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TELECOMMUNICATION
STANDARDIZATION SECTOR
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SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

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

Internet protocol aspects – Transport

Management aspects of the Ethernet-over-Transport (EoT) capable network element

Recommendation ITU-T G.8051/Y.1345

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Recommendation ITU-T G.8051/Y.1345

Management aspects of the Ethernet-over-Transport (EoT) capable network element

Summary

Recommendation ITU-T G.8051/Y.1345 addresses management aspects of the Ethernet transport network element containing transport functions of one or more of the layer networks of the Ethernet transport network. The management of the Ethernet layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client. The management functions for fault management, configuration management, performance monitoring, and security management are specified.

The 2009 Revision of this Recommendation has added the management of additional transport functions that have been introduced in the 2009 Revision of Recommendation ITU-T G.8021/Y.1341.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.8051/Y.1345	2007-10-22	15
2.0	ITU-T G.8051/Y.1345	2009-11-13	15

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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.8051/Y.1345

Management aspects of the Ethernet-over-Transport (EoT) capable network element

1 Scope

This Recommendation addresses management aspects of the Ethernet-over-Transport (EoT) capable network element containing transport functions of one or more of the layer networks of the Ethernet transport network. The management of the Ethernet layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client. In this version of this Recommendation, fault management, configuration management, performance management, and security management are specified. Accounting management is for further study. Furthermore, only the management information (MI) of the following EoT equipment functions is addressed:

- Ethernet MAC layer (ETH) flow forwarding, flow termination, connection, diagnostic, and traffic conditioning/shaping functions;
- ETH server to ETH client adaptation functions (including ETH/ETH-m and ETHG/ETH);
- ETH link aggregation functions;
- Ethernet PHY layer (ETYn) trail termination functions;
- ETYn server to ETH client adaptation functions;
- GFP-F-based mapping of Ethernet into SDH;
- GFP-T-based mapping of Gigabit Ethernet code words into VC-4-Xv;
- PDH server to ETH client adaptation functions; and
- OTN server to ETH client adaptation functions.

The management of the adaptation of other clients and servers with respect to EoT is for further study.

This Recommendation also describes the management network organizational model for communication between an element management layer (EML) operations system and the EoT equipment management function within an EoT network element.

The architecture described in this Recommendation for the management of Ethernet transport networks is based upon the following considerations:

- the management view of network element functional elements should be uniform whether those elements form part of an inter-domain interface or part of an intra-domain interface. Those properties necessary to form such a uniform management view are to be included in this Recommendation;
- Ethernet layer network entities (ELNE) refer to trail termination, adaptation, and connection functions as described in [ITU-T G.8010];
- a network element may only contain Ethernet layer network entities;
- a network element may contain both Ethernet layer network entities (ELNE) and client layer network entities (CLNE);
- client layer entities are managed as part of their own logical domain;
- CLNE and ELNE may or may not share a common message communication function (MCF) and management application function (MAF) depending on application; and
- CLNE and ELNE may or may not share the same agent.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T G.707] Recommendation ITU-T G.707/Y.1322 (2007), *Network node interface for the synchronous digital hierarchy (SDH).*

[ITU-T G.709] Recommendation ITU-T G.709/Y.1331 (2003), *Interfaces for the Optical Transport Network (OTN).*

[ITU-T G.805] Recommendation ITU-T G.805 (2000), *Generic functional architecture of transport networks.*

[ITU-T G.806] Recommendation ITU-T G.806 (2009), *Characteristics of transport equipment – Description methodology and generic functionality.*

[ITU-T G.832] Recommendation ITU-T G.832 (1998), *Transport of SDH elements on PDH networks – Frame and multiplexing structures*, plus Amendment 1 (2004), *Payload type code of virtual concatenation of 34368 kbit/s signals.*

[ITU-T G.7041] Recommendation ITU-T G.7041/Y.1303 (2008), *Generic framing procedure (GFP)*, plus Amendment 1 (2009).

[ITU-T G.7710] Recommendation ITU-T G.7710/Y.1701 (2007), *Common equipment management function requirements.*

[ITU-T G.7712] Recommendation ITU-T G.7712/Y.1703 (2008), *Architecture and specification of data communication network.*

[ITU-T G.8010] Recommendation ITU-T G.8010/Y.1306 (2004), *Architecture of Ethernet layer networks*, plus Amendment 1 (2006).

[ITU-T G.8012] Recommendation ITU-T G.8012/Y.1308 (2004), *Ethernet UNI and Ethernet NNI*, plus Amendment 1 (2006).

[ITU-T G.8021] Recommendation ITU-T G.8021/Y.1341 (2007), *Characteristics of Ethernet transport network equipment functional blocks*, plus Amendment 1 (2009) and Amendment 2 (2010).

[ITU-T M.20] Recommendation ITU-T M.20 (1992), *Maintenance philosophy for telecommunication networks*.

[ITU-T M.3010] Recommendation ITU-T M.3010 (2000), *Principles for a telecommunications management network*, plus Amendment 1 (2003) and Amendment 2 (2005).

[ITU-T M.3013] Recommendation ITU-T M.3013 (2000), *Considerations for a telecommunications management network.*

[ITU-T M.3100] Recommendation ITU-T M.3100 (2005), *Generic network information model.*

[ITU-T X.700] Recommendation ITU-T X.700 (1992), *Management framework for Open Systems Interconnection (OSI) for CCITT applications.*

[ITU-T X.701] Recommendation ITU-T X.701 (1997) | ISO/IEC 10040:1998, *Information technology – Open Systems Interconnection – Systems management overview.*

[ITU-T X.733] Recommendation ITU-T X.733 (1992) | ISO/IEC 10164-4:1992, *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function*, plus Amendment 1 (1995).

[ITU-T X.735] Recommendation ITU-T X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems Management: Log control function*, plus Amendment 1 (1995).

[ITU-T Y.1731] Recommendation ITU-T Y.1731 (2008), *OAM functions and mechanisms for Ethernet based networks.*

[IEEE 802.3] IEEE 802.3 (2002), *Information technology – Telecommunications and information exchange between systems – Local and Metropolitan Area Networks – Specific requirements – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 Terms defined in [ITU-T G.7710]:

– Local craft terminal;

– Management application function (MAF).

3.1.2 Term defined in [ITU-T G.7712]:

– Data communication network (DCN).

3.1.3 Terms defined in [ITU-T G.806]:

– Atomic function (AF);

– Management point (MP).

3.1.4 Terms defined in [ITU-T M.3010]:

– Network element (NE);

– Network element function (NEF);

– Operations system (OS);

– Q-interface;

– Workstation function (WF).

3.1.5 Term defined in [ITU-T M.3013]:

– Message communication function (MCF).

3.1.6 Terms defined in [ITU-T M.3100]:

– Alarm reporting;

– Alarm reporting control (ARC);

– Managed entity;

– Management interface;

– Persistence interval;

– Operations system (OS);

– Operations system function (OSF);
– Qualified problem;
– Reset threshold report;
– Threshold report;
– Timed interval.

3.1.7 Term defined in [ITU-T X.700]:

– Managed object (MO).

3.1.8 Terms defined in [ITU-T X.701]:

– Agent;
– Manager;
– Managed object class (MOC).

3.2 Terms defined in this Recommendation

This Recommendation defines or specializes the following terms:

3.2.1 EoT management network (EoT.MN): An EoT management network is a subset of a TMN that is responsible for managing those parts of a network element that contain EoT layer network entities. An EoT.MN may be subdivided into a set of EoT management subnetworks.

3.2.2 EoT management subnetwork (EoT.MSN): An EoT management subnetwork (EoT.MSN) consists of a set of separate embedded communication channels (ECC) and associated intra-site data communication links which are interconnected to form a data communication network (DCN) within any given EoT transport topology. For EoT, the physical channel supporting the ECC is the Ethernet management communication channel (MCC) as defined in [ITU-T Y.1731]. An EoT.MSN represents an EoT specific local communications network (LCN) portion of a network operator's overall data communication network or TMN.

3.2.3 EoT network element (EoT.NE): That part of a network element that contains entities from one or more EoT layer networks. An EoT.NE may therefore be a stand-alone physical entity or a subset of a network element. It supports at least network element functions (NEFs) and may also support an operations system function (OSF). It contains managed objects (MOs), a message communication function (MCF) and a management application function (MAF). The functions of an EoT.NE may be contained within an NE that also supports other layer networks. These layer network entities are considered to be managed separately from EoT entities. As such, they are not part of the EoT.MN or EoT.MSN.

3.2.4 Ethernet management communication channel (EoT MCC): The Ethernet management communication channel (MCC) function provides a management communication channel between a pair of maintenance entity group (MEG) end points (MEP). The MCC can be used to perform remote management. The specific use of MCC is outside the scope of this Recommendation. A MEP can send a frame with ETH-MCC information to its peer MEP with remote maintenance request, remote maintenance reply, notification, etc. Configuration information needs to be provisioned to the MEP to support the MCC functions. See [ITU-T Y.1731] for detailed information and the protocol data unit (PDU) structure of the MCC.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

AcSL Accepted Signal Label

AF Atomic Function

AIS	Alarm Indication Signal
ALM	ALarM reporting
ARC	Alarm Reporting Control
CC	Continuity Check
CCM	Continuity Check Message
CLNE	Client Layer Network Entity
CTP	Connection Termination Point
CtrlP	Control Plane
DCN	Data Communication Network
ECC	Embedded Communication Channel
EMF	Equipment Management Function
EoT	Ethernet over Transport
EoT.C	EoT Channel layer
EoT.MN	EoT MN
EoT.MSN	EoT MSN
EoT.NE	EoT NE
EoT.P	EoT Path layer
EoT.S	EoT Section layer
FCAPS	Fault Management, Configuration Management, Account Management, Performance Management and Security Management
FFS	For Further Study
FM	Fault Management
FTS	Forced Transmitter Shutdown
GNE	Gateway Network Element
IP	Interworking Protocol
IS	Intermediate System
LAN	Local Area Network
LCN	Local Communications Network
LCT	Local Craft Terminal
MAF	Management Application Function
MCC	Management Communication Channel
MCF	Message Communication Function
MD	Mediation Device
ME	Maintenance Entity
MEG	ME Group
MEL	MEG Level
MEP	MEG End Point

MIP	MEG Intermediate Point
MF	Mediation Function
MI	Management Information
MIB	Management Information Base
MN	Management Network
MO	Managed Object
MOC	Managed Object Class
MgmtP	Management Plane
MP	Management Point
MSN	Management SubNetwork
NALM	No ALaRm reporting
NALM-CD	No ALaRm reporting, CountDown
NALM-NR	No ALaRm reporting, NotReady
NALM-QI	No ALaRm reporting, Qualified Inhibit
NALM-TI	No ALaRm reporting, Timed Inhibit
NE	Network Element
NEF	Network Element Function
NEL	Network Element Layer
OAM	Operations, Administration, Maintenance
OAM&P	Operations, Administration, Maintenance and Provisioning
OS	Operations System
OSF	Operations System Function
OSI	Open Systems Interconnection
PM	Performance Management
PMC	Performance Monitoring Clock
PS	Protection Switching
QoS	Quality of Service
RDI	Remote Defect Indication
RTC	Real-Time Clock
SCC	Signalling Communication Channel
TCM	Tandem Connection Monitoring
TMN	Telecommunications Management Network
TTP	Trail Termination Point
WAN	Wide Area Network
WS	WorkStation
WTR	Wait To Restore

5 Conventions

In this Recommendation, EoT.MN stands for EoT management network, EoT.MSN for EoT management subnetwork, EoT.NE for EoT NE, EoT.C for EoT channel layer, EoT.P for EoT path layer, and EoT.S for EoT section layer.

