International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.8051/Y.1345

(03/2018)

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

Packet over Transport aspects – Ethernet over Transport aspects

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS, NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

Internet protocol aspects – Transport

Management aspects of the Ethernet transport (ET) 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 transport (ET) capable network element

Summary

Recommendation ITU-T G.8051/Y.1345 addresses management aspects of the Ethernet transport (ET) 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. The management functions for fault management, configuration management, performance monitoring and security management are specified.

The 2009 revision of this Recommendation added the management of additional transport functions that were introduced in the 2009 revision of Recommendation ITU-T G.8021/Y.1341.

The 2013 revision of this Recommendation added the management of additional functions, including: client signal fail (CSF); proactive loss measurement using loss measurement message (LMM)/loss measurement reply (LMR); proactive delay measurement using delay measurement message (DMM)/delay measurement reply (DMR) and one-way delay measurement (1DM); synthetic loss measurement using synthetic loss message (SLM)/synthetic loss reply (SLR) and one-way synthetic loss measurement (1SL) (proactive and on-demand); performance management (PM) requirements on protocol data unit (PDU) generation type, message period, measurement interval, repetition period, start time, stop time and session duration; and PM data collection requirements.

The 2015 revision of this Recommendation updated the management information (MI) signals for the ETHx_FT function in clause 8.5, the MI signals for the ETHx/MCC function in clause 8.6, the one-way synthetic loss measurement (1SL) management information (MI) signal for the ETHDe_FT_Sk function in clause 8.8 and the on-demand and proactive loss measurement requirements in clause 10.2.

The 2018 revision of this Recommendation has updated the fault cause persistency function at the ETH connection (ETH-C) function for ring protection, the configuration management for protection switching and connection functions. Finally, in alignment with Recommendation ITU-T G.8021/Y.1341, this revision has removed both fault management functions and the management information (MI) signals that are related to ETYn_TT, ODUkP-X-L/MT_A and ETYn/ETH_A. This revision has also removed the MI signals to activate processes in adaptation functions (i.e., MI_Active).

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.8051/Y.1345	2007-10-22	15	11.1002/1000/9186
2.0	ITU-T G.8051/Y.1345	2009-11-13	15	11.1002/1000/10430
2.1	ITU-T G.8051/Y.1345 (2009) Amd. 1	2011-06-06	15	11.1002/1000/11139
3.0	ITU-T G.8051/Y.1345	2013-08-29	15	11.1002/1000/12024
3.1	ITU-T G.8051/Y.1345 (2013) Amd. 1	2014-05-14	15	11.1002/1000/12186
4.0	ITU-T G.8051/Y.1345	2015-08-13	15	11.1002/1000/12549
4.1	ITU-T G.8051/Y.1345 (2015) Amd. 1	2017-08-13	15	11.1002/1000/13314
5.0	ITU-T G.8051/Y.1345	2018-03-16	15	11.1002/1000/13546

Keywords

Carrier Ethernet, network management, transport resource.

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

FOREWORD

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

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

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

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In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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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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Management aspects of the Ethernet transport (ET) capable network element

1 Scope

This Recommendation addresses management aspects of the Ethernet transport (ET) 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 (PM) and security management are specified. Accounting management is for further study. Furthermore, only the management information (MI) of the following ET 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;
– 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 ET 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 ET equipment management function (EMF) within an ET 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 (ELNEs) 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 (ELNEs);
– a network element may contain both Ethernet layer network entities (ELNEs) and client layer network entities (CLNEs);
– client layer entities are managed as part of their own logical domain;
– CLNEs and ELNEs may or may not share a common message communication function (MCF) and management application function (MAF) depending on application; and
– CLNEs and ELNEs may or may not share the same agent,
– server layer network entities (SLNEs) and ELNEs 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 (2016), *Interfaces for the optical transport network.*

[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 (2012), *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.*

[ITU-T G.7041] Recommendation ITU-T G.7041/Y.1303 (2016), *Generic framing procedure*.

[ITU-T G.7710] Recommendation ITU-T G.7710/Y.1701 (2012), *Common equipment management function requirements.*

[ITU-T G.7712] Recommendation ITU-T G.7712/Y.1703 (2010), *Architecture and specification of data communication network.*

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

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

[ITU-T G.8013] Recommendation ITU-T G.8013/Y.1731 (2015), *Operations, administration and maintenance (OAM) functions and mechanisms for Ethernet-based networks*.

[ITU-T G.8021] Recommendation ITU-T G.8021/Y.1341 (2018), *Characteristics of Ethernet transport network equipment functional blocks.*

[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.*

[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.*

[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.*

[ITU-T Y.1563] Recommendation ITU-T Y.1563 (01/2009), *Ethernet frame transfer and availability performance.*

[IEEE 802.3] IEEE 802.3-2015, *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.806]:

– Atomic function (AF);

– Management point (MP).

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

– Local craft terminal;

– Management application function (MAF).

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

– Data communication network (DCN).

3.1.4 Terms defined in [ITU-T G.8001]:

– ET management network (ET.MN);

– ET management subnetwork (ET.MSN);

– ET network element (ET.NE);

– Ethernet management communication channel (ET MCC).

– Traffic conditioning function;

– Traffic shaping function

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

– Network element (NE);

– Network element function (NEF);

– Operations system (OS);

– Q-interface;

– Workstation function (WF).

