed at a tandem connection or at section MEG level.

The ETHG_FT function at the ingress/egress of an N point ETH group maintenance entity group terminates the group maintenance entity group and N–1 point-to-point group maintenance entities.

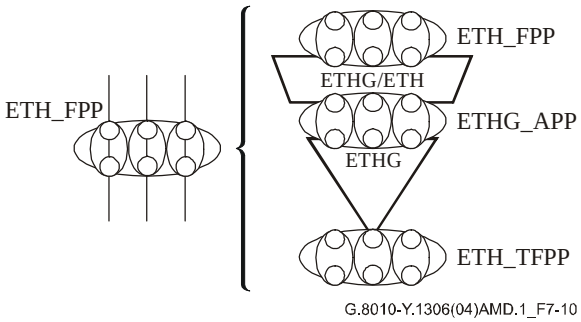

Figure 7-10 – Creating ETH proactive bundle monitoring functions by expansion of an ETH_FPP

7.2.8.3 ETH MEG on-demand monitoring

On-demand ETH MEG monitoring application complements the proactive ETH MEG monitoring application. On-demand ETH MEG monitoring application provides performance characterization and fault localization capabilities. The latter allows for discovering the node in which an ETH continuity or connectivity fault is located. On-demand ETH OAM can be inserted at the ingress of the ETH maintenance entity, which is then replied to from intermediate and/or egress points of the ETH maintenance entity group. The result (pass/fail, value/value set) is reported to the requester. The exchanged OAM information may be in the form of a single instance, a single series within a restricted period of time, a repetitive instance or a repetitive series. A repetitive instance or series is an instance or series which repeats after a specified period (e.g., one hour).

Insertion, extraction and processing of this on-demand ETH OAM is functionally performed in ETH diagnostic flow termination functions ETHDy_FT. For this purpose, the ETH_FP is expanded into an ETH_FP, ETHDy/ETH_A function, ETHD_AP, ETHDy_FT and ETH_TFP as illustrated in Figure 7-11.

An ETHDy_FT function has two modes: originator and responder (refer to 7.5.1.3). Both modes are enabled in the ETHDe_FT function, which is part of an ETH MEP compound function (see 7.2.8.4). The responder mode is enabled in the ETHDi_FT function, which is part of an ETH MIP compound function (see 7.2.8.5).

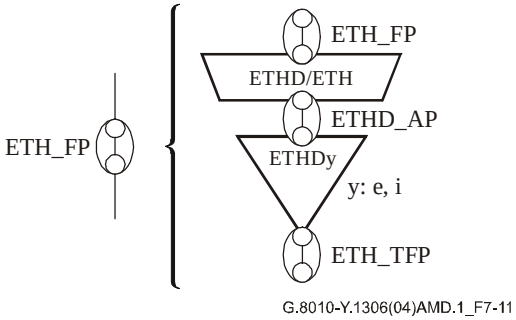

Figure 7-11 – Creating ETH on-demand monitoring functions by expansion of an ETH_FP

7.2.8.4 ETH MEP compound functions

The ETH MEP flow termination functions combine the following atomic functions (Figures 7-12 and 7-13):

– ETH path/tandem connection/section/group to ETH or ETH adaptation;

– ETH path/tandem connection/section/group flow termination;

– ETH diagnostic to ETH adaptation;

– ETH diagnostic flow termination.

An ETH MEP function is capable of originating and terminating proactive ETH OAM signals and of originating, responding to and terminating diagnostic ETH OAM signals.

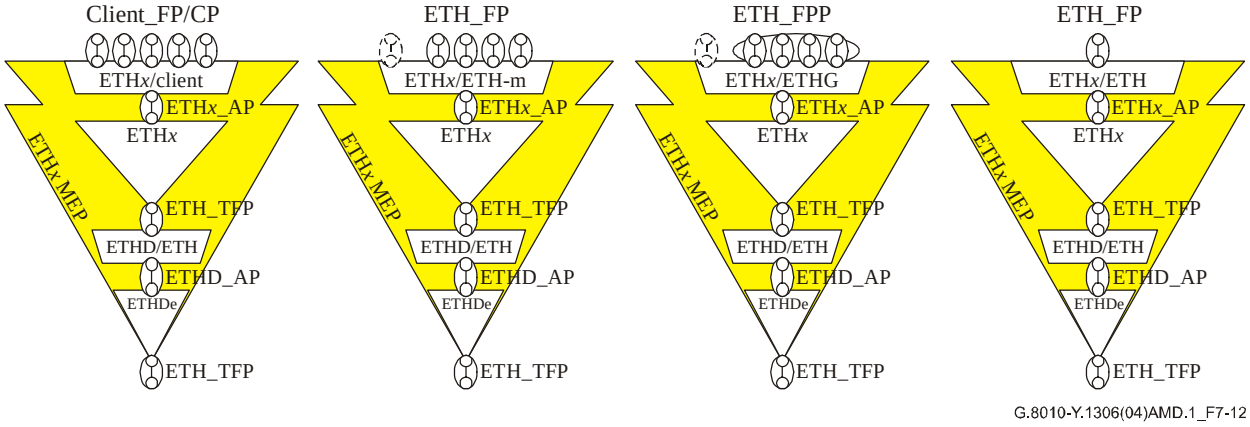

Figure 7-12 – ETH*x* (*x* = P, T, S) MEP compound functions

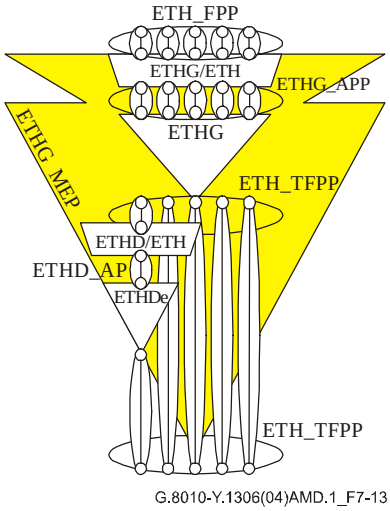

Figure 7-13 – ETHG MEP compound function

7.2.8.5 ETH MIP compound function

The ETH MIP compound function consists of two pairs of the ETH diagnostic adaptation and flow termination functions, each facing in opposite directions (Figure 7-14).

An ETH MIP function is capable of responding to on-demand ETH OAM signals.

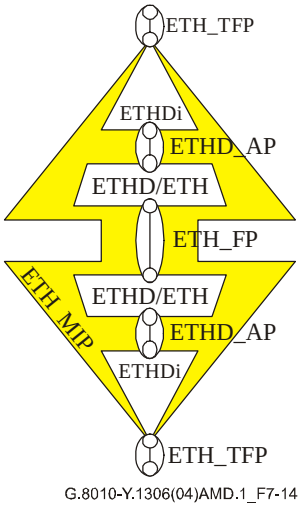

Figure 7-14 – ETH MIP compound function

A variant of this ETH MIP compound function is the half-MIP compound function which consists of a single pair of the ETH diagnostic adaptation and flow termination functions (Figure 7-15).

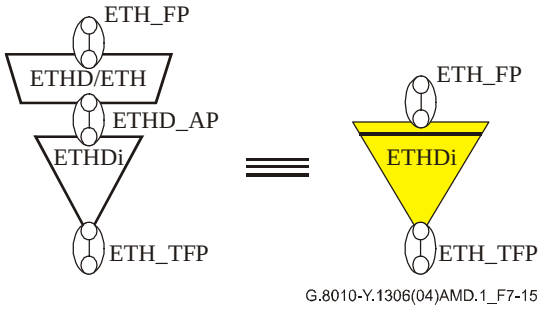

Figure 7-15 – ETH half-MIP compound function

4.10 Additions to subclause 7.3, Ethernet layer network management requirements

Modify the text in 7.3 as follows:

Refer to ITU-T Rec. Y.1730 for ETH OAM requirements based on ETH reference models and MEs and refer to ITU-T Rec. Y.1731 for ETH OAM functions and mechanisms. Further Ethernet layer network management requirements are for further study.

4.11 Additions to subclause 7.4, Ethernet layer network traffic management

Modify the text in 7.4 as follows:

ETH traffic management refers to all network actions aiming to meet the network performance objectives and negotiated quality of service commitments, and to avoid congested conditions. One of the elements of this traffic management concerns the conditioning of the ingress traffic ~~in~~ at an ETH administrative domain to enforce ~~it to be within the boundaries of~~ the traffic parameters defined in the service level agreement (SLA). Another element of this traffic management concerns the shaping of the egress traffic at an ETH administrative domain to adapt it to the traffic parameters defined in the service level agreement. For this purpose, the ETH_FPP can be expanded into an ETH_FPP, ETH_TCS function and ETH_FPP as illustrated in Figure ~~27~~7-16.