6 EoT management architecture

See clause 6 of [ITU-T G.7710] for the generic architecture for managing transport equipment. EoT specific management architecture is described below.

6.1 EoT network management architecture

The transport layer networks of Ethernet over Transport (EoT) are described in [ITU-T G.8010], [ITU-T G.8012], and [ITU-T Y.1731]. The management of the EoT layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client.

6.1.1 Relationship between TMN, EoT.MN, and EoT.MSN

The EoT management network (EoT.MN) may be partitioned into EoT management subnetworks (EoT.MSNs). The inter-relationship between a management network, its subnetworks and a TMN, as generically described in clause 6 of [ITU-T G.7710], is applicable to EoT.

6.1.2 Access to the EoT.MSN

See clause 6.1.2 of [ITU-T G.7710] for the generic requirements.

6.1.3 EoT.MSN requirements

See clause 6.1.3 of [ITU-T G.7710] for the generic requirements.

Furthermore, all EoT.NEs must support management communication functions. The MCF of an EoT.NE initiates/terminates (in the sense of the lower protocol layers), forwards, or otherwise processes management messages over MCCs, or over other DCN interfaces. In addition:

- All EoT.NEs are required to terminate the EoT.S-MCCs, see clause 6.1.4. In OSI terms, this means that each NE must be able to perform the functions of an end system.
- EoT.NEs may also be required to forward management messages between ports according to routing control information held in the EoT.NE. In OSI terms, this means that some EoT.NEs may be required to perform the functions of an intermediate system.
- In addition to supporting interfaces for the EoT.S-MCC, an EoT.NE may also be required to support other DCN interfaces, which may include EoT.P-MCCs or EoT.C-MCCs or an Ethernet DCN interface.

The use of the EoT.P-MCCs and EoT.C-MCCs for management communications is within the scope of this Recommendation, see clause 6.1.7.

6.1.4 EoT.MSN data communication network

Refer to clause 6.1.4 of [ITU-T G.7710] for the generic requirements.

6.1.4.1 Management communication channel

The EoT.MN supports three management communication channels (MCC):

1) EoT.S-MCC (MCC_S)
2) EoT.P-MCC (MCC_P)
3) EoT.C-MCC (MCC_C)

EoT.S-, EoT.P-, and EoT.C-MCCs are specified in [ITU-T G.8010].

Figure 6-1 illustrates a network scenario consisting of two operators. Operator B provides an EoT Path layer Service to operator A (i.e., Operator B transports the EoT Path layer signal that begins and ends Operator A's domain). According to [ITU-T G.8010], the MCC_P and the MCC_C signals passed transparently through Operator B's network.

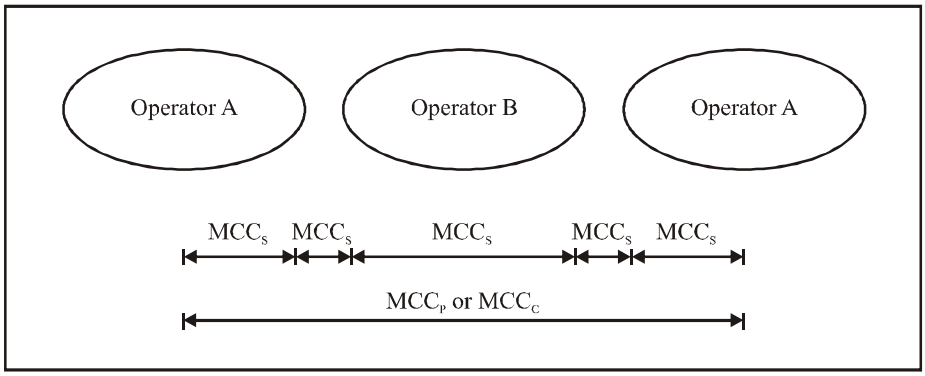

Figure 6-1 – MCC scenarios

The physical layer is terminated in every network element, and its related adaptation function provides the EoT section layer signals as well as the MCC_S. Hence, the MCC_S cannot cross administrative domains. Figures 6-1, 6-2 and 6-3 illustrate scenarios where the MCC_P is transported transparently through Operator B's domain (the Operator B network elements are not shown in Figures 6-2 and 6-3). In these scenarios, it is possible that Operator B may use the MCC_S within its own domain for the management of its domain.

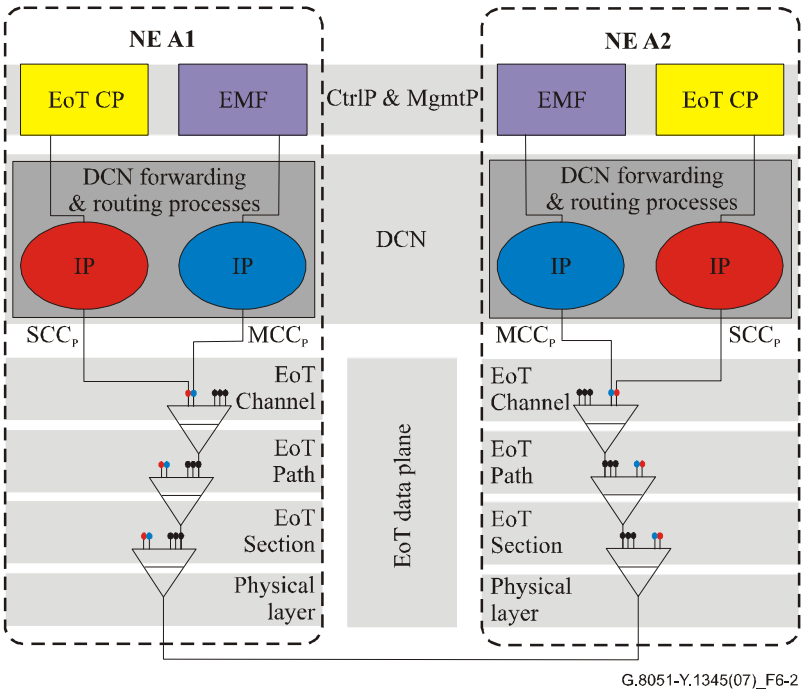

Figure 6-2 – MCC_P scenario example

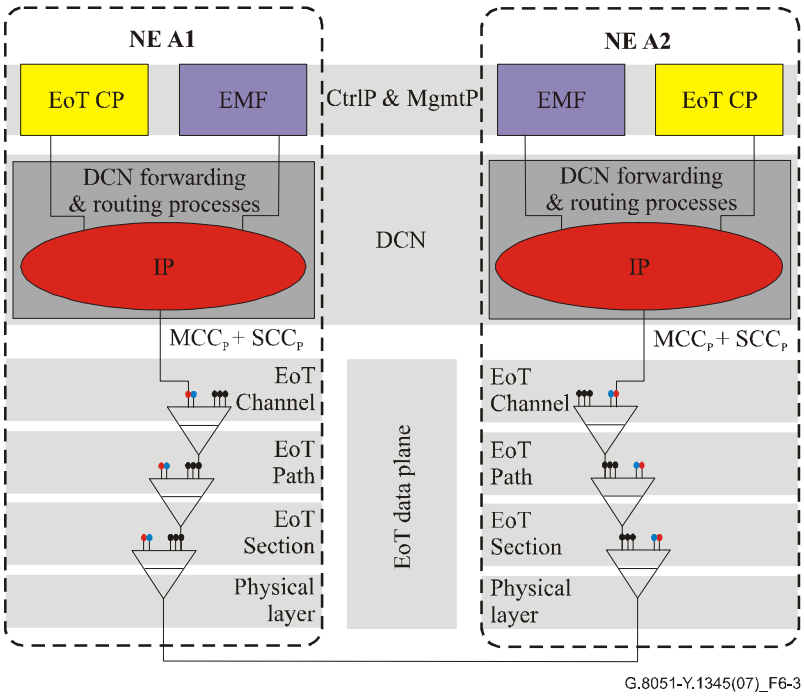

Figure 6-3 – MCC$_P$ scenario example

6.1.4.2 MCC physical characteristics

The EoT.S-, EoT.C- and EoT.P-MCCs are logical elements within the EoT Transport Module (ETM-n). The MCC provides general management communications between two EoT network elements with access to the EoT.S, EoT.P, and EoT.C characteristic information respectively. The EoT.S-, EoT.P-, or EoT.C-MCC is provided by the EoT OAM function at section, path, or channel layer as defined in [ITU-T Y.1731] or by any other ECC of the EoT transport network.

The EoT.S management communication channel (MCC$_S$) shall operate as a single message channel between EoT.S termination points. The bit rate of the MCC$_S$ shall be configurable.

The EoT.P management communication channel (MCC$_P$) shall operate as a single message channel between any network elements that terminate the EoT.P layer. The MCC$_P$ is transported transparently through EoT.NEs that only terminate the EoT.S layer and forward the EoT.P signal. The bit rate of the MCC$_P$ shall be configurable.

The EoT.C management communication channel (MCC$_C$) shall operate as a single message channel between any network elements that terminate the EoT.C layer. The MCC$_C$ is transported transparently through EoT.NEs that only terminate the EoT.S layer or the EoT.S and EoT.P layers and forward the EoT.C signal. The bit rate of the MCC$_C$ shall be configurable.

6.1.4.3 MCC data link layer protocol

The MCC data link protocols for management applications are under study for [ITU-T G.7712].

6.1.5 Management of DCN

See clause 6.1.5 of [ITU-T G.7710] for the generic requirements.

6.1.6 Remote log-in

See clause 6.1.6 of [ITU-T G.7710] for the generic requirements.

6.1.7 Relationship between technology domains

See clause 6.1.7 of [ITU-T G.7710] for the generic requirements.

6.2 EoT equipment management function architecture

This clause provides an overview of the minimum functions which are required to support inter-vendor/network communications and single-ended maintenance of EoT NEs within an MSN, or between communicating peer EoT NEs across a network interface. Single-ended maintenance is the ability to access remotely located EoT NEs to perform maintenance functions (see the performance management applications, clause 10.1 of [ITU-T G.7710]).