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

– Message communication function (MCF).

3.1.7 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.

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

– Managed object (MO).

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

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

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

1DM	One-way Delay Measurement
1SL	One-way Synthetic Loss measurement
AcSL	Accepted Signal Label
AF	Atomic Function
AIS	Alarm Indication Signal
ALM	Alarm reporting
APP	Access Point Pool
ARC	Alarm Reporting Control
CC	Continuity Check
CCM	Continuity Check Message
CLNE	Client Layer Network Entity
COMMS	Communication channel
CSF	Client Signal Fail
CTP	Connection Termination Point

CtrlP	Control Plane
DA	Destination Address
DCN	Data Communication Network
DE	Drop Eligibility
DEG	Degraded
DEGM	Degraded M
DEGTHR	Degraded Threshold
DMM	Delay Measurement Message
DMR	Delay Measurement Reply
ECC	Embedded Communication Channel
ELNE	Ethernet Layer Network Entity
EMF	Equipment Management Function
EMS	Element Management System
ET	Ethernet Transport
ETC	Ethernet Coding
ET.C	ET Channel layer
ET.MN	ET MN
ET.MSN	ET MSN
ET.NE	ET NE
ET.P	ET Path layer
ET.S	ET Section layer
ETH	Ethernet MAC layer
ETH-C	ETH Connection
ETHx	Ethernet MAC layer network – x, x=s for section, x=p for path, x=t for TCM
FCAPS	Fault Management, Configuration Management, Account Management, Performance Management and Security Management
FFS	For Further Study
FLR	Frame Loss Ratio
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
LMM	Loss Measurement Message
LMR	Loss Measurement Reply

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
P	Priority
PDU	Protocol Data Unit
PM	Performance Management
PMC	Performance Monitoring Clock
PS	Protection Switching
QoS	Quality of Service

RDI	Remote Defect Indication
RTC	Real-Time Clock
SA	Source Address
SES	Severely Errored Seconds
SL	Synthetic Loss
SLM	Synthetic Loss Message
SLNE	Server Layer Network Entity
SLR	Synthetic Loss Reply
TCM	Tandem Connection Monitoring
TF	Transmitted Frames
TMN	Telecommunications Management Network
TTP	Trail Termination Point
WTR	Wait To Restore

5 Conventions

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

6 ET management architecture

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

6.1 ET network management architecture

The transport layer networks of Ethernet over transport (ET) are described in [ITU-T G.8010], [ITU-T G.8012] and [ITU-T G.8013]. The management of the ET 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, ET.MN and ET.MSN

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

6.1.2 Access to the ET.MSN

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

6.1.3 ET.MSN requirements

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

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

– All ET.NEs are required to terminate the ET.S-MCCs, see clause 6.1.4. In OSI terms, this means that each network element (NE) must be able to perform the functions of an end system.

– ET.NEs may also be required to forward management messages between ports according to routing control information held in the ET.NE. In open systems interconnection (OSI) terms, this means that some ET.NEs may be required to perform the functions of an intermediate system.

– In addition to supporting interfaces for the ET.S-MCC, an ET.NE may also be required to support other DCN interfaces, which may include ET.P-MCCs or ET.C-MCCs or an Ethernet DCN interface.

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

6.1.4 ET.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 ET.MN supports three management communication channels (MCCs):

1) ET.S-MCC (MCC_S)

2) ET.P-MCC (MCC_P)

3) ET.C-MCC (MCC_C)

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

Figure 6-1 illustrates a network scenario consisting of two operators. Operator B provides an ET path layer service to operator A (i.e., Operator B transports the ET 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.

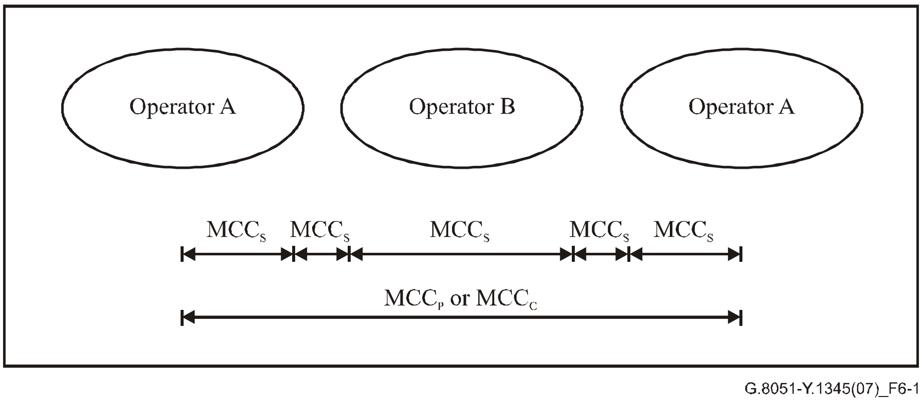

Figure 6-1 – MCC scenarios

The physical layer is terminated in every network element and its related adaptation function provides the ET 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.