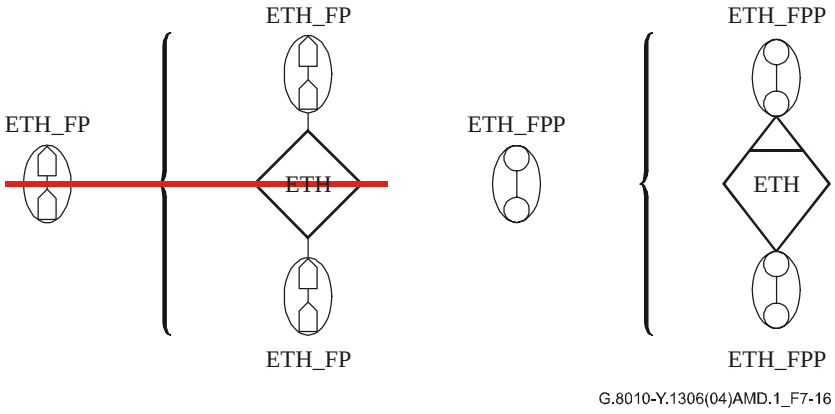

Figure ~~27~~7-16 – Expanding an ETH_FPP
for the purpose of traffic conditioning and shaping

4.12 New clause 7.5, ETH transport processing functions

Add the following text:

7.5 ETH transport processing functions

The ETH transport processing functions are:

– ETH flow termination function;

– ETH-to-ETH adaptation functions;

– ETH-to-client adaptation functions;

– Server-to-ETH adaptation functions.

This clause describes the functionality of the ETH flow termination functions and the ETH-to-ETH adaptation functions. The ETH-to-client adaptation functions are described in 6.5.1 and the server-to-ETH adaptation functions are described in 6.5.2. Refer to ITU-T Rec. G.8021/Y.1341 for specifications of these functions.

7.5.1 ETH flow termination functions

The bidirectional ETH flow termination (ETH*x*_FT, *x* = P, T, S) function is performed by a co-located pair of ETH flow termination source (ETH*x*_FT_So) and sink (ETH*x*_FT_Sk) functions.

The following generic processes may be assigned to an ETH connection monitoring flow termination:

– validation of connectivity integrity;

– assessment of transmission quality;

– transmission defect detection and indication;

– connectivity fault localization.

The ETH*x*_FT_So function accepts adapted information from a client (sub)layer network at its input, inserts the ETH trail termination OAM (with MEG level set to *local* MEG level) as a separate and distinct logical data stream and presents the characteristic information of the ETH connection monitoring sublayer network at its output.

The ETH*x*_FT_Sk accepts the characteristic information of the ETH connection monitoring sublayer network at its input, extracts and processes the ETH OAM destined for the function and presents the remainder as adapted information at its access point output, while presenting the ETH maintenance entity group fault and performance status at its management point output.

There are several ETH flow termination functions defined, each for a specific application:

– ETH path (ETHP), tandem connection (ETHT) and section (ETHS) flow termination;

– ETH group (ETHG) flow termination;

– ETH diagnostic (ETHD) flow termination.

7.5.1.1 ETH path, tandem connection, section flow termination function

The ETH*x*_FT function is the endpoint of the ETH maintenance entity group.

The ETH*x*_FT_So function inserts a path, tandem connection or section level ETH-CCM OAM signal, which carries the connectivity check, frame loss measurement and remote defect indication information.

The ETH*x*_FT_Sk function extracts and processes path, tandem connection or section level ETH-CCM, ETH-AIS and ETH-LCK OAM signals.

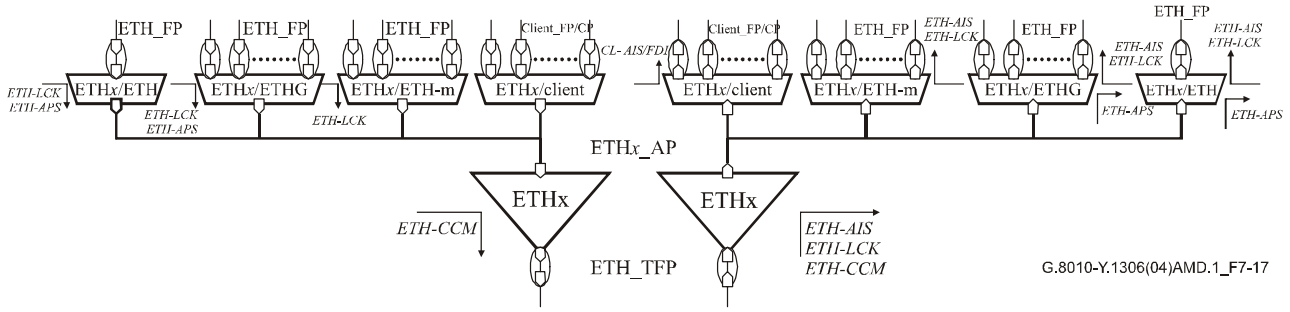

Figure 7-17 – ETH*x* atomic functions and their ETH OAM signals

7.5.1.2 ETH group (ETHG) flow termination function

The ETHG_FT function is the endpoint of the ETH group maintenance entity group level (ETH MEG level in the range 7 to 1). The ETH group MEG performs monitoring for the group of ETH_CI signals within the ETH_FPP. The ETH_FPP may include the complete range of ETH_FPs, or a subset of them.

The ETH OAM is carried over either the ETH_FP with the lowest number in the contiguous range of ETH_FPs, or over a selected ETH_FP within the group of arbitrary ETH_FPs. Note that this selected group member must always be present, with or without user traffic.

The ETHG_FT_So function may insert tandem connection or section level ETH CCM OAM signals.

The ETHG_FT_Sk function extracts and processes tandem connection or section level ETH CCM, AIS and LCK OAM signals.

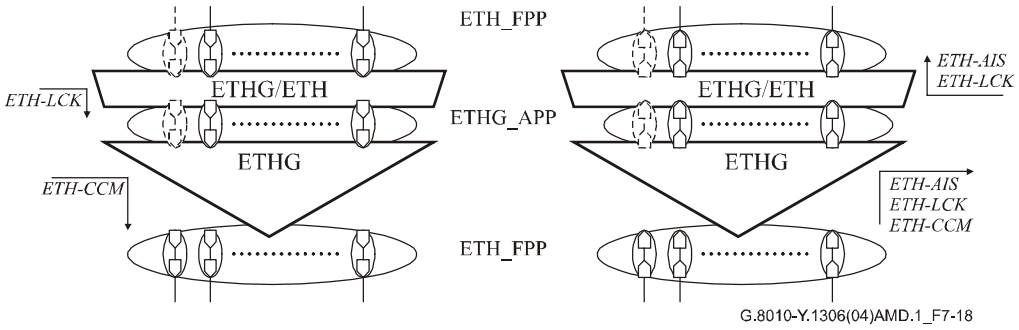

Figure 7-18 – ETHG atomic functions and their ETH OAM signals

7.5.1.3 ETH diagnostic (ETHD) flow termination function

The ETHD_FT function is an endpoint (ETHDe) or intermediate point (ETHDi) of ETH on-demand OAM frames for an ETH path, tandem connection or section maintenance entity group. As an endpoint of on-demand OAM, it acts as originator and responder, as an intermediate point, it acts only as responder.

The ETHDe_FT_So function (endpoint role) is able to insert ETH LBM, TST, LTM, LMM and/or DMM OAM signals with MEG level as per configuration when ordered to do so via its management point. The ETHDe_FT_So function inserts ETH LBR, LMR or DMR OAM frames when ordered to do so via its remote point that is controlled by its associated ETHD_FT_Sk function and inserts ETH LTR OAM frames when ordered to do so via its management point. For LMR, it inserts the transmit frame count, while for DMR, it inserts the transmit timestamp.

The ETHDi_FT_So function (intermediate point role) inserts ETH LTM OAM signals with MEG level as per configuration when ordered to do so via its management point. The ETHDi_FT_So

function inserts ETH LBR OAM frames when ordered to do so via its remote point that is controlled by its associated ETHD_FT_Sk function, and inserts ETH LTR OAM frames when ordered to do so via its management point.

The ETHD_FT_So functions receive from one or more on-demand functions in the EMF on-demand OAM frames, including OAM-specific fields, destination address and MEG-independent common fields via their management point, and insert the MEG level, type and source addresses to construct the on-demand OAM-specific frame. For the case of LMM, it also inserts the frame count, and for DMM, it inserts the timestamp.