It should be noted that the management functions have been categorized according to the classifications given in [ITU-T X.700].

Detailed specifications of the management functions, in terms of managed objects classes, attributes and message specification, are for further study.

The EoT equipment management function (EMF) (see Figure 6-4) provides the means through which the EoT network element function (NEF) is managed by an internal or external manager. If a network element (NE) contains an internal manager, this manager will be part of the EoT EMF.

The EoT EMF interacts with the other atomic functions (refer to [ITU-T G.8021]) by exchanging information across the MP reference points. See [ITU-T G.806] and [ITU-T G.8021] for more information on atomic functions (AF) and on management points (MP). The EoT EMF contains a number of functions that provide a data reduction mechanism on the information received across the MP reference points. The outputs of these functions are available to the agent via the network element resources and management applications functions (MAF) which represent this information as managed objects.

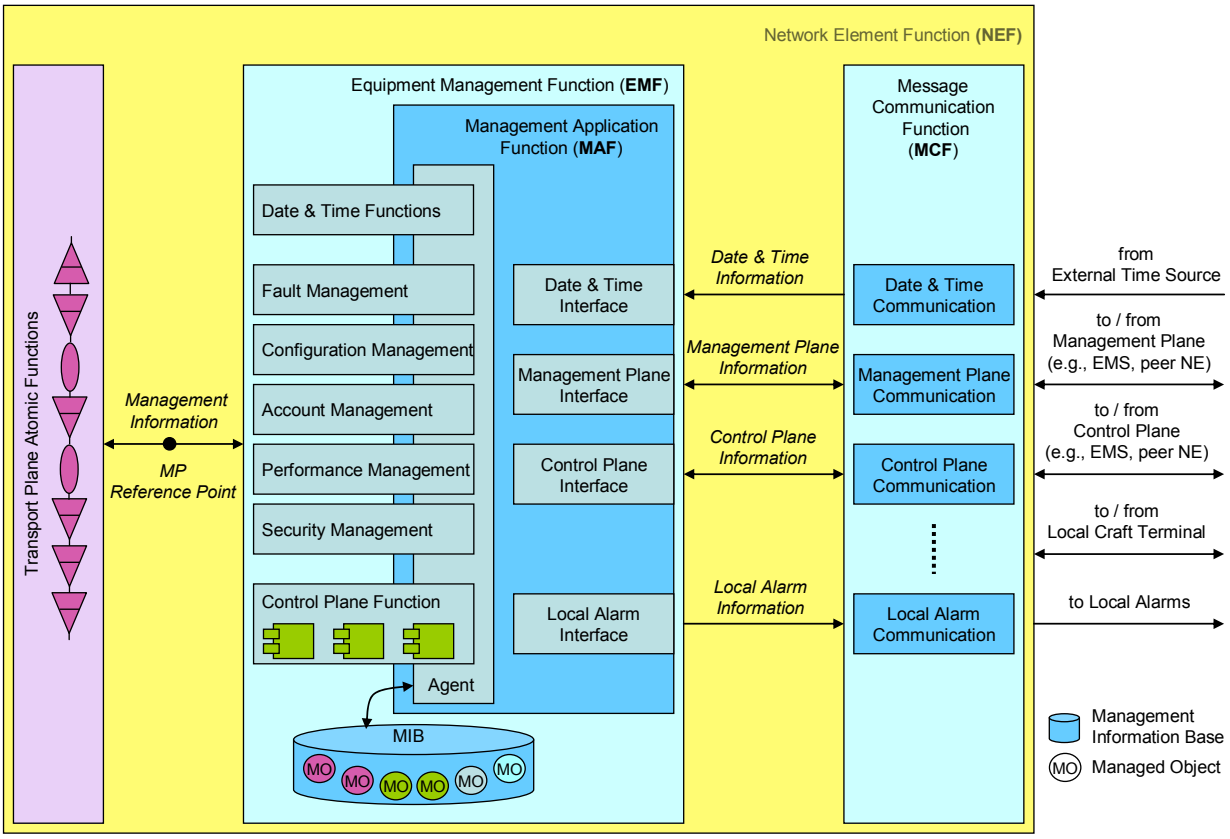

Figure 6-4 – EoT equipment management function

Network element resources provide event processing and storage. The MAF processes the information provided to and by the NE resources. The agent converts this information to management messages and responds to management messages from the manager by performing the appropriate operations on the managed objects.

This information to and from the agent is passed across the V reference point to the message communication function (MCF).

6.3 Information flows over management points

The information flows described in this clause are functional. The existence of these information flows in the equipment will depend on the functionality provided by the EoT NE and the options selected.

The information flow over the MP reference points that arises from anomalies and defects detected in the atomic functions is described in specific details for each atomic function in [ITU-T G.8021].

The information flow over the MP reference points that arises from provisioning and reporting data is described in specific details for each atomic function in [ITU-T G.8021]. The information listed under the Input column refers to the provisioning data that is passed from the EoT EMF to the atomic functions. The information listed under the Output column refers to the reports passed to the EoT EMF from the atomic functions.

7 Fault (maintenance) management

Fault management is a set of functions which enables the detection, isolation and correction of abnormal operation of the telecommunication network and its environment. It provides facilities for the performance of the maintenance phases from [ITU-T M.20]. The quality assurance measurements for fault management include component measurements for reliability, availability and survivability.

7.1 Fault management applications

See [ITU-T G.7710] for a description of the basic fault management applications.

7.1.1 Supervision

The supervision process describes the way in which the actual occurrence of a disturbance or fault is analysed with the purpose of providing an appropriate indication of performance and/or detected fault condition to maintenance personnel. The supervision philosophy is based on the concepts underlying the functional model of [ITU-T G.805], [ITU-T G.8010], and the alarm reporting function of [ITU-T X.733].

The five basic supervision categories are related to transmission, quality of service, processing, equipment and environment. These supervision processes are able to declare fault causes, which need further validation before the appropriate alarm is reported. See [ITU-T G.7710] for additional discussion of these categories.

The EoT NE shall indicate to the OS when a termination point is no longer able to supervise the signal (e.g., implementing equipment has a fault or loss of power).

7.1.1.1 Transmission supervision

See clause 7.1.1.1 of [ITU-T G.7710] for a general description of transmission supervision.

For EoT NE, the following defects are monitored for the purpose of transmission supervision:

- Continuity supervision: Loss of Continuity defect (dLOC[i])

  Ethernet Continuity Check (CC) management jobs, using Y.1731 CCM, can be separately established (within a MEP) for fault management, performance management, and protection switching.

  As a default, one MEP (with MEL = 7, OAM message period = 1 second, and priority = 7) has to be instantiated per TTP for fault management (i.e., RDI)
- Connectivity supervision: Unexpected MEL defect (dUNL), MisMerge defect (dMMG), and Unexpected MEP defect (dUNM)
- Signal quality supervision: Degraded Signal defect (dDEG)
- Configuration supervision: Unexpected Periodicity defect (dUNP) and Unexpected Priority defect (dUNPr)
- Maintenance signal supervision: Remote Defect Indicator defect (dRDI[]), Alarm Indication Signal defect (dAIS), and Locked Defect (dLCK)

The atomic function associated failure conditions are listed in clause 7.2.1.

7.1.1.2 Quality of service supervision

See [ITU-T G.7710] for a description of quality of service supervision.

7.1.1.3 Processing supervision

See [ITU-T G.7710] for a description of processing supervision.

7.1.1.4 Hardware supervision

See [ITU-T G.7710] for a description of equipment supervision.

7.1.1.5 Environment supervision

See [ITU-T G.7710] for a description of environment supervision.

7.1.2 Validation

See [ITU-T G.7710] for a description of fault cause validation.

7.1.3 Alarm handling

7.1.3.1 Severity assignment

See [ITU-T G.7710] for a description of severity categories.

7.1.3.2 Alarm reporting control

Alarm reporting control (ARC) provides an automatic in-service provisioning capability.

The following ARC states may be specified for a managed entity:

ALM ALarM reporting; Alarm reporting is turned on.

NALM No ALarM reporting; Alarm reporting is turned off.

NALM-CD No ALarM reporting, CountDown; this is a substate of NALM-QI and performs the persistence timing countdown function when the managed entity is qualified problem free.

NALM-NR No ALarM reporting, NotReady; this is a substate of NALM-QI and performs a wait function until the managed entity is qualified problem free.

NALM-QI No ALarM reporting, Qualified Inhibit; Alarm reporting is turned off until the managed entity is qualified problem free for a specified persistence interval.

NALM-TI No ALarM reporting, Timed Inhibit; Alarm Reporting is turned off for a specified timed interval.

Alarm reporting may be turned off (using NALM, NALM-TI, or NALM-QI) on a per-managed entity basis to allow sufficient time for customer testing and other maintenance activities in an "alarm free" state. Once a managed entity is ready, alarm reporting is automatically turned on (to ALM). The managed entity may be automatically turned on either by using NALM-TI or NALM-QI and allowing the resource to transition out automatically, or by invoking first the NALM state from an EMS and when maintenance activity is done, invoking the ALM state. This latter automation is carried out by the EMS. For further details relating to ARC, see [ITU-T M.3100].

7.1.3.3 Reportable failures

See [ITU-T G.7710] for a description of reportable failures.

7.1.3.4 Alarm reporting

Alarm surveillance is concerned with the detection and reporting of relevant events and conditions which occur in the network. In a network, events and conditions detected within the equipment and incoming signals should be reportable. In addition, a number of events external to the equipment should also be reportable. Alarms are indications that are automatically generated by an NE as a result of the declaration of a failure. The OS shall have the ability to define which events and conditions generate autonomous reports, and which shall be reported on request.

The following alarm-related functions shall be supported:

1) Autonomous reporting of alarms;
2) Request for reporting of all alarms;
3) Reporting of all alarms;
4) Allow or inhibit of autonomous alarm reporting;
5) Reporting on request status of allow or inhibit alarm reporting;
6) Reporting of protection switch events.

7.1.3.4.1 Local reporting

See [ITU-T G.7710] for a description of local reporting.

7.1.3.4.2 TMN reporting

See [ITU-T G.7710] for a description of TMN reporting.

7.2 Fault management functions

Figure 7-1 contains the functional model of fault management inside the EoT EMF. This model is consistent with the alarm flow functional model, specified in [ITU-T M.3100]. It must be noted that it does not address configuration aspects relating to fault management, the full ARC functional model, nor does it define where all possible event report parameters get assigned. Figure 7-1 is intended only to illustrate which well-known functions are impacted by ARC, and which are not, and to provide a generalized alarm flow view.