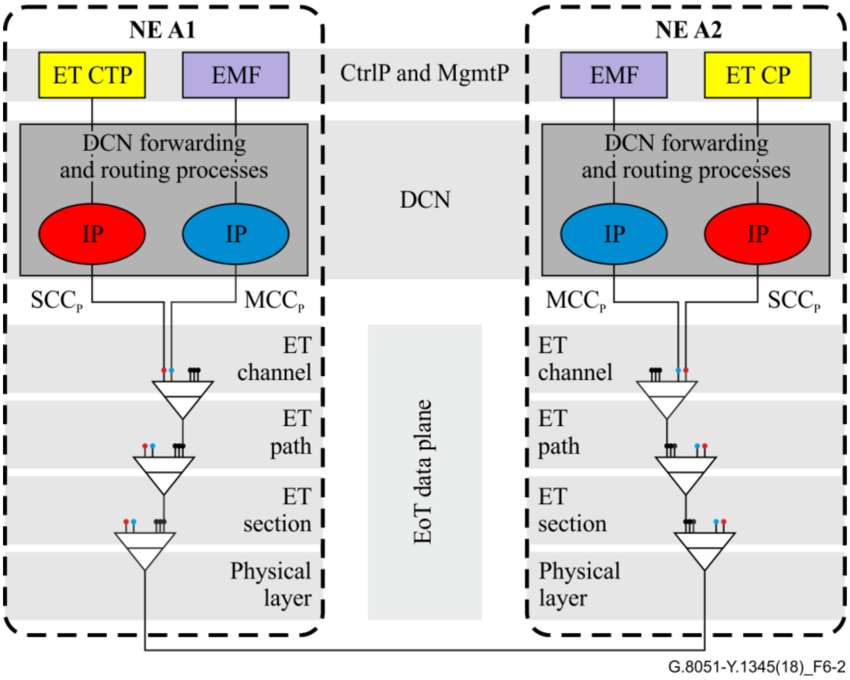

Figure 6-2 – MCCP scenario example

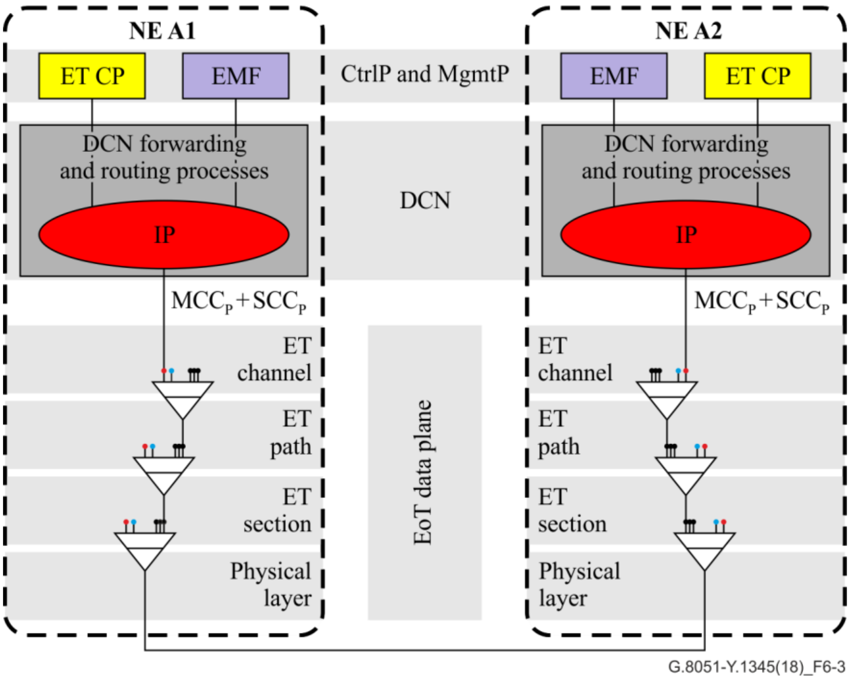

Figure 6-3 – MCCP scenario example

6.1.4.2 MCC physical characteristics

The ET.S-, ET.C- and ET.P-MCCs are logical elements within the ET transport module (ETM-n). The MCC provides general management communications between two ET network elements with access to the ET.S, ET.P and ET.C characteristic information respectively. The ET.S-, ET.P-, or ET.C-MCC is provided by the ET OAM function at section, path, or channel layer as defined in [ITU-T Y.G.8013] or by any other ECC of the ET transport network.

The ET.S management communication channel (MCC_S) shall operate as a single message channel between ET.S termination points. The bit rate of the MCC_S shall be configurable.

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

The ET.C management communication channel (MCC_C) shall operate as a single message channel between any network elements that terminate the ET.C layer. The MCC_C is transported transparently through ET.NEs that only terminate the ET.S layer or the ET.S and ET.P layers and forward the ET.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 ET 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 ET NEs within an MSN, or between communicating peer ET NEs across a network interface. Single-ended maintenance is the ability to access remotely located ET 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 ET equipment management function (EMF) (see Figure 6-4) provides the means through which the ET 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 ET EMF.

The ET EMF interacts with the other atomic functions (AFs) (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 AF and on management points (MPs). The ET 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 (MAFs) which represent this information as managed objects.