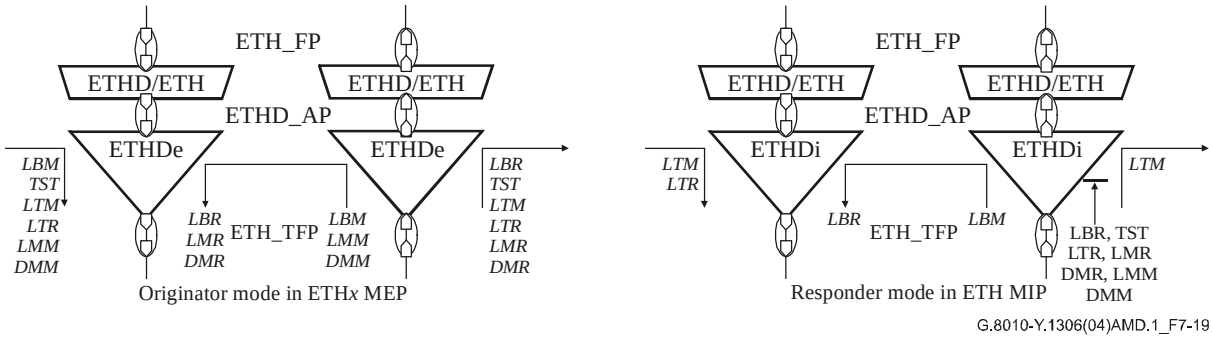

Figure 7-19 – ETHD atomic functions and their ETH OAM signals

The ETHDe_FT_Sk function (endpoint role) extracts and processes ETH LBM, LBR, TST, LTM, LTR, LMM, LMR, DMM and DMR OAM signals with MEG level as per configuration and matches the destination address (unicast, multicast) of the ETHDe_FT function. It forwards the received LBR, TST, LTM, LTR, LMR and DMR OAM signals to its management point; the LMR OAM signal with the additional receive frame count and the DMR OAM signal with the additional receive timestamp. The ETHDe_FT_Sk function controls the insertion, by its associated ETHDe_FT_So function, of the LBM, LMM and DMM associated reply OAM frames (LBR, LMR, DMR) after insertion of the receive frame count value in the LMM frame and receive timestamp in the DMM frame.

The ETHDi_FT_Sk function (intermediate point role) extracts ETH LBM, LBR, TST, LTM, LTR, LMM, LMR, DMM and DMR OAM signals with MEG level as per configuration and matches the destination address (unicast, multicast) of the ETHDi_FT function. It forwards the received LTM OAM signals to its management point. The ETHDi_FT_Sk function controls the insertion, by its associated ETHDi_FT_So function, of the LBM associated reply OAM frame (LBR). The ETHDi_FT_Sk function discards the extracted LBR, TST, LTR, LMM, LMR, DMM and DMR OAM signals.

7.5.2 ETH adaptation functions

The bidirectional ETH*x*/ETH adaptation (ETH*x*/ETH_A, *x* = P, T, S) function is performed by a co-located pair of ETH connection monitoring adaptation source (ETH*x*/ETH_A_So) and sink (ETH*x*/ETH_A_Sk) functions.

The following generic processes may be assigned to an ETH MEG monitoring adaptation:

– forwarding or blocking client signals depending on the administrative state;

– filtering incoming OAM frames to secure MEG monitoring operation;

– generation of OAM maintenance signals AIS and LCK (refer to Figures 7-17 and 7-18);

– multiplexing or demultiplexing ETH_CI signals, including addition or removal of a tributary identifier.

There are five ETH*x*/ETH adaptation functions defined:

– ETH*x*/ETH-m adaptation function, which is the endpoint of a path, tandem connection or section monitoring ETH sublayer carrying a multiplexed set of ETH_CI signals;

– ETH*x*/ETH adaptation function, which is the endpoint of a path, tandem connection or section monitoring ETH sublayer;

– ETH*x*/ETHG adaptation function, which is the endpoint of a path, tandem connection or section monitoring ETH sublayer carrying a multiplexed set of ETH_CI signals of an ETH group;

– ETHG/ETH adaptation function, which is the endpoint of either a tandem connection or a section connection monitoring ETH sublayer carrying an aggregated set of ETH_CI signals;

– ETHD/ETH adaptation function, which is the ETH diagnostic sublayer entry/exit.

7.5.2.1 ETH*x*/ETH-m adaptation

The ETH*x*/ETH-m adaptation source (ETH*x*/ETH-m_A_So) performs the following processes between its set of input ETH_FPs and its output ETH*x*_AP:

– Supports configuration of *client* MEG Level for each ETH_FP;

– Forwards or blocks forwarding of all the ETH_CI signals depending on the administrative state (refer to ITU-T Rec. X.731) of the ETH*x*/ETH-m_A function. Blocks forwarding of ETH_CI signals when the administrative state is LOCKED and inserts the ETH-LCK maintenance signal at the client's MEG level;

– Multiplexes ETH_CI traffic units from the *N* ETH_FPs and insert a VLAN tag as appropriate;

– Supports configuration of the *local* MEG level;

– Filters ETH OAM frames within the ETH_CI signals to secure the ETH OAM deployment within this ETH MEG. ETH OAM frames with a MEG level lower than or equal to the local MEG level should be discarded, while ETH OAM frames with a MEG level higher than the local MEG level should be forwarded transparently;

– Outputs the resulting ETH*x*_AI.

The ETH*x*/ETH-m adaptation sink (ETH*x*/ETH-m_A_Sk) performs the following processes between its input ETH*x*_AP and its set of output ETH_FPs:

– Supports configuration of the *local* MEG level;

– Filters ETH OAM frames within the ETH*x*_AI signal to confine the ETH OAM to this ETH MEG. ETH OAM frames with MEG level lower than or equal to the local MEG level should be discarded, while ETH OAM frames with MEG level higher than the local MEG level should be forwarded transparently;

– Demultiplexes ETH_CI traffic units according to the VID value in the VLAN tag or the configured VID value;

– Supports configuration of *client* MEG level for each ETH_FP;

– On detection of a Signal Fail condition, adds ETH-AIS OAM at the client's MEG level to all ETH_CI signals;

– Forwards or blocks forwarding of all the ETH_CI signals depending on the administrative state (refer to ITU-T Rec. X.731) of the ETH*x*/ETH-m_A function. Blocks forwarding of ETH_CI signals when the administrative state is LOCKED and inserts the ETH-LCK maintenance signal at the client's MEG level in all ETH_CI signals;

– Outputs the resulting ETH_CI traffic units on the appropriate ETH_FP.

7.5.2.2 ETH*x*/ETH adaptation

The ETH*x*/ETH adaptation source (ETH*x*/ETH_A_So) performs the following processes between its ETH_FP input and its ETH*x*_AP output:

– Supports configuration of the *client* MEG level and *local* MEG level;

– Forwards or blocks forwarding of the ETH_CI signal depending on the administrative state (refer to ITU-T Rec. X.731) of the ETH*x*/ETH_A function. Blocks forwarding of the ETH_CI signal when the administrative state is LOCKED and inserts the ETH-LCK maintenance signal at the client's MEG level;

– Generates AI_P and AI_DE signals based on CI_P, CI_DE and local configuration;

– Filters ETH OAM frames within the ETH_CI signal to secure the ETH OAM deployment within this ETH MEG. ETH OAM frames, with an MEG level lower than or equal to the local MEG level, should be discarded, while ETH OAM frames, with an MEG level higher than the local MEG level, should be forwarded transparently;

– Generates the APS OAM signal (with the *local* MEG level) to transport the CI_APS information.

The ETH*x*/ETH adaptation sink (ETH*x*/ETH_A_Sk) performs the following processes between its ETH*x*_AP input and its ETH_FP output:

– Supports configuration of *client* MEG level and *local* MEG level;

– Extracts the APS OAM frame and retrieves the APS information to forward it as CI_APS;

– Filters ETH OAM frames within the ETH*x*_AI signal to confine the ETH OAM to this ETH MEG. ETH OAM frames, with an MEG level lower than or equal to the local MEG Level should be discarded, while ETH OAM frames, with an MEG level higher than the local MEG level should be forwarded transparently;

– Processes AI_P and AI_DE signals and generates CI_P, CI_DE;

– On detection of a Signal Fail condition, adds ETH-AIS OAM at the client's MEG level to the ETH_CI signal;

– Forwards or blocks forwarding of the ETH_CI signal depending on the administrative state (refer to ITU-T Rec. X.731) of the ETH*x*/ETH_A function. Blocks forwarding of the ETH_CI signal when the administrative state is LOCKED and inserts the ETH-LCK maintenance signal at the client's MEG level.