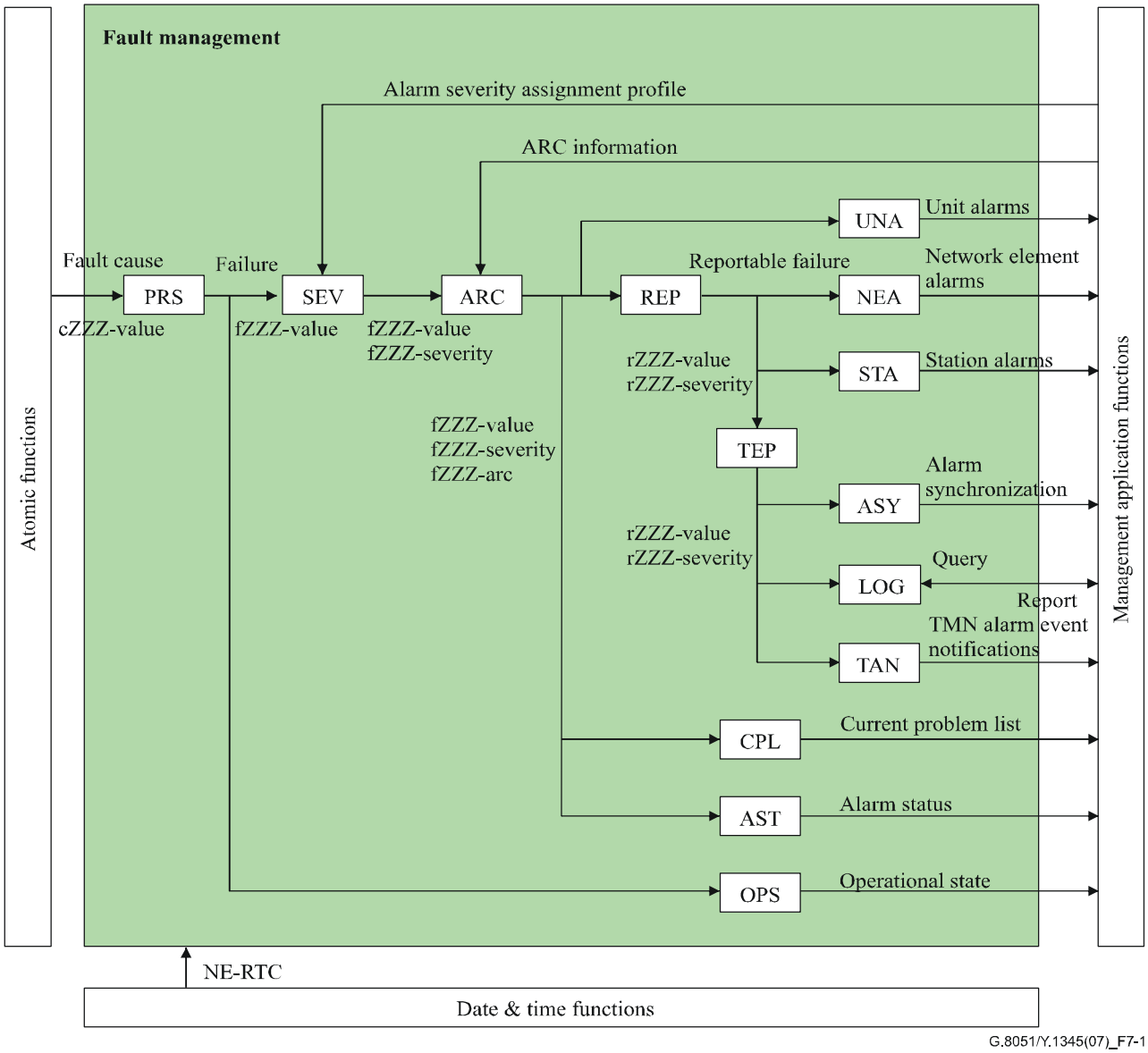

Figure 7-1 – Fault management within the EoT EMF

7.2.1 Fault cause persistency function – PRS

The defect correlations provide a data reduction mechanism on the fault and performance monitoring primitives' information presented at the MP reference points.

The equipment management function within the network element performs a persistency check on the fault causes (that are reported across the MP reference points) before it declares a fault cause a failure. In addition to the transmission failures, hardware failures with signal transfer interruption are also reported at the input of the fault cause function for further processing. See Figure 7-2.

Symbol

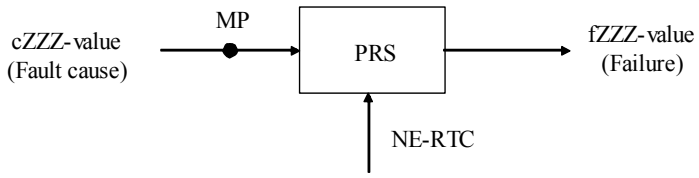

Figure 7-2 – Fault cause persistency function

Inputs and outputs

Table 7-1 – Inputs/outputs for the fault cause persistency function

Atomic Function (see G.8021)	**Input**	**Output**
ETHx_FT_Sk	cSSF cLCK cLOC[i] cMMG cUNM cUNP cUNPri cUNL cDEG cRDI[i]	fSSF fLCK fLOC[i] fMMG fUNM fUNP fUNPri fUNL fDEG fRDI[i]
ETYn-Np/ETH-LAG-Na_A_Sk	cPLL[1..Na] cTLL[1..Na]	fPLL[1..Na] fTLL[1..Na]
ETH-LAG_FT_Sk	cSSF	fSSF
ETYn_TT_Sk	cLOS cRDI cFDI	fLOS fRDI fFDI
Sn/ETH_A_Sk	cPLM cLFD cUPM cEXM cCSF	fPLM fLFD fUPM fEXM fCSF
Sn-X-L/ETH_A_Sk	cPLM cLFD cUPM cEXM cCSF	fPLM fLFD fUPM fEXM fCSF
Sm/ETH_A_Sk	cPLM cLFD cUPM cEXM cCSF	fPLM fLFD fUPM fEXM fCSF
Sm-X-L/ETH_A_Sk	cPLM cLFD cUPM cEXM cCSF	fPLM fLFD fUPM fEXM fCSF
Sn-X/ETC3_A_Sk	cPLM cLFD cUPM cEXM cCSF	fPLM fLFD fUPM fEXM fCSF
Pq/ETH_A_Sk	cPLM cLFD cUPM cEXM cCSF	fPLM fLFD fUPM fEXM fCSF

Table 7-1 – Inputs/outputs for the fault cause persistency function

Atomic Function (see G.8021)	**Input**	**Output**
Pq-X-L/ETH_A_Sk	cPLM cLFD cUPM cEXM cCSF	fPLM fLFD fUPM fEXM fCSF
ODUkP/ETH_A_Sk	cPLM cLFD cUPM cEXM cCSF	fPLM fLFD fUPM fEXM fCSF
ODUkP-X-L/ETH_A_Sk	cVcPLM cLFD cUPM cEXM cCSF	fVcPLM fLFD fUPM fEXM fCSF

Process

The equipment management function within the network element performs a persistency check on the fault causes before it declares a fault cause a failure.

A transmission failure (fXXX) shall be declared if the fault cause persists continuously for 2.5 ± 0.5 s. The failure shall be cleared if the fault cause is absent continuously for 10 ± 0.5 s.

The specific set of failures associated with each atomic function is listed in Table 7-1.

The failure declaration and clearing shall be time-stamped. The time-stamp shall indicate the time at which the fault cause is activated at the input of the fault cause persistency (i.e., defect-to-failure integration) function, and the time at which the fault cause is deactivated at the input of the fault cause persistency function.

7.2.2 Severity assignment function – SEV

See [ITU-T G.7710] for a description of the severity assignment function.

7.2.3 Alarm reporting control function – ARC

The alarm reporting control (ARC) function allows a management system to control the alarm reporting on a managed entity basis as defined in [ITU-T M.3100].

The alarms that can be controlled with this function are defined for each atomic function in [ITU-T G.8021].

The following ARC states may be specified for a managed entity:

ALM ALarM reporting; Alarm reporting is turned on.

NALM No ALarM reporting; Alarm reporting is turned off.

NALM-CD No ALarM reporting, CountDown; this is a substate of NALM-QI and performs the persistence timing countdown function when the managed entity is qualified problem free.

NALM-NR No ALarM reporting, NotReady; this is a substate of NALM-QI and performs a wait function until the managed entity is qualified problem free.

NALM-QI No ALarM reporting, Qualified Inhibit; Alarm reporting is turned off until the managed entity is qualified problem free for a specified persistence interval.

NALM-TI No ALarM reporting, Timed Inhibit; Alarm Reporting is turned off for a specified timed interval.

The ALM state is required for all managed entities that can detect alarms.

In addition, at least one of the states: NALM, NALM-TI, or NALM-QI must be supported.

If NALM-QI is supported, then NALM-NR is required and NALM-CD is optional.

Table 7-2 – ARC specifications for EoT

Atomic function	Qualified problems	QoS reporting	Default state value
ETHx_FT_Sk	fSSF fLCK fLOC[i] fMMG fUNM fUNP fUNPri fUNL fDEG fRDI[i]	FFS	ALM
ETYn-Np/ETH-LAG-Na_A_Sk	fPLL[1..Na] fTLL[1..Na]	FFS	ALM
ETH-LAG_FT_Sk	fSSF	FFS	ALM
ETYn_TT_Sk	fLOS fRDI fFDI	FFS	ALM
Sn/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	FFS	ALM
Sn-X-L/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	FFS	ALM
Sm/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	FFS	ALM
Sm-X-L/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	FFS	ALM

Table 7-2 – ARC specifications for EoT

Atomic function	Qualified problems	QoS reporting	Default state value
Sn-X/ETC3_A_Sk	fPLM fLFD fUPM fEXM fCSF	FFS	ALM
Pq/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	FFS	ALM
Pq-X-L/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF		ALM
ODUkP/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	FFS	ALM
ODUkP-X-L/ETH_A_Sk	fVcPLM fLFD fUPM fEXM fCSF	FFS	ALM

7.2.4 Reportable failure function – REP

See [ITU-T G.7710] for a description of the reportable failure function.

7.2.5 Unit alarms function – UNA

See [ITU-T G.7710] for a description of the unit alarms function.

7.2.6 Network element alarms function – NEA

See [ITU-T G.7710] for a description of the network element alarms function.

7.2.7 Station alarms function – STA

See [ITU-T G.7710] for a description of the station alarms function.

7.2.8 TMN event pre-processing function – TEP

See [ITU-T G.7710] for a description of the TMN event pre-processing alarm function.

7.2.9 Alarm synchronization function – ASY

See [ITU-T G.7710] for a description of the alarm synchronization function.

7.2.10 Logging function – LOG

Alarm history management is concerned with the recording of alarms. Historical data shall be stored in registers in the NE. Each register contains all the parameters of an alarm message.

Registers shall be readable on demand or periodically. The OS can define the operating mode of the registers as wrapping or stop when full. The OS may also flush the registers or stop recording at any time.