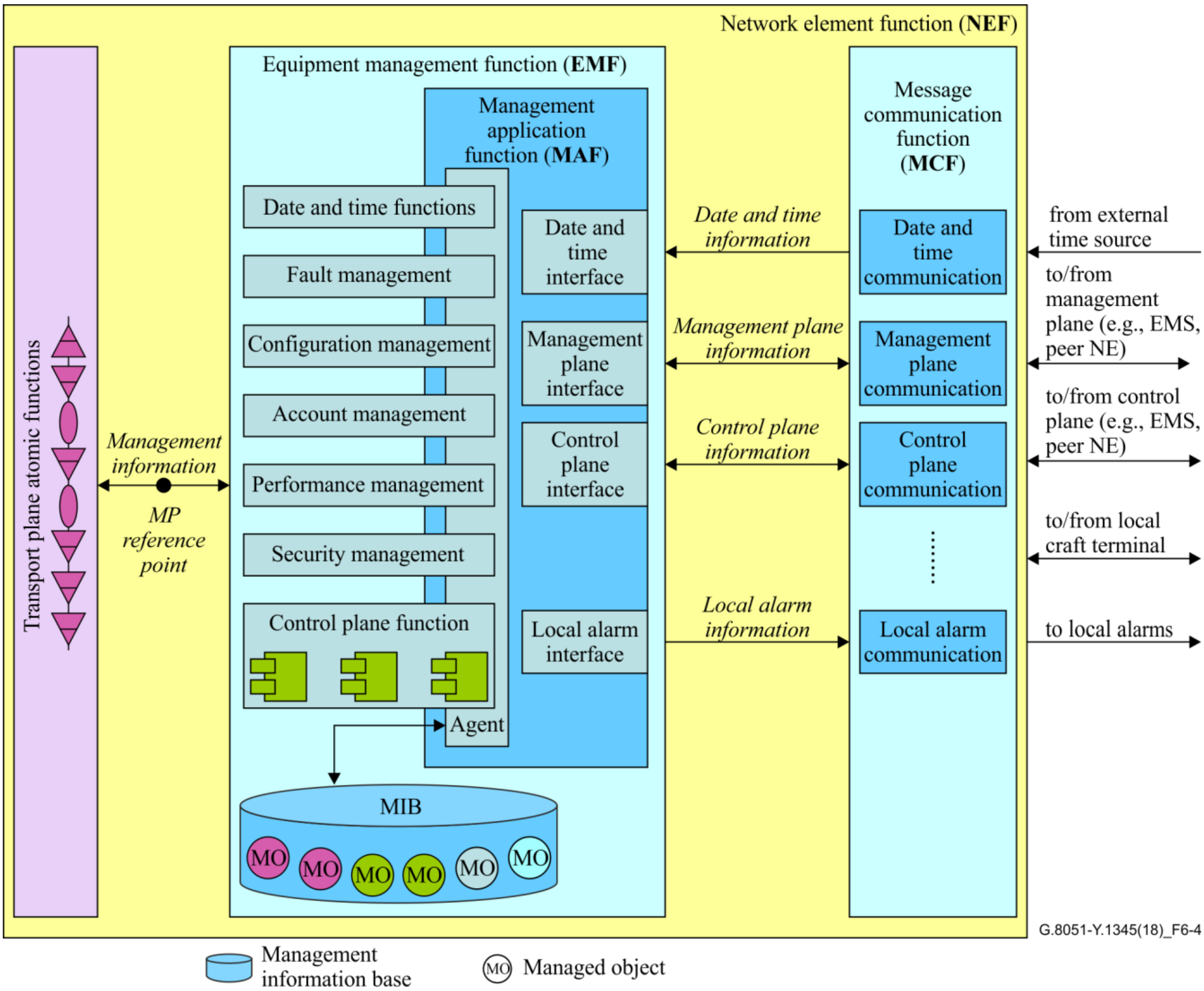

Figure 6-4 – ET equipment management function

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 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 ET 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 AF 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 AF in [ITU-T G.8021]. The information listed under the Input column refers to the provisioning data that is passed from the ET EMF to the AFs. The information listed under the Output column refers to the reports passed to the ET EMF from the AFs.

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 ET 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 ET 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 ITU-T G.8013/Y.1731 continuity check message (CCM), can be separately established (within a MEP) for fault management, performance management and protection switching.

  As a default, one MEG end point (MEP) (with MEL = 7, OAM message period = 1 second and priority = 7) has to be instantiated per trail termination point (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 element management system (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 ET 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.