NOTE – For the case where this function is deployed in an ETH SNC/S protection scheme (refer to ITU-T Rec. G.8031/Y.1342) the administrative state should not be set to LOCKED.

7.5.2.3 ETH*x*/ETHG adaptation

The ETH*x*/ETHG adaptation function is a combination of the ETH*x*/ETH-m adaptation function and the ETH*x*/ETH adaptation function. The ETH*x*/ETH-m adaptation function supports an arbitrary and independent set of one to 2^N–2 client ETH_CI signals; the ETH*x*/ETHG adaptation function supports a single group of up to "G" client ETH_CI signals of which only a single ETH_CI signal in the group carries a client MEG OAM.

This ETH*x*/ETHG adaptation function multiplexes the individual ETH_CI signals in the ETH group created in an ETHG/ETH adaptation function, which is typically located at the other end of the UNI or NNI.

The ETH*x*/ETHG adaptation source (ETH*x*/ETHG_A_So) performs the following processes between its ETH_FPP input and its ETH*x*_AP output:

– Supports configuration of *client* MEG level and ETH_FP in the ETH_FPP, which will carry the ETHG's MEG OAM;

– Forwards or blocks forwarding of all the ETH_CI signals in the ETH group, depending on the administrative state (refer to ITU-T Rec. X.731) of the ETH*x*/ETHG_A function. Blocks forwarding of the ETH_CI signals in the group when the administrative state is LOCKED and inserts the ETH-LCK maintenance signal at the client's MEG level in the ETH_CI carrying the ETHG's OAM;
– Multiplexes ETH_CI traffic units from the *N* ETH_FPs and inserts a VLAN tag as appropriate;
– Performs ETH multiplexing to form an aggregate ETH signal;
– Supports configuration of the *local* MEG level;
– Filters ETH OAM frames within the aggregate ETH signal to secure the ETH OAM deployment within this ETH MEG. ETH OAM frames, with an MEG level lower than or equal to the local MEG level, should be discarded, while ETH OAM frames, with an MEG level higher than the local MEG level, should be forwarded transparently;
– Generates the APS OAM signal (with the *local* MEG level) to transport the CI_APS information;
– Outputs the resulting ETH*x*_AI.

The ETH*x*/ETHG adaptation sink (ETH*x*/ETHG_A_Sk) performs the following processes between its input ETH*x*_AP and its output ETH_FPP:

– Supports configuration of the *local* MEG level;
– Extracts the APS OAM frame and retrieves the APS information to forward it as CI_APS;
– Filters ETH OAM frames within the ETH*x*_AI signal to confine the ETH OAM to this ETH MEG. ETH OAM frames, with an MEG level lower than or equal to the local MEG level should be discarded, while ETH OAM frames, with an MEG level higher than the local MEG level, should be forwarded transparently;
– Demultiplexes ETH_CI traffic units according to the VID value in the VLAN tag or the configured VID value;
– Supports configuration of the *client* MEG level and ETH_FP in the ETH_FPP that will carry the ETHG's MEG OAM;
– On detection of a Signal Fail condition, adds ETH-AIS OAM at the client's MEG level to the ETH_CI carrying the ETHG's OAM;
– Forwards or blocks forwarding of all the ETH_CI signals in the ETH group depending on the administrative state (refer to ITU-T Rec. X.731) of the ETH*x*/ETHG_A function. Blocks forwarding of the ETH_CI signals in the group when the administrative state is LOCKED and inserts the ETH-LCK maintenance signal at the client's MEG level in the ETH_CI carrying the ETHG's OAM;
– Outputs the resulting ETH_CI traffic units on the appropriate ETH_FP.

7.5.2.4 ETHG/ETH adaptation

The ETHG/ETH adaptation source (ETHG/ETH_A_So) performs the following processes between its ETH_FPP input and its ETHG_APP output:

– Supports configuration of the *client* MEG level for each ETH_FP;
– Forwards or blocks forwarding of all the ETH_CI signals depending on the administrative state (refer to ITU-T Rec. X.731) of the ETHG/ETH_A function. Blocks forwarding of the ETH_CI signals when the administrative state is LOCKED and inserts the ETH-LCK maintenance signals at the client's MEG level;
– Supports configuration of the *local* MEG level;

– Filters ETH OAM frames within the ETH_CI signal (if present) that will carry the ETH group MEG's ETH OAM to secure the ETH OAM deployment within this ETH group MEG. ETH OAM frames, with an MEG level lower than or equal to the local MEG level should be discarded, while ETH OAM frames, with an MEG level higher than the local MEG level should be forwarded transparently;

– Outputs the resulting ETH*x*_AI.

The ETHG/ETH adaptation sink (ETHG/ETH_A_Sk) performs the following processes between its ETHG_APP input and its ETH_FPP output:

– Supports configuration of the *local* MEG level;

– Filters ETH OAM frames within the ETHG_AI signal to confine the ETH OAM to this ETH Group MEG. ETH OAM frames, with an MEG level lower than or equal to the local MEG level should be discarded, while ETH OAM frames, with an MEG level higher than the local MEG level, should be forwarded transparently;

– Supports configuration of the *client* MEG level for each ETH_FP;

– On detection of a Signal Fail condition, adds ETH-AIS OAM at the client's MEG level to all ETH_CI signals in the group;

– Forwards or blocks forwarding of the group of ETH_CI signals depending on the administrative state (refer to ITU-T Rec. X.731) of the ETHG/ETH_A function. Blocks forwarding of the group of ETH_CI signals when the administrative state is LOCKED and inserts the ETH-LCK maintenance signal at the client's MEG level in all ETH_CI signals within the group of ETH_CI signals.

7.5.2.5 ETHD/ETH adaptation

The ETHD/ETH adaptation source (ETHD/ETH_A_So) performs the following process between its ETH_FP input and its ETHD_AP output:

– Forwards signal at input to output.

The ETHD/ETH adaptation sink (ETHD/ETH_A_Sk) performs the following process between its ETHD_AP input and its ETH_FP output:

– Forwards signal at input to output.

4.13 Add new Appendix IV

Appendix IV

ETHn_CI (n = 0, 1, 2) traffic unit formats

The figures below show the relationship between the frame formats of the traffic units, the insertion of VLAN tags and the insertion of OAM frames. The corresponding sets of MEG levels are also shown. These figures do not describe the potential locations where a C-Priority tag or S-Priority tag may be inserted.