NOTE – Wrapping is the deletion of the earliest record to allow a new record when a register is full. Flushing is the removal of all records in the register. See [ITU-T X.735] for additional details.

See [ITU-T G.7710] for a description of the logging function.

7.2.11 TMN alarm event notifications function – TAN

See [ITU-T G.7710] for a description of the TMN alarm event notifications function.

7.2.12 Current problem list function – CPL

See [ITU-T G.7710] for a description of the current problem list function.

7.2.13 Alarm status function – AST

See [ITU-T G.7710] for a description of the alarm status function.

7.2.14 Operational state function – OPS

See [ITU-T G.7710] for a description of the operational state function.

Table 7-3 lists the failures that could influence the operational state of the related objects.

Table 7-3 – Operational state function input and output signals for Ethernet

Atomic function	Failure input (fZZZ value)	Operational state output (Enabled/Disabled) of the trail object
ETHx_FT_Sk	fSSF fLOC[i] fMMG fUNM fUNP fUNPri fUNL fRDI[i]	Enabled Enabled Enabled Enabled Enabled Enabled Enabled Enabled
ETYn-Np/ETH-LAG-Na_A_Sk	fPLL[1..Na] fTLL[1..Na]	Enabled Enabled
ETH-LAG_FT_Sk	fSSF	Enabled
ETYn_TT_Sk	fLOS fRDI fFDI	Disabled Enabled Enabled
Sn/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	Enabled Enabled Enabled Enabled Enabled
Sn-X-L/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	Enabled Enabled Enabled Enabled Enabled

Table 7-3 – Operational state function input and output signals for Ethernet

Atomic function	Failure input (fZZZ value)	Operational state output (Enabled/Disabled) of the trail object
Sm/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	Enabled Enabled Enabled Enabled Enabled
Sm-X-L/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	Enabled Enabled Enabled Enabled Enabled
Sn-X/ETC3_A_Sk	fPLM fLFD fUPM fEXM fCSF	Enabled Enabled Enabled Enabled Enabled
Pq/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	Enabled Enabled Enabled Enabled Enabled
Pq-X-L/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	Enabled Enabled Enabled Enabled Enabled
ODUkP/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	Enabled Enabled Enabled Enabled Enabled
ODUkP-X-L/ETH_A_Sk	fVcPLM fLFD fUPM fEXM fCSF	Enabled Enabled Enabled Enabled Enabled

7.2.15 External events

For further study.

8 Configuration management

See [ITU-T G.7710] for the generic requirements for configuration management. EoT specific specifications, if needed, are explicitly described.

8.1 Hardware

See [ITU-T G.7710] for a description of hardware management.

8.2 Software

See [ITU-T G.7710] for a description of software management.

8.3 Protection switching

For further study.

8.4 Trail termination

See [ITU-T G.7710] for a description of trail termination management.

This function allows a user to provision and monitor the operation of the Ethernet PHY Trail Termination process.

The MI signals listed in Table 8-1 are communicated between the EMF and the PHY trail termination process across the management point within the EoT NE.

Table 8-1 – Provisioning and reporting for PHY trail termination functions

MI signal	Value range	Default value
Provisioning		
ETYn_TT_So_MI_FTSEnable	true, false	false
Reporting		
ETYn_TT_So_MI_PHYType	See IEEE 802.3 clause 30.3.2.1.2	–
ETYn_TT_So_MI_PHYTypeList	See IEEE 802.3 clause 30.3.2.1.3	–
NOTE – According to [ITU-T G.8021].		

The EMF shall support the following functions:

– Provisioning of the trail termination management information.

– Retrieving the trail termination management information.

– Notifying the changes of the trail termination management information.

– Receiving the monitored trail termination management information.

8.5 Flow termination

This function allows a user to provision and monitor the operation of the ETHx and ETH-LAG Flow Termination processes.

The MI signals listed in Table 8-2 are communicated between the EMF and the Flow Termination processes across the management point within the EoT NE.

Table 8-2 – Provisioning and reporting for flow termination functions

MI signal	Value range	Default value
Provisioning		
ETHx_FT_So_MI_MEL	0, 1, 2, 3, 4, 5, 6, 7	By agreement
ETHx_FT_So_MI_MEG_ID	See Annex A of [ITU-T Y.1731]	–
ETHx_FT_So_MI_MEP_ID	0..8191; see Figure 9.2-3 of [ITU-T Y.1731]	–
ETHx_FT_So_MI_CC_Enable	true, false	false
ETHx_FT_So_MI_CC_Pri	0, 1, 2, 3, 4, 5, 6, 7	7

Table 8-2 – Provisioning and reporting for flow termination functions

MI signal	Value range	Default value
ETHx_FT_So_MI_CC_Period	3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min	3.3 ms for PS, 100 ms for PM, 1 s for FM
ETHx_FT_So_MI_LM_Enable	true, false	true
ETHx_FT_Sk_MI_MEG_ID	See Annex A of [ITU-T Y.1731]	–
ETHx_FT_Sk_MI_PeerMEP_ID[]	List of peer MEP IDs; 0..8191 for each ID; see Figure 9.2-3 of [ITU-T Y.1731]	–
ETHx_FT_Sk_MI_CC_Period	3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min	3.3 ms for PS, 100 ms for PM, 1 s for FM
ETHx_FT_Sk_MI_CC_Pri	0..7	7
ETHx_FT_Sk_MI_CC_Enable	true, false	false
ETHx_FT_Sk_MI_LM_Enable	true, false	true
ETHx_FT_Sk_MI_GetSvdCCM	(NOTE – Use to request the saved latest CCM frame that caused a defect to be raised.)	–
ETHx_FT_Sk_MI_1second	–	–
ETHx_FT_Sk_MI_LM_DEGM	2-10; see Table 7-1 of [ITU-T G.806]	10
ETHx_FT_Sk_MI_LM_M	2-10	10
ETHx_FT_Sk_MI_LM_DEGTHR	0% .. 100%; see Table 7-1 of [ITU-T G.806]	30%
Reporting		
ETHx_FT_Sk_MI_SvdCCM	Last received CCM frame that caused defect	–
Provisioning		
ETH-LAG_FT_Sk_MI_SSF_Reported	true, false	true

The EMF shall support the following functions:

– Provisioning of the flow termination management information.

– Retrieving the flow termination management information.

– Notifying the changes of the flow termination management information.

– Receiving the monitored flow termination management information.

8.6 Adaptation

See clause 8.5 of [ITU-T G.7710] for a description of adaptation management.

An Access Point that has multiple adaptation functions connected to it, thereby allowing different clients to be transported via the server signal, requires a mechanism for the selection of the active client.

This function allows a user to provision and monitor the operation of the EoT Adaptation processes.

The MI signals listed in Table 8-3 are communicated between the EMF and the Adaptation processes across the management point within the EoT NE.

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ETHx/ETH_A_So **Provisioning**		
ETHx/ETH_A_So_MI_MEL	0..7	–
ETHx/ETH_A_So_MI_LCK_Period	1 s, 1 min	1 s
ETHx/ETH_A_So_MI_LCK_Pri	0..7	7
ETHx/ETH_A_So_MI_Client_MEL	0..7	–
ETHx/ETH_A_So_MI_Admin_State	LCK, Normal	Normal
ETHx/ETH_A_So_MI_APS_Pri	0..7	7
ETHx/ETH_A_Sk **Provisioning**		
ETHx/ETH_A_Sk_MI_Admin_State	LCK, Normal	Normal
ETHx/ETH_A_Sk_MI_LCK_Period	1 s, 1 min	1 s
ETHx/ETH_A_Sk_MI_LCK_Pri	0..7	7
ETHx/ETH_A_Sk_MI_Client_MEL	0..7	–
ETHx/ETH_A_Sk_MI_AIS_Pri	0..7	7
ETHx/ETH_A_Sk_MI_AIS_Period	1 s, 1 min	1 s
ETHx/ETH_A_Sk_MI_MEL	0..7	7
ETHx/ETH-m_A_So **Provisioning**		
ETHx/ETH-m_A_So_MI_MEL	0..7	7
ETHx/ETH-m_A_So_MI_LCK_Period[1…M] (for each of the 1 through M VLANs)	1 s, 1 min	1 s
ETHx/ETH-m_A_So_MI_LCK_Pri[1…M]	0..7	7
ETHx/ETH-m_A_So_MI_Client_MEL[1…M]	0..7	–
ETHx/ETH-m_A_So_MI_Admin_State	LCK, Normal	Normal
ETHx/ETH-m_A_So_MI_VLAN_Config	(Note)	(Note)
ETHx/ETH-m_A_So_MI_Etype	2 byte integer ≥ 0x0600	S-Tag: 0x88a8 C-Tag: 0x8100
ETHx/ETH-m_A_So_PCP_Config	8P0D, 7P1D, 6P2D, 5P3D, 4P4D, DEI	8P0D
ETHx/ETH-m_A_So_Queue_Config	(Note)	(Note)
ETHx/ETH-m_A_Sk **Provisioning**		
ETHx/ETH-m_A_Sk_MI_Admin_State	LCK, Normal	Normal
ETHx/ETH-m_A_Sk_MI_LCK/AIS_Period[1…M]	1 s, 1 min	1 s
ETHx/ETH-m_A_Sk_MI_LCK/AIS_Pri[1…M]	0..7	7
ETHx/ETH-m_A_Sk_MI_Client_MEL[1…M]	0..7	–
ETHx/ETH-m_A_Sk_MI_VLAN_Config	(Note)	(Note)
ETHx/ETH-m_A_Sk_MI_P_Regenerate	(Note)	(Note)
ETHx/ETH-m_A_Sk_MI_PVID	(Note)	(Note)
ETHx/ETH-m_A_Sk_MI_Etype	2 byte integer ≥ 0x0600	S-Tag: 0x88a8 C-Tag: 0x8100
ETHx/ETH-m_A_Sk_MI_PCP_Config	8P0D, 7P1D, 6P2D, 5P3D, 4P4D, DEI	8P0D