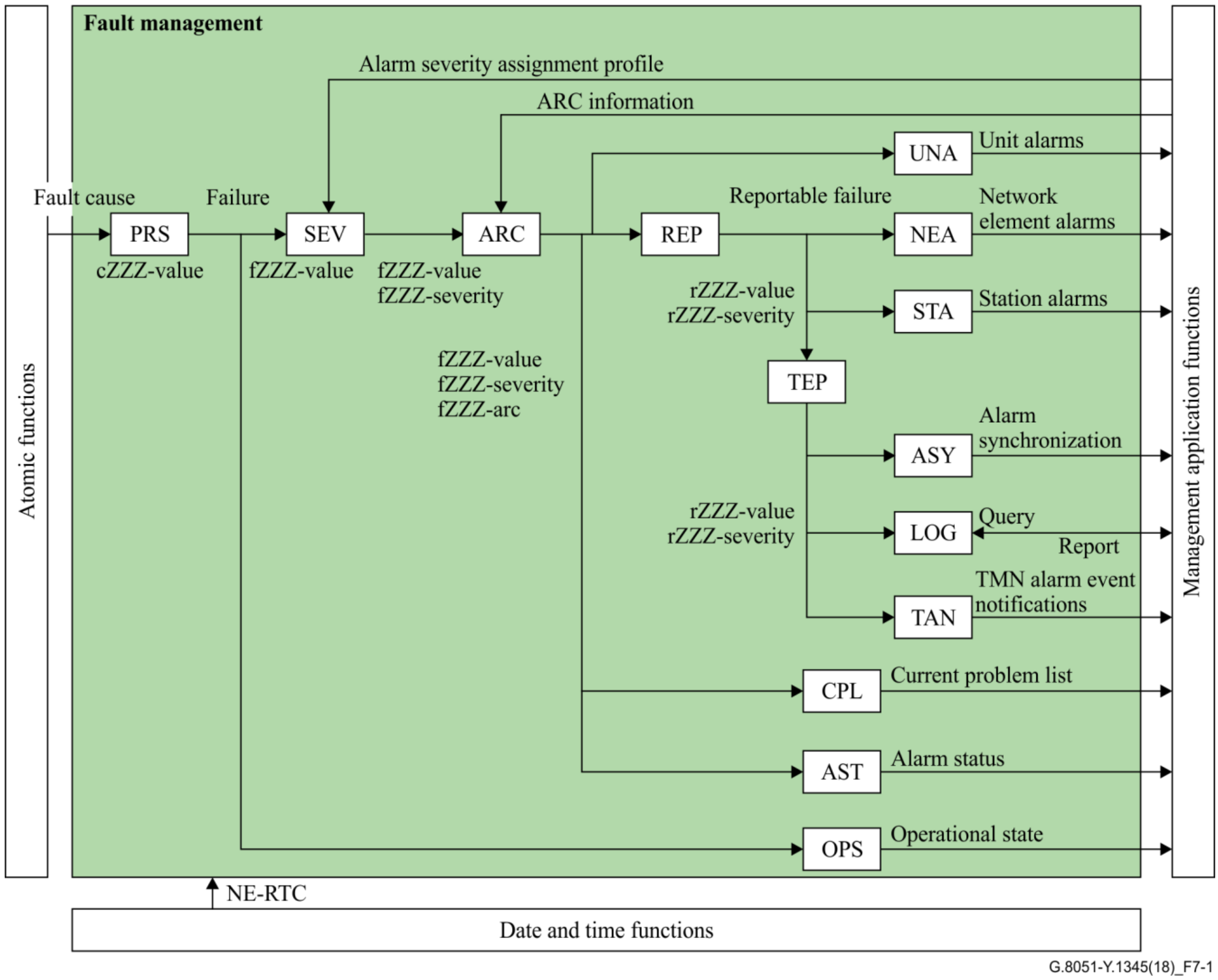

Figure 7-1 – Fault management within the ET EMF

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 EMF 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

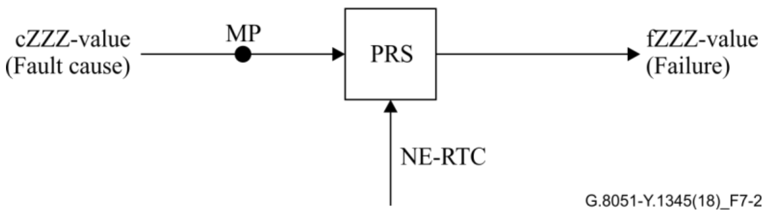

Figure 7-2 – Fault cause persistency function

For an ET.NE that supports the atomic functions listed in Table 7-1, the EMF PRS process shall supports the persistency check for the associated fault causes.

Inputs and outputs

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

Atomic function (see [ITU-T G.8021])	**Input**	**Output**
ETH_C per ring protection process	cFOP-PM	fFOP-PM
ETH_C per ring port process	cFOP-TO	fFOP-TO
ETHx_FT_Sk	cSSF cLCK cLOC[i] cMMG cUNM cUNP cUNPri cUNL cDEG cRDI	fSSF fLCK fLOC[i] fMMG fUNM fUNP fUNPri fUNL fDEG fRDI
ETHG_FT_Sk	cLOC[i] cUNL cMMG cUNM cDEG cUNP cUNPr cRDI cSSF cLCK	fLOC[i] fUNL fMMG fUNM fDEG fUNP fUNPr fRDI fSSF fLCK
ETHx/ETH_A_Sk	cCSF	fCSF
ETHx/ETH-m_A_Sk	cCSF	fCSF
ETHG/ETH_A_Sk	cCSF	fCSF
ETHn-Np/ETH-LAG-Na_A_Sk	cPLL[1..Na] cTLL[1..Na]	fPLL[1..Na] fTLL[1..Na]
ETH-LAG_FT_Sk	cSSF	fSSF
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

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

Atomic function (see [ITU-T G.8021])	**Input**	**Output**
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
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
ODU2P/ETHPP-OS_A_Sk	cPLM cLFD cUPM cEXM cCSF	fPLM fLFD fUPM fEXM fCSF

Process

The EMF 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 AF in [ITU-T G.8021].

The ARC states that may be specified for a managed entity are defined in clause 7.1.3.2. For ET.NE:

– 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.