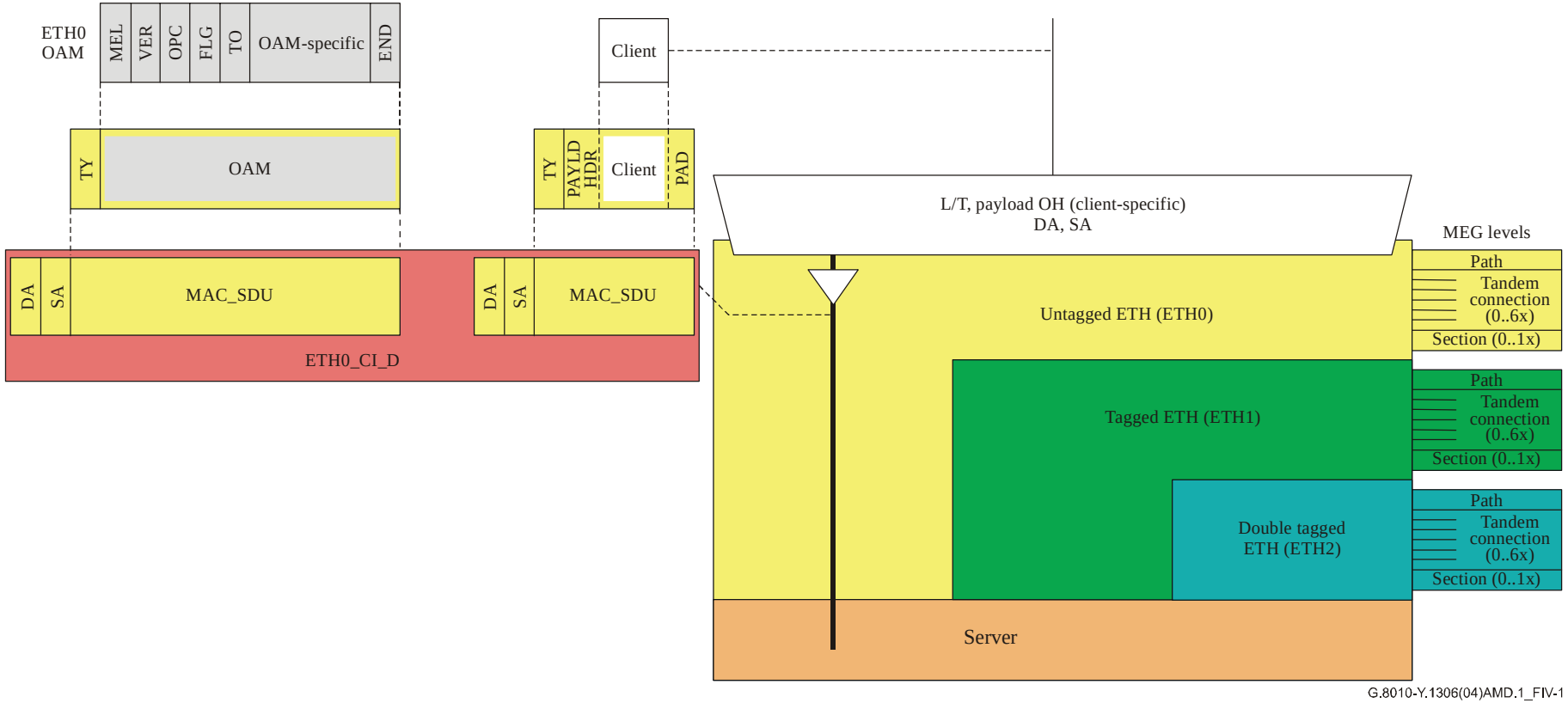

Figure IV.1 – ETH0 over server with ETH0 OAM

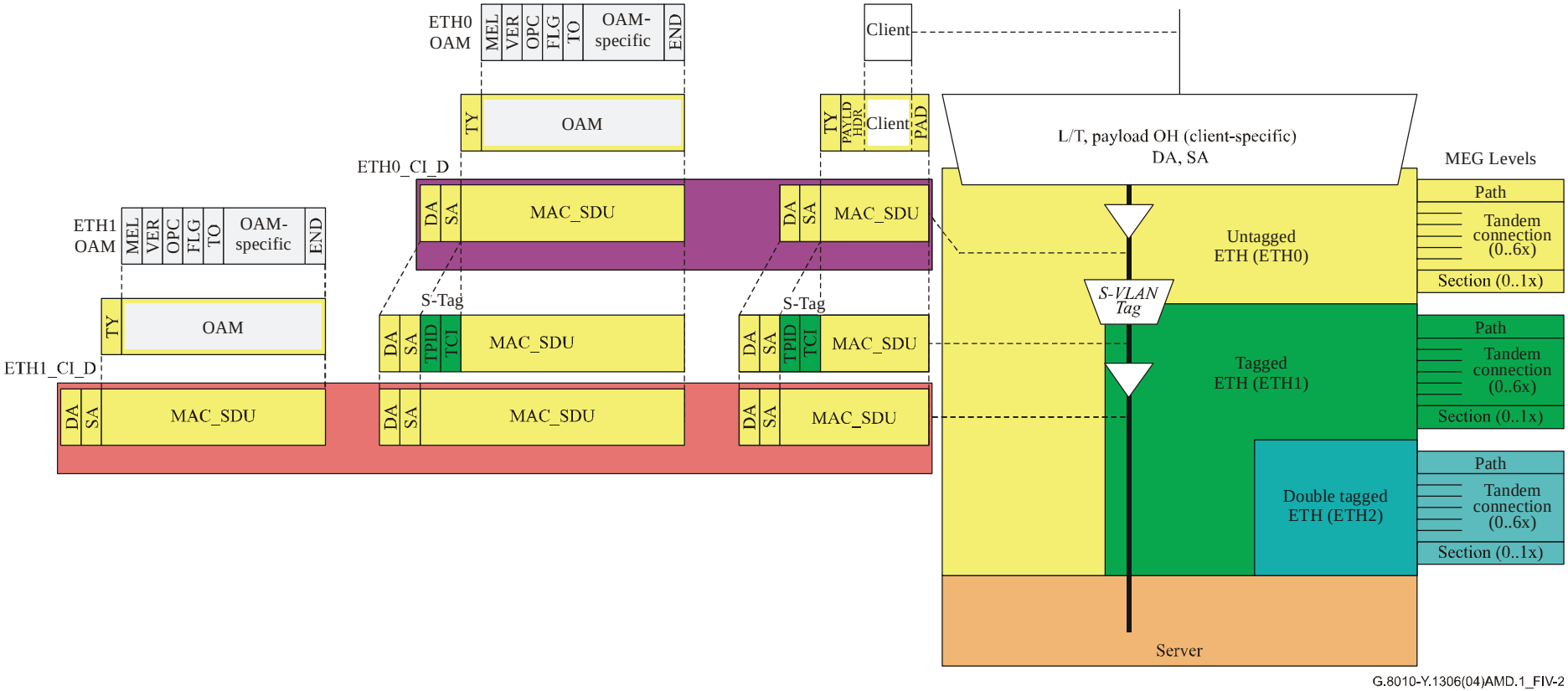

Figure IV.2 – ETH0 over ETH1 over Server with ETH0 and ETH1 OAM

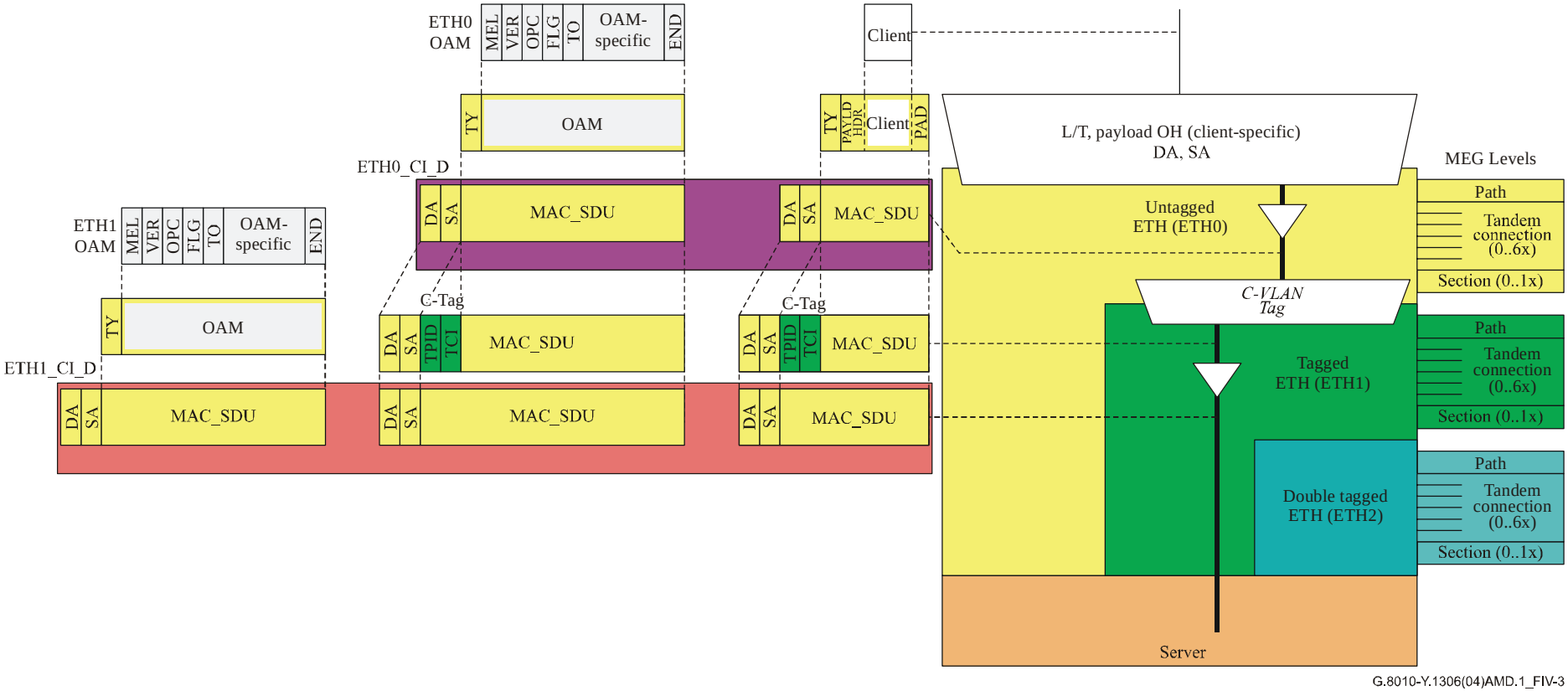

Figure IV.3 – ETH0 over ETH1 over Server with ETH0 and ETH1 OAM

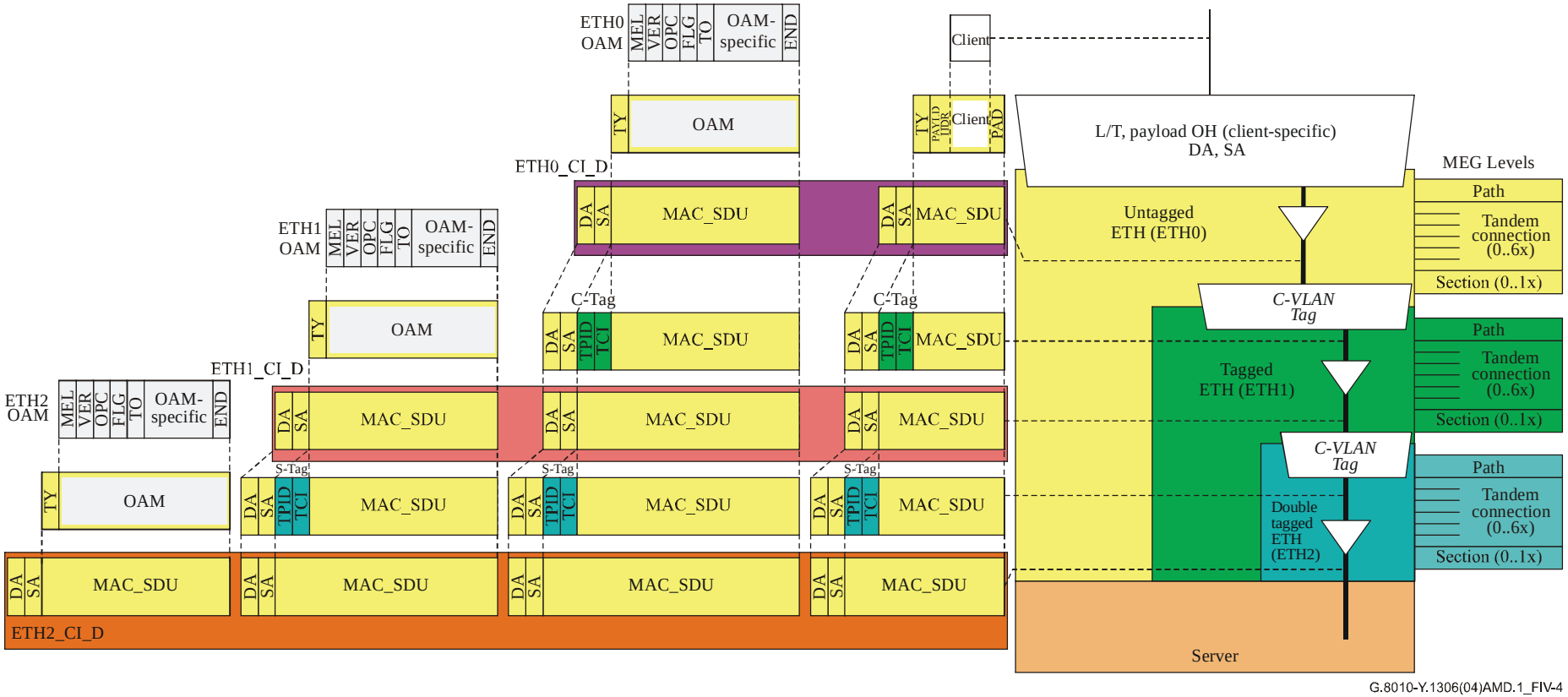

Figure IV.4 – ETH0 over ETH1 over ETH2 over Server with ETH0, ETH1 and ETH2 OAM

4.14 Add new Appendix V

Appendix V

Maintenance entity group level allocation examples

EC service with three owners

An EC service for which the customer, service provider and network operator are operating in "client/server" mode for customer/network and "peering" mode for service provider/network operator has the following default ETH MEG level allocation (Figure V.1):

Customer-to-customer:	Path, tandem connections 6 to 1
Within one customer network:	Path, tandem connections 6 to 1, section
Service provider:	Path, tandem connections 6 and 5
Network operator:	Tandem connections 4 to 1, section
Customer-to-network:	Section
Network operator A-to-network operator B:	Section

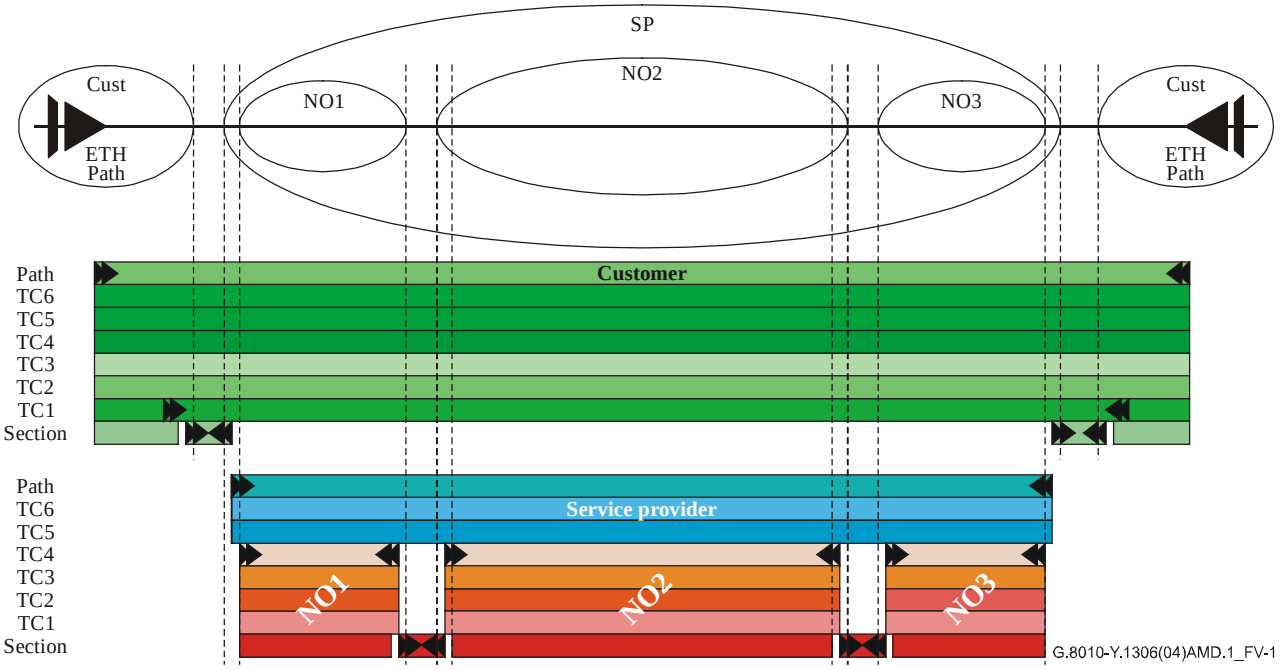