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ETHx/ETH-m_A_Sk_MI_MEL	0..7	–
ETHx/ETH-m_A_Sk_MI_Frametype_Config	AllowTaggedOnly; AllowUntaggedOnly; AllowAll	AllowUntagged Only
ETHx/ETH-m_A_Sk_MI_Filter_Config	(Note)	(Note)
ETHG/ETH_A_So **Provisioning**		
ETHG/ETH_A_So_MI_MEL	0..7	–
ETHG/ETH_A_So_MI_LCK_Period[1…M]	1 s, 1 min	1 s
ETHG/ETH_A_So_MI_LCK_Pri[1…M]	0..7	7
ETHG/ETH_A_So_MI_Client_MEL[1…M]	0..7	–
ETHG/ETH_A_So_MI_Admin_State	LCK, Normal	Normal
ETHG/ETH_A_So_MI_APS_Pri	0..7	7
ETHG/ETH_A_Sk **Provisioning**		
ETHG/ETH_A_Sk_MI_Admin_State	LCK, Normal	Normal
ETHG/ETH_A_Sk_MI_LCK/AIS_Period[1…M]	0..7	7
ETHG/ETH_A_Sk_MI_LCK/AIS_Pri[1…M]	0..7	7
ETHG/ETH_A_Sk_MI_Client_MEL[1…M]	0..7	–
ETHG/ETH_A_Sk_MI_MEL	0..7	–
ETHDi/ETH_A_So **Provisioning**		
ETHDi/ETH_A_So_MI_MEL	0..7	7
ETHDi/ETH_A_So_MI_RAPS_Pri	0..7	7
ETHDi/ETH_A_So_MI_MIP_MAC	6 byte MAC unicast address	–
ETHDi/ETH_A_Sk_MI_RAPS_MEL	0..7	–
ETYn-Np/ETH-LAG-Na_A_So **Provisioning**		
ETYn-Np/ETH-LAG-Na_A_So_MI_TxPauseEnable	true, false	false
ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_AP_List	(Note)	(Note)
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ ActorAdmin_State	See IEEE 802.3 clause 30.7.2.1.20	–
ETYn-Np/ETH-LAG-Na_A_So **Reporting**		
ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_ActorSystemID	See IEEE 802.3 clause 30.7.1.1.4	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_ActorSystemPriority	See IEEE 802.3 clause 30.7.1.1.5	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_ActorOperKey	See IEEE 802.3 clause 30.7.1.1.8	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_PartnerSystemID	See IEEE 802.3 clause 30.7.1.1.10	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_PartnerSystemPriority	See IEEE 802.3 clause 30.7.1.1.11	–

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_PartnerOperKey	See IEEE 802.3 clause 30.7.1.1.12	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_DataRate	See IEEE 802.3 clause 30.7.1.1.16	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_CollectorMaxDelay	See IEEE 802.3 clause 30.7.1.1.32	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ActorOperKey	See IEEE 802.3 clause 30.7.2.1.5	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperSystemPriority	See IEEE 802.3 clause 30.7.2.1.7	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperSystemID	See IEEE 802.3 clause 30.7.2.1.9	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperKey	See IEEE 802.3 clause 30.7.2.1.11	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ActorPort	See IEEE 802.3 clause 30.7.2.1.14	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ActorPortPriority	See IEEE 802.3 clause 30.7.2.1.15	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperPort	See IEEE 802.3 clause 30.7.2.1.17	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperPortPriority	See IEEE 802.3 clause 30.7.2.1.19	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ActorOperState	See IEEE 802.3 clause 30.7.2.1.21	–
ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperState	See IEEE 802.3 clause 30.7.2.1.23	–
ETYn-Np/ETH-LAG-Na_A_Sk **Provisioning**		
ETYn-Np/ETH-LAG-Na_A_Sk_MI_PLLThr[1..Na]	(Note)	(Note)
ETH-LAG/ETH_A_Sk **Provisioning**		
ETH-LAG/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
ETYn/ETH_A_So **Provisioning**		
ETYn/ETH_A_So_MI_TxPauseEnable	true, false	false
ETYn/ETH_A_Sk **Provisioning**		
ETYn/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
ETYn/ETH_A_Sk_MI_MAC_Length	1518, 1522, 2000	2000
Sn/ETH_A_So **Provisioning**		
Sn/ETH_A_So_MI_CSFEnable	true, false	true
Sn/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
Sn/ETH_A_Sk **Provisioning**		
Sn/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
Sn/ETH_A_Sk_MI_CSF_Reported	true, false	false
Sn/ETH_A_Sk_MI_MAC_Length	1518, 1522, 2000	2000

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
Sn/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	true
Sn/ETH_A_Sk **Reporting**		
Sn/ETH_A_Sk_MI_AcSL (see Table 9-11 of [ITU-T G.707])	0..255	–
Sn/ETH_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Sn/ETH_A_Sk_MI_AcUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
Sn-X-L/ETH_A_So **Provisioning**		
Sn-X-L/ETH_A_So_MI_CSFEnable	true, false	true
Sn-X-L/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
Sn-X-L/ETH_A_Sk **Provisioning**		
Sn-X-L/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
Sn-X-L/ETH_A_Sk_MI_CSF_Reported	true, false	false
Sn-X-L/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	true
Sn-X-L/ETH_A_Sk **Reporting**		
Sn-X-L/ETH_A_Sk_MI_AcSL (see Table 9-11 of [ITU-T G.707])	0..255	–
Sn-X-L/ETH_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Sn-X-L/ETH_A_Sk_MI_AcUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
Sm/ETH_A_So **Provisioning**		
Sm/ETH_A_So_MI_CSFEnable	true, false	true
Sm/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
Sm/ETH_A_Sk **Provisioning**		
Sm/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
Sm/ETH_A_Sk_MI_CSF_Reported	true, false	false
Sm/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	true
Sm/ETH_A_Sk **Reporting**		
Sm/ETH_A_Sk_MI_AcSL (see Tables 9-12 and 9-13 of [ITU-T G.707])	0..255	–
Sm/ETH_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Sm/ETH_A_Sk_MI_AcUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
Sm-X-L/ETH_A_So **Provisioning**		
Sm-X-L/ETH_A_So_MI_CSFEnable	true, false	true
Sm-X-L/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
Sm-X-L/ETH_A_Sk **Provisioning**		
Sm-X-L/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
Sm-X-L/ETH_A_Sk_MI_CSF_Reported	true, false	false
Sm-X-L/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	true

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
Sm-X-L/ETH_A_Sk **Reporting**		
Sm-X-L/ETH_A_Sk_MI_AcSL (see Tables 9-12 and 9-13 of [ITU-T G.707])	0..255	–
Sm-X-L/ETH_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Sm-X-L/ETH_A_Sk_MI_AcUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
Sn-X/ETC3_A_So **Provisioning**		
Sn-X/ETC3_A_So_MI_CSFEnable	true, false	true
Sn-X/ETC3_A_Sk **Provisioning**		
Sn-X/ETC3_A_Sk_MI_CSF_Reported	true, false	false
Sn-X/ETC3_A_Sk **Reporting**		
Sn-X/ETC3_A_Sk_MI_AcSL (see Table 9-11 of [ITU-T G.707])	0..255	–
Sn-X/ETC3_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Sn-X/ETC3_A_Sk_MI_AcPFI (see clause 6.1.3.1 of [ITU-T G.7041])	0 or 1	–
Sn-X/ETC3_A_Sk_MI_AcUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
Pq/ETH_A_So **Provisioning**		
Pq/ETH_A_So_MI_CSFEnable	true, false	true
Pq/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
Pq/ETH_A_Sk **Provisioning**		
Pq/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
Pq/ETH_A_Sk_MI_CSF_Reported	true, false	false
Pq/ETH_A_Sk_MI_CSFrdifdiReported	true, false	false
Pq/ETH_A_Sk **Reporting**		
Pq/ETH_A_Sk_MI_AcSL (see clause 2.1.2 of [ITU-T G.832])	0..7	–
Pq/ETH_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Pq/ETH_A_Sk_MI_AcUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
Pq-X-L/ETH_A_So **Provisioning**		
Pq-X-L/ETH_A_So_MI_CSFEnable	true, false	true
Pq-X-L/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
Pq-X-L/ETH_A_Sk **Provisioning**		
Pq-X-L/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
Pq-X-L/ETH_A_Sk_MI_CSF_Reported	true, false	false
Pq-X-L/ETH_A_Sk_MI_CSFrdifdiReported	true, false	false

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
Pq-X-L/ETH_A_Sk **Reporting**		
Pq-X-L/ETH_A_Sk_MI_AcSL (see clause 2.1.2 of [ITU-T G.832])	0..7	–
Pq-X-L/ETH_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Pq-X-L/ETH_A_Sk_MI_AcUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
ODUkP/ETH_A_So **Provisioning**		
ODUkP/ETH_A_So_MI_Active	true, false	–
ODUkP/ETH_A_So_MI_CSFEnable	true, false	true
ODUkP/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
ODUkP/ETH_A_Sk **Provisioning**		
ODUkP/ETH_A_Sk_MI_Active	true, false	–
ODUkP/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
ODUkP/ETH_A_Sk_MI_CSF_Reported	true, false	false
ODUkP/ETH_A_Sk_MI_MAC_Length	1518, 1522, 2000	2000
ODUkP/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	true
ODUkP/ETH_A_Sk **Reporting**		
ODUkP/ETH_A_Sk_MI_AcPT (see Table 15-8 of [ITU-T G.709])	0..255	–
ODUkP/ETH_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
ODUkP/ETH_A_Sk_MI_AcUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
ODUkP-X-L/ETH_A_So **Provisioning**		
ODUkP-X-L/ETH_A_So_MI_Active	true, false	–
ODUkP-X-L/ETH_A_So_MI_CSFEnable	true, false	true
ODUkP-X-L/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
ODUkP-X-L/ETH_A_Sk **Provisioning**		
ODUkP-X-L/ETH_A_Sk_MI_Active	true, false	–
ODUkP-X-L/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
ODUkP-X-L/ETH_A_Sk_MI_CSF_Reported	true, false	false
ODUkP-X-L/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	true
ODUkP-X-L/ETH_A_Sk **Reporting**		
ODUkP-X-L/ETH_A_Sk_MI_AcVcPT (see Table 18-1 of [ITU-T G.709])	0..255	–
ODUkP-X-L/ETH_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
ODUkP-X-L/ETH_A_Sk_MI_AcUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
NOTE – According to [ITU-T G.8021].		

8.7 Connection

See clause 8.6 of [ITU-T G.7710] for a description of connection management.

This function allows a user to provision the operation of an ETH Connection process.

The MI signals listed in Table 8-4 are communicated from the EMF to the Connection process through the management point.