In Table 7-2 below, for each managed entity a subset of the plausible failures (defined in Table 7-1) are selected as qualified problems. These qualified problems are recommended as they are deemed essential to the operability of the subject managed entity. Note that for each managed entity, one or more of the qualified problems could then be further selected by the management system to be included in the ARC list (see clause 7.2.3 of [ITU-T G.7710]) for controlling the reporting of alarm for the entity. When an entity is put in the ARC state of NALM-QI, alarm reporting for the entity is turned off until the managed entity is free of all the failures specified in the ARC list.

Default ARC state is also specified for each managed entity. If the ARC function is supported by the ET.NE and an ARC state is not explicitly provisioned from the management system for the managed entity, then the default ARC specified in Table 7-2 should be in effect.

For an ET.NE that supports the AFs listed in Table 7-2, the EMF ARC process shall support alarm reporting control for the associated fault causes.

Table 7-2 – ARC specifications for ET

Atomic function	Qualified problems	QoS reporting	Default state value
ETH_C per ring protection process	fFOP-PM	FFS	ALM
ETH_C per ring port process	fFOP-TO	FFS	ALM
ETHx_FT_Sk	fSSF fLCK fLOC[i] fMMG fUNM fUNP fUNPri fUNL fDEG fRDI	FFS	ALM
ETHG_FT_Sk	fLOC[i] fUNL fMMG fUNM fDEG fUNP fUNPr fRDI fSSF fLCK	FFS	ALM

Table 7-2 – ARC specifications for ET

Atomic function	Qualified problems	QoS reporting	Default state value
ETHx/ETH_A_Sk	fCSF	FFS	ALM
ETHx/ETH-m_A_Sk	fCSF	FFS	ALM
ETHG/ETH_A_Sk	fCSF	FFS	ALM
ETHn-Np/ETH-LAG-Na_A_Sk	fPLL[1..Na] fTLL[1..Na]	FFS	ALM
ETH-LAG_FT_Sk	fSSF	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
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	FFS	ALM
ODUkP/ETH_A_Sk	fPLM fLFD fUPM fEXM fCSF	FFS	ALM

Table 7-2 – ARC specifications for ET

Atomic function	Qualified problems	QoS reporting	Default state value
ODU2P/ETHPP-OS_A_Sk	fPLM 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.

For an ET.NE that supports the AFs listed in Table 7-3, the EMF OPS process shall supports operational state for the associated fault causes.

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
ETH_C per ring protection process	fFOP-PM	Enabled
ETH_C per ring port process	fFOP-TO	Enabled
ETHx_FT_Sk	fSSF fLOC[i] fMMG fUNM fUNP fUNPri fUNL fRDI	Enabled Enabled Enabled Enabled Enabled Enabled Enabled Enabled
ETHG_FT_Sk	fLOC[i] fUNL fMMG fUNM fDEG fUNP fUNPr fRDI fSSF fLCK	Enabled Enabled Enabled Enabled Enabled Enabled Enabled Enabled Enabled Enabled
ETHx/ETH_A_Sk	fCSF	Enabled
ETHx/ETH-m_A_Sk	fCSF	Enabled
ETHG/ETH_A_Sk	fCSF	Enabled
ETHn-Np/ETH-LAG-Na_A_Sk	fPLL[1..Na] fTLL[1..Na]	Enabled Enabled
ETH-LAG_FT_Sk	fSSF	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
Sm/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-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
ODU2P/ETHPP-OS_A_Sk	fPLM 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. ET 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

See [ITU-T G.7710] for a description of protection switching.

This function allows a user to provision and monitor the operation of protection processes deployed in an ETH connection (ETH-C) process.

MI signals concerning the protection processes are listed in Table 8-4 and communicated between the EMF and the protection process through the management point. According these MI signals, the EMF generates a corresponding event notification and state report signals to the MAF.

For the protection processes supported by an ET.NE, the ET.NE EMF shall support the following management functions:

– Provisioning the protection switching management information

– Retrieving the protection switching management information

– Notifying the changes of the protection switching management information

– Receiving the monitored protection switching management information

8.4 Trail termination

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

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 ET NE.

For the flow termination functions supported by an ET.NE, the ET.NE EMF shall support the following management functions:

– Provisioning 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

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_MEP_MAC	Per [ITU-T G.8021]	–
ETHx_FT_So_MI_CC_Enable	true, false	false
ETHx_FT_So_MI_LMC_Enable	true, false	true
ETHx_FT_So_MI_MEG_ID	See Annex A of [ITU-T G.8013]	–
ETHx_FT_So_MI_MEP_ID	0..8191; see Figure 9.2-3 of [ITU-T G.8013]	–
ETHx_FT_So_MI_CC_Period	3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min	1 s
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_LML_Enable[1…M_{LM}]	true, false	true
ETHx_FT_So_MI_LM_MAC_DA[1…M_{LM}]	Per [ITU-T G.8021]	--
ETHx_FT_So_MI_LM_Period[1…M_{LM}]	100ms, 1s, 10s	100 ms
ETHx_FT_So_MI_LM_Pri[1…M_{LM}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHx_FT_So_MI_DM_Enable[1…M_{DM}]	true, false	false
ETHx_FT_So_MI_DM_MAC_DA[1…M_{DM}]	Per [ITU-T G.8021]	--
ETHx_FT_So_MI_DM_Test_ID[1…M_{DM}]	Non-negative integer (optional)	--
ETHx_FT_So_MI_DM_Length[1…M_{DM}]	Non-negative integer representing number of byte for the length of the padding TLV. Note that the total fame size of the DM PDU should be between 64 and 9216 bytes.	0
ETHx_FT_So_MI_DM_Period[1…M_{DM}]	100ms, 1s, 10s	100 ms
ETHx_FT_So_MI_DM_Pri[1…M_{DM}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHx_FT_So_MI_1DM_Enable[1…M_{1DM}]	true, false	false
ETHx_FT_So_MI_1DM_MAC_DA[1…M_{1DM}]	Per [ITU-T G.8021]	--
ETHx_FT_So_MI_1DM_Test_ID[1…M_{1DM}]	Non-negative integer (optional)	--
ETHx_FT_So_MI_1DM_Length[1…M_{1DM}]	Non-negative integer representing number of byte for the length of the padding TLV. Note that the total fame size of the DM PDU should be between 64 and 9216 bytes.	0
ETHx_FT_So_MI_1DM_Period[1…M_{1DM}]	100ms, 1s, 10s	100 ms
ETHx_FT_So_MI_1DM_Pri[1…M_{1DM}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHx_FT_So_MI_SL_Enable[1…M_{SL}]	true, false	false
ETHx_FT_So_MI_SL_MAC_DA[1…M_{SL}]	Per [ITU-T G.8021]	--
ETHx_FT_So_MI_SL_Test_ID[1…M_{SL}]	Non-negative integer (optional)	--
ETHx_FT_So_MI_SL_Length[1…M_{SL}]	Non-negative integer representing number of byte for the length of the padding TLV. Note that the total fame size of the DM PDU should be between 64 and 9216 bytes.	0
ETHx_FT_So_MI_SL_Period[1…M_{SL}]	10ms, 100ms, 1s, 10s	100 ms
ETHx_FT_So_MI_SL_Pri[1…M_{SL}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHx_FT_So_MI_1SL_Enable[1…M_{1SL}]	true, false	false
ETHx_FT_So_MI_1SL_MAC_DA[1…M_{1SL}]	Per [ITU-T G.8021]	--

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

MI signal	Value range	Default value
ETHx_FT_So_MI_1SL_Test_ID[1…M_{1SL}]	Non-negative integer (optional)	--
ETHx_FT_So_MI_1SL_Length[1…M_{1SL}]	Non-negative integer representing number of byte for the length of the padding TLV. Note that the total fame size of the DM PDU should be between 64 and 9216 bytes.	0
ETHx_FT_So_MI_1SL_Period[1…M_{1SL}]	10ms, 100ms, 1s, 10s	100 ms
ETHx_FT_So_MI_1SL_Pri[1…M_{1SL}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHx_FT_Sk_MI_CC_Enable	true, false	false
ETHx_FT_Sk_MI_LMC_Enable	true, false	true
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%
ETHx_FT_Sk_MI_LM_TFMIN	FFS	FFS
ETHx_FT_Sk_MI_MEL	0, 1, 2, 3, 4, 5, 6, 7	By agreement
ETHx_FT_Sk_MI_MEG_ID	See Annex A of [ITU-T G.8013]	–
ETHx_FT_Sk_MI_PeerMEP_ID[i]	List of peer MEP IDs; 0..8191 for each ID; see Figure 9.2-3 of [ITU-T G.8013]	–
ETHx_FT_Sk_MI_CC_Period	3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min	1 s
ETHx_FT_Sk_MI_CC_Pri	0..7	7
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_1DM_Enable[1…M_{1DM}]	true, false	false
ETHx_FT_Sk_MI_1DM_MAC_SA[1…M_{1DM}]	Per [ITU-T G.8021]	–
ETHx_FT_Sk_MI_1DM_Pri[1...M_{1DM}]	0..7	7
ETHx_FT_Sk_MI_1DM_Test_ID[1…M_{1DM}]	Non-negative integer (optional)	--
ETHx_FT_Sk_MI_1SL_Enable[1…M_{1SL}]	true, false	false
ETHx_FT_Sk_MI_1SL_MAC_SA[1…M_{1SL}]	Per [ITU-T G.8021]	–
ETHx_FT_Sk_MI_1SL_Test_ID[1…M_{1SL}]	Non-negative integer (optional)	--
ETHx_FT_Sk_MI_MEP_MAC	Per [ITU-T G.8021]	--
Reporting		
ETHx_FT_Sk_MI_SvdCCM	Last received CCM frame that caused defect	–
ETHx_FT_Sk_MI_BW_Report(SA, PortID, NominalBW, CurrentBW)	Per configured at peer source	--