Figure V.1 – Example of default allocation of ETH MEG levels in hybrid client/server and peering modes

For the case where the customer and network are not able to operate in client/server mode, customer, service provider and network operator(s) all operate in "peering" mode. The default ETH MEG level allocation is listed below and illustrated in Figure V.2:

Customer-to-customer:	Path, tandem connections 6 and 5
Within one customer network:	Path, tandem connections 6 to 1, section
Service provider:	Tandem connections 4 and 3
Network operator:	Tandem connections 2 and 1, section
Customer-to-network:	Section
Network operator A-to-network operator B:	Section

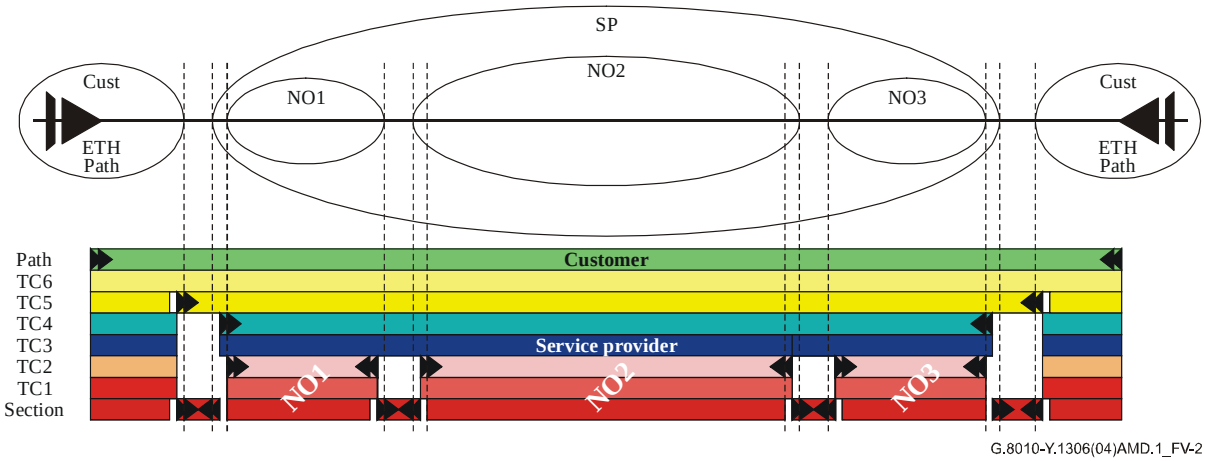

Figure V.2 – Example of default allocation of ETH MEG levels in peering mode

The deployment of the ETH MEG levels may depend on the relationship between the service provider and the network operators providing the EC service. When NO2 also performs the SP role, it may wish to monitor the status/performance of the EC segment between the edge of the network and the edge of the NO2 domain. Tandem connection level 5 could be activated at those interface ports to provide the SP/NO2 with this information (Figure V.3).