Table 8-4 – Provisioning and reporting for connection functions

MI signal	Value range	Default value
ETH_C **Provisioning**		
ETH_C_MI_Create_FF	(Note)	(Note)
ETH_C_MI_Modify_FF	(Note)	(Note)
ETH_C_MI_Delete_FF	(Note)	(Note)
ETH_C **Provisioning per Flow Forwarding Process**		
ETH_C_MI_FF_Set_PortIds	(Note)	(Note)
ETH_C_MI_FF_ConnectionType	(Note)	(Note)
ETH_C_ MI_FF_Flush_Learned	–	–
ETH_C_ MI_FF_Flush_Config	–	–
ETH_C_ MI_FF_Group_Default	(Note)	(Note)
ETH_C_ MI_FF_ETH_FF	(Note)	(Note)
ETH_C_ MI_FF_Ageing	10 to 10^6 seconds	300 seconds
ETH_C_MI_FF_Learning	(Note)	(Note)
ETH_C_MI_FF_STP_Learning_State[i] (for each port)	true, false	true
ETH_C_MI_FF_Flow_Port_Group[j]	true, false	false
ETH_C **Provisioning per SNC/S protection process**		
ETH_C_MI_PS_WorkingPortId	(Note)	(Note)
ETH_C_MI_PS_ProtectionPortId	(Note)	(Note)
ETH_C_MI_PS_ProtType	(Note)	(Note)
ETH_C_MI_PS_OperType	(Note)	(Note)
ETH_C_MI_PS_HoTime	(Note)	(Note)
ETH_C_MI_PS_WTR	(Note)	(Note)
ETH_C_MI_PS_ExtCMD	(Note)	(Note)
ETH_C **Provisioning per Ring protection process**		
ETH_C_MI_RAPS_RPL_Owner_Node	(Note)	(Note)
ETH_C_MI_RAPS_RPL_Neighbour_Node	(Note)	(Note)
ETH_C_MI_RAPS_Propagate_TC[1…M]	(Note)	(Note)
ETH_C_MI_RAPS_Compatible_Version	(Note)	(Note)
ETH_C_MI_RAPS_Revertive	(Note)	(Note)
ETH_C_MI_RAPS_Sub_Ring_Without_Virtual_Channel	(Note)	(Note)
NOTE – According to [ITU-T G.8021].		

The EMF shall support the following functions:

– Provisioning of the connection management information.

– Retrieving the connection management information.

– Notifying the changes of the connection management information.

8.8 Diagnostic

This function allows a user to provision the operation of an ETH Diagnostic process.

The MI signals listed in Table 8-5 are communicated from the EMF to the Diagnostic process across the management point within the EoT NE.

Table 8-5 – Provisioning and reporting for diagnostic functions

MI signal	Value range	Default value
Provisioning of Diagnostic Flow Termination Source for MEP		
ETHDe_FT_So_MI_MEL	0..7	–
ETHDe_FT_So_MI_MEP_MAC	6 byte MAC unicast address	–
ETHDe_FT_So_MI_LM_Start(DA,P,Period)	(Notes 1 and 2)	–
ETHDe_FT_So_MI_LM_Terminate	–	–
ETHDe_FT_So_MI_LB_Discover(DA,DE,P)	(Note 2)	–
ETHDe_FT_So_MI_LB_Series(DA,DE,P,TLV,N,Period)	(Notes 1 and 2)	–
ETHDe_FT_So_MI_LB_Test(DA,DE,P,Pattern, Length, Period)	(Notes 1 and 2)	–
ETHDe_FT_So_MI_LB_Test_Terminate	–	–
ETHDe_FT_So_MI_DM_Start(DA,P,Period)	(Notes 1 and 2)	–
ETHDe_FT_So_MI_DM_Terminate	–	–
ETHDe_FT_So_MI_1DM_Start(DA,P,Period)	(Notes 1 and 2)	–
ETHDe_FT_So_MI_1DM_Terminate	–	–
ETHDe_FT_So_MI_Test(DA,DE,P,Pattern, Length, Period)	(Notes 1 and 2)	–
ETHDe_FT_So_MI_Test_Terminate	–	–
Reporting of Diagnostic Flow Termination Source for MEP		
ETHDe_FT_So_MI_LM_Result(N_TF, N_LF, F_TF, F_LF)	(Note 1)	–
ETHDe_FT_So_MI_LB_Discover_Result(MACs)	6 byte MAC unicast address	–
ETHDe_FT_So_MI_LB_Series_Result(REC,ERR,OO)	(Note 1)	–
ETHDe_FT_So_MI_LB_Test_Result(Sent, REC, CRC, BERR, OO)	(Note 1)	–
ETHDe_FT_So_MI_DM_Result(Delay,Variation)	(Note 1)	–
ETHDe_FT_So_MI_Test_Result(Sent)	(Note 1)	–
Provisioning of Diagnostic Flow Termination Sink for MEP		
ETHDe_FT_Sk_MI_MEL	0..7	–
ETHDe_FT_Sk_MI_MEP_MAC	6 byte Unicast MAC address	–
ETHDe_FT_Sk_MI_LMM_Pri	0..7	7
ETHDe_FT_Sk_MI_1DM_Start(SA)	6 byte Unicast MAC address	–

Table 8-5 – Provisioning and reporting for diagnostic functions

MI signal	Value range	Default value
ETHDe_FT_Sk_MI_1DM_Terminate	–	–
ETHDe_FT_Sk_MI_TST_Start(SA, pattern)	(Note 1)	–
ETHDe_FT_Sk_MI_TST_Terminate	–	–
Reporting of Diagnostic Flow Termination Sink for MEP		
ETHDe_FT_Sk_MI_1DM_Result(Delay, Variation)	(Note 1)	–
ETHDe_FT_Sk_MI_TST_Result(REC, CRC, BER, OO)	(Note 1)	–
Provisioning of Diagnostic Flow Termination Source for MIP		
ETHDi_FT_So_MI_MEL	0..7	–
ETHDi_FT_So_MI_MEG_MAC	6 byte MAC unicast address	–
Provisioning of Diagnostic Flow Termination Sink for MIP		
ETHDi_FT_Sk_MI_MEL	0..7	–
ETHDi_FT_Sk_MI_MEG_MAC	6 byte MAC unicast address	–
NOTE 1 – According to [ITU-T G.8021]. NOTE 2 – DA is 6-byte MAC address, P is 0..7, DE is 0..1.		

The EMF shall support the following functions:

– Provisioning of the diagnostic management information.

– Retrieving the diagnostic management information.

– Notifying the changes of the diagnostic management information.

– Receiving the monitored diagnostic management information.

8.9 Traffic conditioning and shaping

This function allows a user to provision the operation of an ETH traffic conditioning and shaping process.

The MI signals listed in Table 8-6 are communicated between the EMF and the traffic conditioning and shaping process across the management point within the EoT NE.

Table 8-6 – Provisioning for traffic conditioning and shaping functions

MI signal	Value range	Default value
ETH_TCS_So **Provisioning**		
ETH_TCS_So_MI_PrioConfig	(Note)	(Note)
ETH_TCS_So_MI_QueueConfig	(Note)	(Note)
ETH_TCS_So_MI_SchedConfig	(Note)	(Note)
ETH_TCS_Sk_MI_PrioConfig	(Note)	(Note)
ETH_TCS_Sk_MI_CondConfig[]	(Note)	(Note)
ETH_GTCS_So **Provisioning**		
ETH_GTCS_So_MI_PrioConfig[]	(Note)	(Note)
ETH_GTCS_So_MI_QueueConfig[]	(Note)	(Note)
ETH_GTCS_So_MI_SchedConfig[]	(Note)	(Note)
NOTE – According to [ITU-T G.8021].		

The EMF shall support the following functions:

– Provisioning of the traffic conditioning and shaping management information.

– Retrieving the traffic conditioning and shaping management information.

– Notifying the changes of the traffic conditioning and shaping management information.

– Receiving the monitored traffic conditioning and shaping management information.

8.10 XXX_Reported

See clause 8.8 of [ITU-T G.7710] for a description of XXX_Reported management.

Table 8-7 provides the MI signals that need to be provisioned for consequential defect/failure.

Table 8-7 – Consequential defect/failure related provisioning

MI signal	Value range	Default value
MI_CSF_Reported	true, false	false

8.11 Alarm severity

See clause 8.9 of [ITU-T G.7710] for a description of alarm severity.

8.12 Alarm reporting control (ARC)

See clause 8.10 of [ITU-T G.7710] for a description of alarm reporting control.

8.13 PM thresholds

For further study.

8.14 TCM activations

For further study.

8.15 Date and time

The Date and Time Functions within the EoT EMF comprise the local real-time clock (RTC) function and the performance monitoring clock (PMC) function. The message communication function within the EoT NEF shall be capable of setting the local real-time clock function.

The date and time values are incremented by a free running local clock, or by an external timing source. The FCAPS functions that need date and time information, e.g., to time stamp event reports, obtain this information from the Date and Time function.

8.15.1 Date and Time application

Clause 8.13.1 of [ITU-T G.7710] identifies three Date and Time applications. These are:

– time-stamping;

– performance monitoring clock signals;

– activity scheduling.

The EoT NEF functional requirements for these applications are specified in the following subclauses.

8.15.1.1 Time-stamping

See clause 8.13.1.1 of [ITU-T G.7710] for a description of the time-stamping application.

8.15.1.2 Performance monitoring clock signals

See clause 8.13.1.2 of [ITU-T G.7710] for a description of the PMC signals.

8.15.1.3 Activity scheduling

See clause 8.13.1.3 of [ITU-T G.7710] for a description of the activity scheduling application.

8.15.2 Date and Time functions

There are three Date and Time functions defined. The local real-time clock (RTC) function is required for time-stamping and activity scheduling. The local real-time clock alignment function is required for aligning the clock with an external time reference. The performance monitoring clock (PMC) function, in addition to RTC, is typical for digital counter measurements.

8.15.2.1 Local real-time clock function

The local real-time clock function is specified in clause 8.13.2.1 of [ITU-T G.7710].

8.15.2.2 Local real-time clock alignment function with external time reference

The local real-time clock alignment function with external time reference is specified in clause 8.13.2.2 of [ITU-T G.7710].

8.15.2.3 Performance monitoring clock function

The performance monitoring clock function is specified in clause 8.13.2.3 of [ITU-T G.7710].

9 Accounting management

For further study.

10 Performance management

See clause 10 of [ITU-T G.7710] for the generic requirements for performance management. EoT specific management requirements are described below.

10.1 Performance management applications

See clause 10.1 of [ITU-T G.7710] for the generic description for performance management applications.

10.2 Performance monitoring functions

See clause 10.2 of [ITU-T G.7710] for the generic requirements of performance monitoring functions.

The following are EoT specific performance management requirements:

1) PM measurements are managed at TTPs and CTPs (i.e., MEPs/MIPs are created and deleted)
2) One MEP has to be created per MEL if that has to be supervised
3) Two kinds of measurement jobs have to be supported (ProActive, OnDemand)
4) ProActive measurement jobs are managed at MEPs (establish, disable, enable, terminate)
5) OnDemand measurement jobs are managed at MEPs (establish, modify, abort)
6) On-Demand measurements can be done using 3 different OAM PDU generation mechanisms: single instance, repetitive instance and single series.