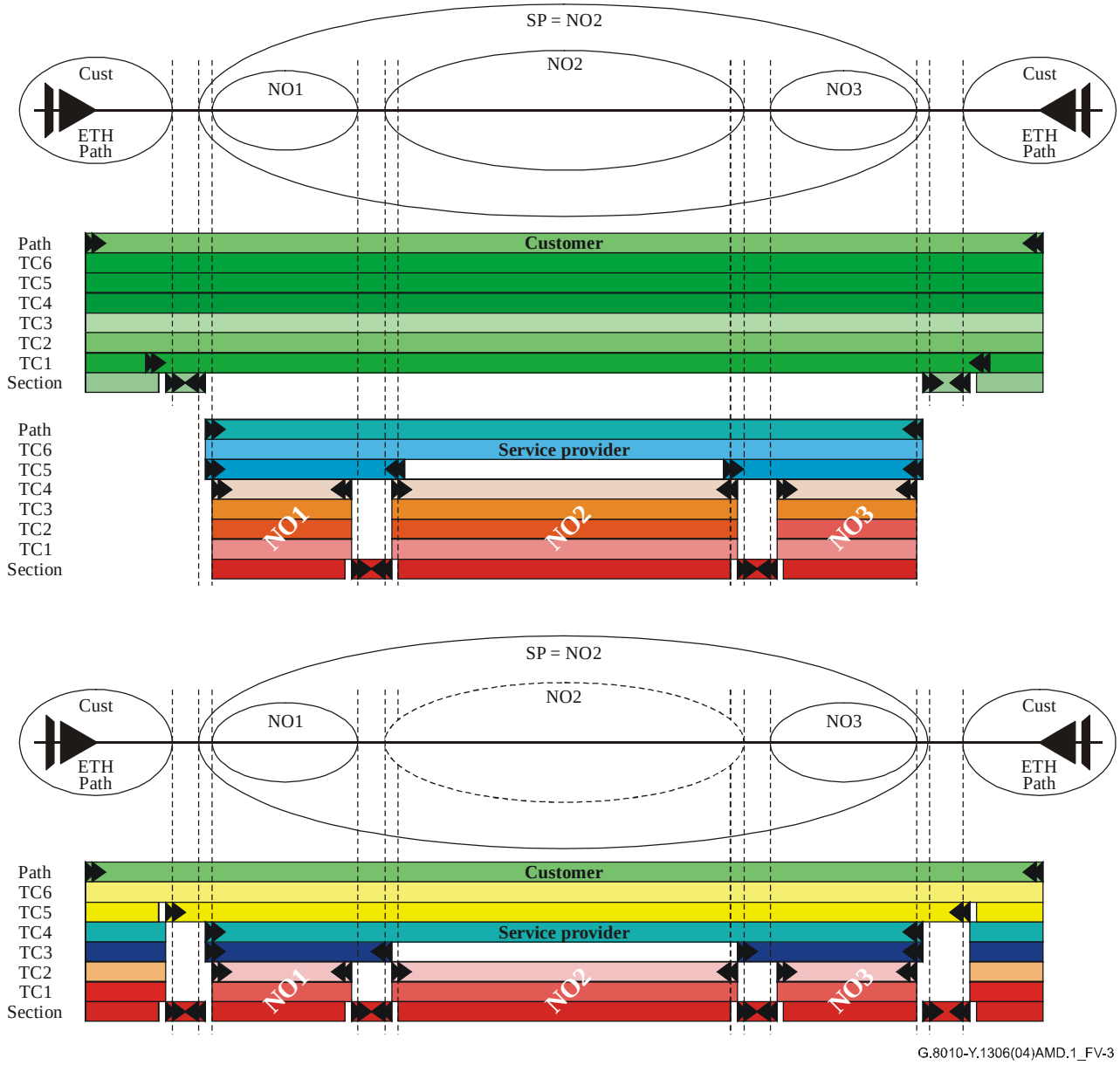

Figure V.3 – Example of allocation of ETH MEG levels in which an SP monitors service received from regional NOs

EC service with two owners

When a single administration provides the EC service, the service provider and network operator roles are merged. The default MEG level allocation is as shown in Figure V.4:

Customer-to-customer:	Path, tandem connections 6 to 1
Within one customer network:	Path, tandem connections 6 to 1, section
Service provider/network operator:	Path, tandem connections 6 to 1, section
Customer-to-network:	Section

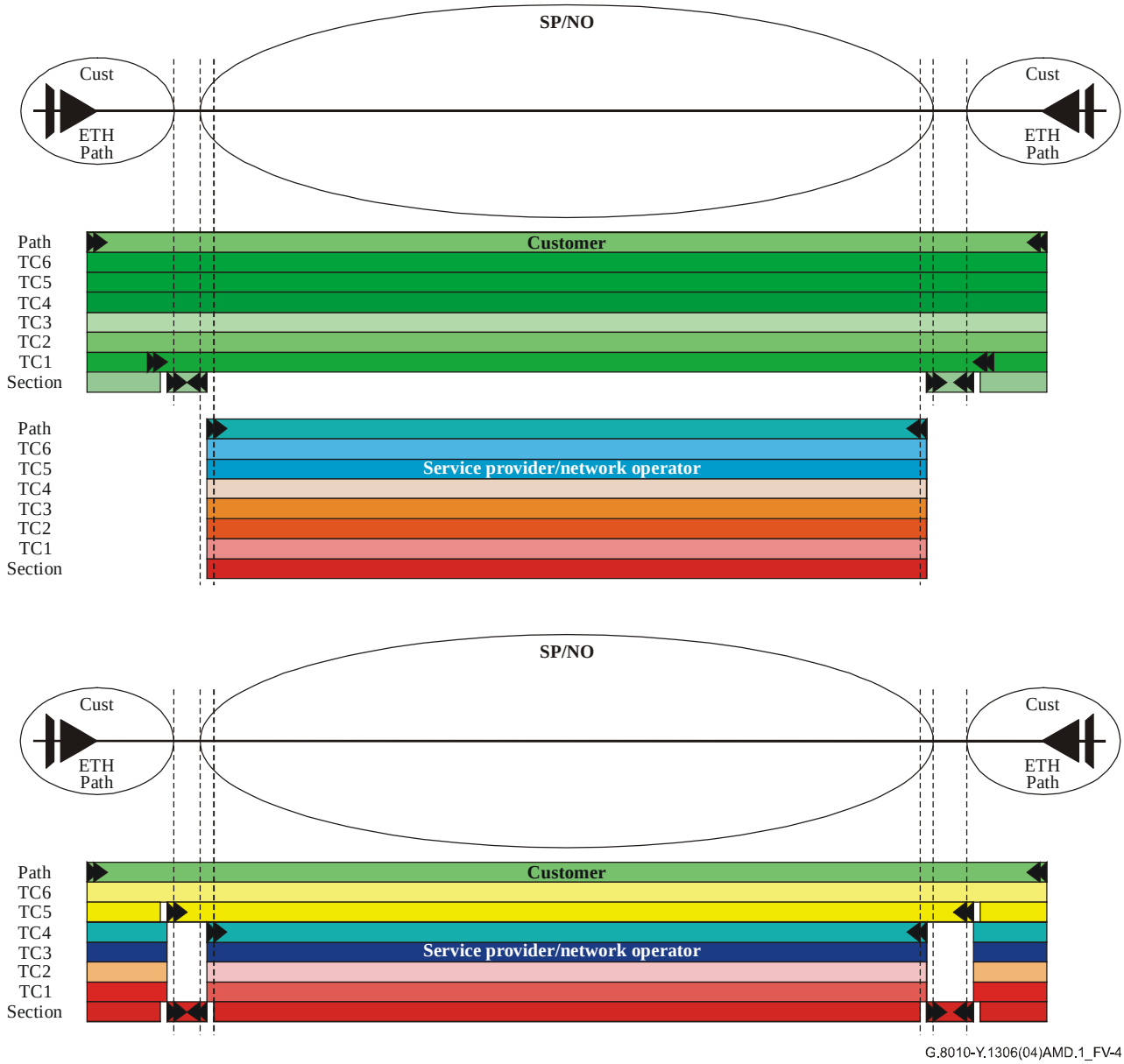

Figure V.4 – Example of allocation of ETH MEG levels in EC service with two owners

Non-EC service with three owners

When the network provides a non-EC service over ETH (e.g., circuit emulation service, MPLS) the EC MEG levels can be allocated to Service Provider and Network Operator as follows as a default:

Service provider: Path, tandem connection 6 and 5

Network operator: Tandem connection 4 to 1, section

Network operator A-to-network operator B: Section

NOTE – The customer has a non-EC signal for which ETH MEG levels are not applicable.

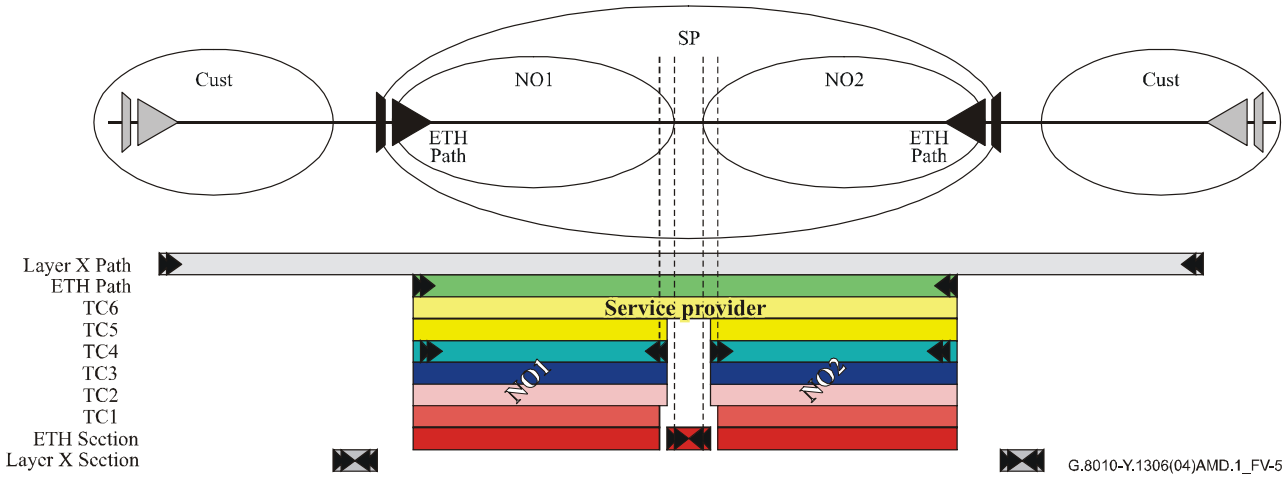

Figure V.5 – Example of allocation of ETH MEG levels in ETH client service (e.g., TDM, T-MPLS)

4.15 Add new Appendix VI

Appendix VI

Allocation of Y.1731 ETH OAM messages onto G.8010/Y.1306 atomic functions

This appendix summarizes the allocation of Y.1731 ETH OAM messages to G.8010/Y.1306 atomic functions.

Table VI.1 – Allocation of Y.1731 ETH OAM messages onto G.8010/Y.1306 atomic functions

Y.1731 OAM	ETH*x* MEP (*x*: P(ath), T(andem connection), S(ection)				ETH*x* MIP	SRV MEP
	ETH*x*/Client adaptation	ETHx/ETH adaptation	ETH*x* termination	ETHDe termination	ETHDi termination	SRV/ETH adaptation
ETH-CCM			X			
ETH-AIS		X	X			X
ETH-LCK		X	X			
ETH-LBM				X	X	
ETH-LBR				X	X	
ETH-TST				X		

Table VI.1 – Allocation of Y.1731 ETH OAM messages onto G.8010/Y.1306 atomic functions

Y.1731 OAM	ETH*x* MEP (*x*: P(ath), T(andem connection), S(ection)				ETH*x* MIP	SRV MEP
	ETH*x*/Client adaptation	ETHx/ETH adaptation	ETH*x* termination	ETHDe termination	ETHDi termination	SRV/ETH adaptation
ETH-LTM				X	X	
ETH-LTR				X	X	
ETH-LMM				X		
ETH-LMR				X		
ETH-DMM				X		
ETH-DMR				X		
ETH-1DM				X		
ETH-APS		X				
ETH-MCC (Note 1)						

NOTE 1 – The allocation of ETH-MCC to a G.8010 atomic function is for further study.

NOTE 2 – The Y.1731-defined ETH-VSM, ETH-VSR, ETH-EXM and ETH-EXR OAM frames are provisions for future vendor-specific and experimental OAM messages. Mapping is outside the scope of this Recommendation.

NOTE 3 – "X" indicates that the OAM message is either: inserted, or extracted, or generated and inserted, or extracted and processed; or generated and inserted and extracted and processed in the atomic function. Note that the on-demand OAM in the ETHDe and ETHDi termination functions is inserted and extracted, while generation and processing is performed in the equipment management function (EMF). Refer to 7.5 for a description and refer to ITU-T Rec. G.8021/Y.1341 for the specification.

4.16 Add new Appendix VII

Appendix VII

Deployment scenario for the ETH group

One of the scenarios in which the ETH group construct is deployed is illustrated in Figure VII.1. Two network elements are interconnected via a UNI or NNI interface. The right-hand network element provides a bundled EVC service ingress point to the left-hand network element. This left-hand network element is incapable of multiplexing its bundle of EVC signals. The multiplexing is therefore performed by the right-hand network element. To monitor the status and performance of the service from the left-hand network element, this network element establishes an ETH Group MEG. One of the EVC signals in the group is configured to carry ETH OAM to monitor this MEG.

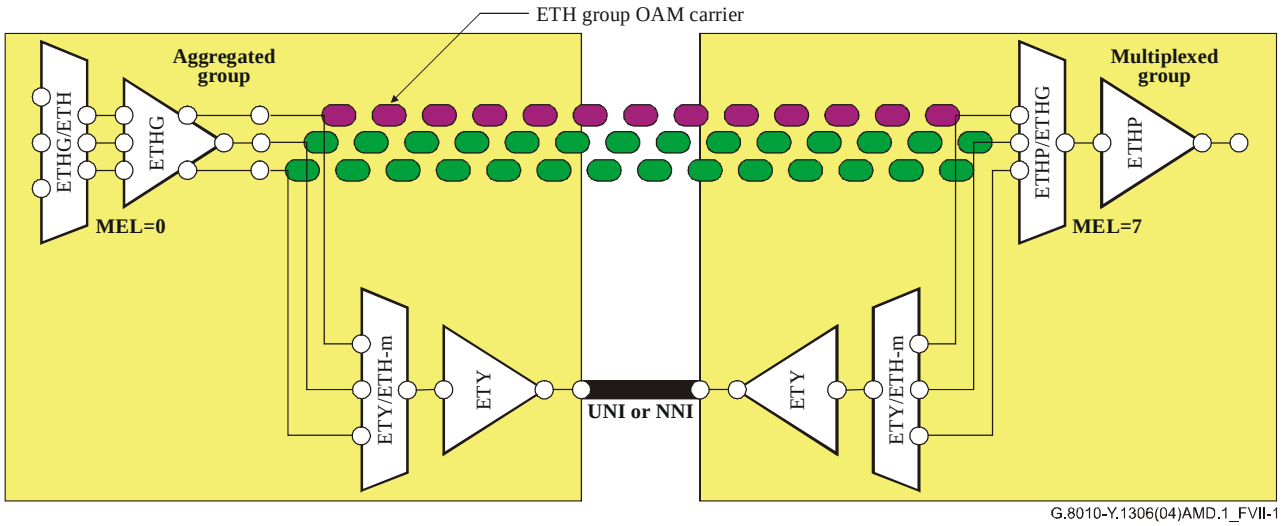

Figure VII.1 – ETH group deployment example

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