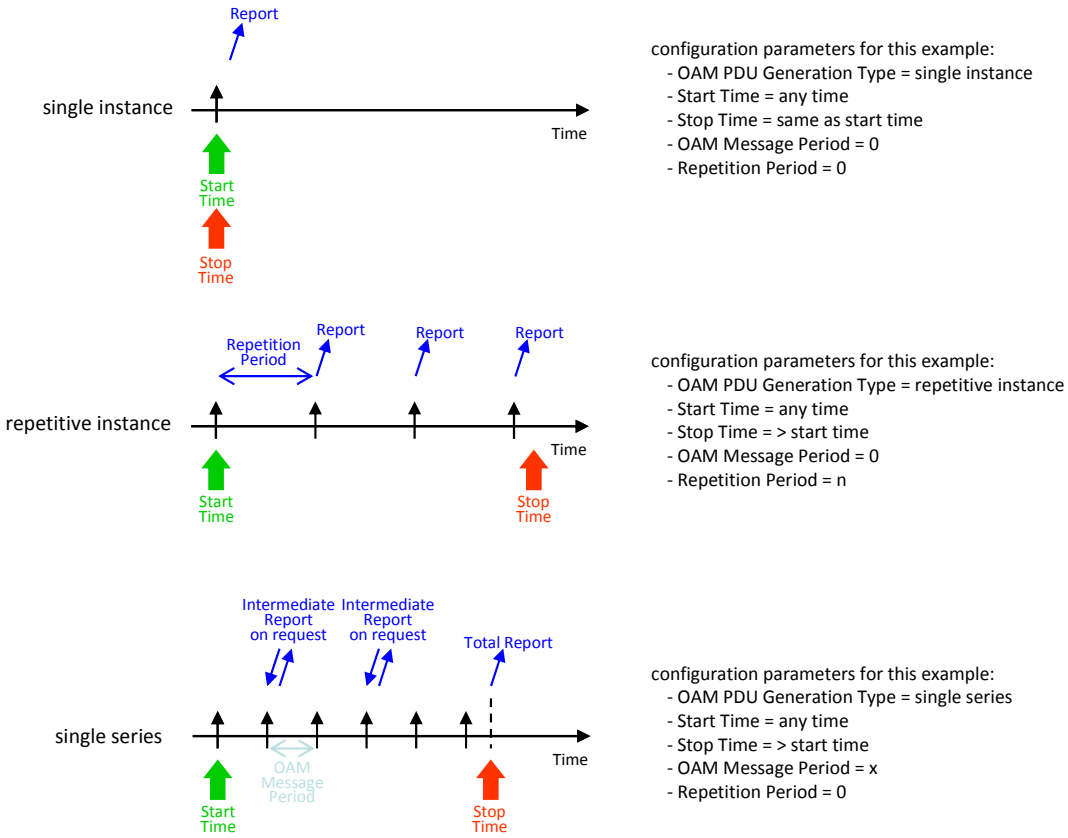

Figure 10-1 – On Demand OAM PDU generation mechanisms

7) It shall be possible to configure the following on-demand measurement parameters (including the default values)
   a) OAM PDU Generation Type; default = repetitive instance
   b) Start Time; default = current time
   c) Stop Time; default = current time + 1 hour
   d) OAM Message Period; default = 0
   e) Repetition Period; default = 0
8) Parallel measurement jobs can be established per priority

9) Performance data is stored in registers associated to the measurement job

10) On-Demand measurement jobs are automatically terminated after (last) report is sent

11) Threshold profiles are managed at the ManagedElement (create, modify, delete)

12) It shall be possible to retrieve the following configuration information:

a) all existing MEPs/MIPs within a TP (TTP or CTP)

b) all existing measurement jobs within a MEP

c) all existing threshold profiles within a network element

d) all threshold settings within a ProActive PM measurement job

13) It shall be possible to retrieve all ProActive PM measurement current and history performance data within a MEP

14) It shall be possible to request intermediate reports on an OnDemand PM measurement job of "single series" type

15) It shall be possible to request an autonomous continuous reporting of Performance data from all Proactive PM measurement jobs within a MEP (i.e., automatic "push" of the measured PM data)

16) If on-demand LM (i.e., LMM/LMR) is supported, for each on-demand LM session the Ethernet NE should:

– Receive from the transport plane the raw measurements (i.e., N_TF, N_LF, F_TF, F_LF) for each OAM period.

– Store the respective cumulative statistics (TN_TF, TN_LF, TF_TF, TF_LF) and FLRs (TN_FLR=TN_LF/TF_TF, TF_FLR=TF_LF/TN_TF). The stored statistics shall be available for retrieval by the management system.

– At the end of the on-demand session, report the statistics to the management system.

NOTE – An on-demand LM or DM session could be a single series of OAM messages or a single instance of OAM message. A single instance OAM could be considered as a special case of a single series OAM.

17) If proactive LM (i.e., LMM/LMR or CCM-based) is supported, for each proactive LM session the Ethernet NE should:

– Receive from the transport plane the raw measurements (i.e., N_TF, N_LF, F_TF, F_LF) for each OAM period.

– Calculate the FLRs (N_FLR=N_LF/F_TF, F_FLR=F-LF/N_TF) for each OAM period; store the temporal minimum, average, and maximum statistics (mN_FLR, aN_FLR, xN_FLR, mF_FLR, aF_FLR, xF_FLR) in the current 15-minute and 24-hour registers. The stored statistics shall be available for retrieval by the management system.

– At the maturity of the current 15-minute and 24-hour periods, the statistics in the current registers shall move to the history registers and then reset the current registers to zeros. See detailed requirements in [ITU-T G.7710].

18) If on-demand 1-way DM (i.e., 1DM) is supported, for each on-demand 1-way DM session the Ethernet NE should:

– Receive from the transport plane the raw time stamps for each OAM period.

– Compute and store the near-end measurements (N_FD, N_FDV) for each OAM period. The stored measurements (i.e., the N_FD array and N_FDV array) shall be available for retrieval by the management system.

– At the end of the on-demand session, report both complete arrays to the management system.

19) If proactive 1-way DM (i.e., 1DM) is supported, for each proactive 1-way DM session the Ethernet NE should:
   - Receive from the transport plane the raw time stamps for each OAM period.
   - Compute the near-end measurements (N_FD, N_FDV) for each OAM period; store the temporal minimum, average, and maximum (N_FD, N_FDV) in the current 15-minute and 24-hour registers. The stored statistics shall be available for retrieval by the management system.
   - At the maturity of the current 15-minute and 24-hour periods, the statistics in the current registers shall move to the history registers and then reset the current registers to zeros. See detailed requirements in [ITU-T G.7710].

20) If on-demand 2-way DM (i.e., DMM/DMR) is supported, for each on-demand 2-way DM session the Ethernet NE should:
   - Receive from the transport plane the raw time stamps for each OAM period.
   - Compute and store the Near-end, Far-end, and Bidirectional (2-way) measurements (N_FD, F_FD, B_FD; N_FDV, F_FDV, B_FDV) for each OAM period. The stored array of each type of the measurements (N_FD, F_FD, B_FD; N_FDV, F_FDV, B_FDV) shall be available for retrieval by the management system.
   - At the end of the on-demand session, report all the complete arrays to the management system.

21) If proactive 2-way DM (i.e., DMM/DMR) is supported, for each proactive 2-way DM session the Ethernet NE should:
   - Receive from the transport plane the raw time stamps for each OAM period.
   - Compute the measurements (N_FD, F_FD, B_FD; N_FDV, F_FDV, B_FDV) for each OAM period; store the temporal minimum, average, and maximum for each type of the measurements (N_FD, F_FD, B_FD; N_FDV, F_FDV, B_FDV) for the current 15-minute and 24-hour registers. The stored statistics shall be available for retrieval by the management system.
   - At the maturity of the current 15-minute and 24-hour periods, the statistics in the current registers shall move to the history registers and then reset current registers to zeros. See detailed requirements in [ITU-T G.7710].

22) The Ethernet NE should support the ability to configure for the start and stop at the respondent-end MEP of a single-ended measurement session (such as LMM/LMR and DMM/DMR).

EoT NE provides the following PM management information (see Table 10-1).

Table 10-1 – PM management information

PM management information	G.8021 function
ETH_FT_Sk_MI_pN_FL ETH_FT_Sk_MI_pN_TF ETH_FT_Sk_MI_pF_FL ETH_FT_Sk_MI_pF_TF ETH_FT_Sk_MI_pF_DS ETH_FT_Sk_MI_pN_DS	ETHx_FT_Sk
ETYn/ETH_A_So_MI_pFramesTransmittedOK ETYn/ETH_A_So_MI_pOctetsTransmittedOK	ETYn/ETH_A_So

Table 10-1 – PM management information

PM management information	G.8021 function
ETYn/ETH_A_Sk_MI_pErrors ETYn/ETH_A_Sk_MI_pFramesReceivedOK ETYn/ETH_A_Sk_MI_pOctetsReceivedOK	ETYn/ETH_A_Sk
ETYn-Np/ETH-LAG-Na_A_So_MI_pAggOctetsTxOK[1..Na] ETYn-Np/ETH-LAG-Na_A_So_MI_pAggFramesTxOK[1..Na] ETYn-Np/ETH-LAG-Na_A_So_MI_pFramesTransmittedOK[1..Np] ETYn-Np/ETH-LAG-Na_A_So_MI_pOctetsTransmittedOK[1..Np]	ETYn-Np/ETH-LAG-Na_A_So
ETYn-Np/ETH-LAG-Na_A_Sk_MI_pAggOctetsRxOK[1..Na] ETYn-Np/ETH-LAG-Na_A_Sk_MI_pAggFramesRxOK[1..Na] ETYn-Np/ETH-LAG-Na_A_Sk_MI_pFramesReceivedOK[1..Np] ETYn-Np/ETH-LAG-Na_A_Sk_MI_pOctetsReceivedOK[1..Np] ETYn-Np/ETH-LAG-Na_A_Sk_MI_pFCSErrors[1..Np]	ETYn-Np/ETH-LAG-Na_A_Sk
Sn/ETH_A_Sk_MI_pFCSErrors	Sn/ETH_A_Sk
Sn-X-L/ETH_A_Sk_MI_pFCSError	Sn-X-L/ETH_A_Sk
Sm/ETH_A_Sk_MI_pFCSError	Sm/ETH_A_Sk
Sm-X-L/ETH_A_Sk_MI_pFCSError	Sm-X-L/ETH_A_Sk
Sn-X/ETC3_A_Sk_MI_pCRC16Errors	Sn-X/ETC3_A_Sk
Pq/ETH_A_Sk_MI_pFCSError	Pq/ETH_A_Sk
Pq-X-L/ETH_A_Sk_MI_pFCSError	Pq-X-L/ETH_A_Sk
ODUkP/ETH_A_Sk_MI_pFCSErrors	ODUkP/ETH_A_Sk
ODUkP-X-L/ETH_A_Sk_MI_pFCSError	ODUkP-X-L/ETH_A_Sk

The EMF shall support the following functions:

– Notifying of the PM management information.

11 Security management

See [ITU-T G.7710] for a description of security management.

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For further details, please refer to the list of ITU-T Recommendations.

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