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

MI signal	Value range	Default value
Provisioning		
ETHG_FT_So_MI_MEL	0, 1, 2, 3, 4, 5, 6, 7	By agreement
ETHG_FT_So_MI_MEP_MAC	Per [ITU-T G.8021]	–
ETHG_FT_So_MI_CC_Enable	true, false	false
ETHG_FT_So_MI_LMC_Enable	true, false	true
ETHG_FT_So_MI_MEG_ID	See Annex A of [ITU-TG.8013]	–
ETHG_FT_So_MI_MEP_ID	0..8191; see Figure 9.2-3 of [ITU-T G.8013]	–
ETHG_FT_So_MI_CC_Period	3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min	1 s
ETHG_FT_So_MI_CC_Pri	0, 1, 2, 3, 4, 5, 6, 7	7
ETHG_FT_So_MI_LML_Enable[1...M_{LM}]	true, false	true
ETHG_FT_So_MI_LM_MAC_DA[1...M_{LM}]	Per [ITU-T G.8021]	--
ETHG_FT_So_MI_LM_Period[1...M_{LM}]	100ms, 1s, 10s	100 ms
ETHG_FT_So_MI_LM_Pri[1...M_{LM}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHG_FT_So_MI_DM_Enable[1…M_{DM}]	true, false	false
ETHG_FT_So_MI_DM_MAC_DA[1…M_{DM}]	Per [ITU-T G.8021]	--
ETHG_FT_So_MI_DM_Test_ID[1…M_{DM}]	Non-negative integer (optional)	--
ETHG_FT_So_MI_DM_Length[1…M_{DM}]	Non-negative integer representing number of byte for the length of the padding TLV. Note that the total fame size of the DM PDU should be between 64 and 9216 bytes.	0
ETHG_FT_So_MI_DM_Period[1…M_{DM}]	100ms, 1s, 10s	100 ms
ETHG_FT_So_MI_DM_Pri[1…M_{DM}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHG_FT_So_MI_1DM_Enable[1…M_{1DM}]	true, false	false
ETHG_FT_So_MI_1DM_MAC_DA[1…M_{1DM}]	Per [ITU-T G.8021]	--
ETHG_FT_So_MI_1DM_Test_ID[1…M_{1DM}]	Non-negative integer (optional)	--
ETHG_FT_So_MI_1DM_Length[1…M_{1DM}]	Non-negative integer representing number of byte for the length of the padding TLV. Note that the total fame size of the DM PDU should be between 64 and 9216 bytes.	0
ETHG_FT_So_MI_1DM_Period[1…M_{1DM}]	100ms, 1s, 10s	100 ms
ETHG_FT_So_MI_1DM_Pri[1…M_{1DM}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHG_FT_So_MI_SL_Enable[1…M_{SL}]	true, false	false

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

MI signal	Value range	Default value
Provisioning		
ETHG_FT_So_MI_SL_MAC_DA[1…M_{SL}]	Per [ITU-T G.8021]	--
ETHG_FT_So_MI_SL_Test_ID[1…M_{SL}]	Non-negative integer (optional)	--
ETHG_FT_So_MI_SL_Length[1…M_{SL}]	Non-negative integer representing number of byte for the length of the padding TLV. Note that the total fame size of the DM PDU should be between 64 and 9216 bytes.	0
ETHG_FT_So_MI_SL_Period[1…M_{SL}]	10ms, 100ms, 1s, 10s	100 ms
ETHG_FT_So_MI_SL_Pri[1…M_{SL}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHG_FT_So_MI_1SL_Enable[1…M_{1SL}]	true, false	false
ETHG_FT_So_MI_1SL_MAC_DA[1…M_{1SL}]	Per [ITU-T G.8021]	--
ETHG_FT_So_MI_1SL_Test_ID[1…M_{1SL}]	Non-negative integer (optional)	--
ETHG_FT_So_MI_1SL_Length[1…M_{1SL}]	Non-negative integer representing number of byte for the length of the padding TLV. Note that the total fame size of the DM PDU should be between 64 and 9216 bytes.	0
ETHG_FT_So_MI_1SL_Period[1…M_{1SL}]	10ms, 100ms, 1s, 10s	100 ms
ETHG_FT_So_MI_1SL_Pri[1…M_{1SL}]	0, 1, 2, 3, 4, 5, 6, 7	7
ETHG_FT_Sk_MI_CC_Enable	true, false	false
ETHG_FT_Sk_MI_LMC_Enable	true, false	true
ETHG_FT_Sk_MI_1Second	–	–
ETHG_FT_Sk_MI_LM_DEGM	2-10; see Table 7-1 of [ITU-T G.806]	10
ETHG_FT_Sk_MI_LM_M	2-10	10
ETHG_FT_Sk_MI_LM_DEGTHR	0% .. 100%; see Table 7-1 of [ITU-T G.806]	30%
ETHG_FT_Sk_MI_LM_TFMIN	FFS	FFS
ETHG_FT_Sk_MI_MEL	0, 1, 2, 3, 4, 5, 6, 7	By agreement
ETHG_FT_Sk_MI_MEG_ID	See Annex A of [ITU-T G.8013]	–
ETHG_FT_Sk_MI_PeerMEP_ID[i]	List of peer MEP IDs; 0..8191 for each ID; see Figure 9.2-3 of [ITU-TG.8013]	–
ETHG_FT_Sk_MI_CC_Period	3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min	1 s
ETHG_FT_Sk_MI_CC_Pri	0..7	7
ETHG_FT_Sk_MI_GetSvdCCM	(NOTE – Use to request the saved latest CCM frame that caused a defect to be raised.)	–

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

MI signal	Value range	Default value
Provisioning		
ETHG_FT_Sk_MI_1DM_Enable[1…M_{1DM}]	true, false	false
ETHG_FT_Sk_MI_1DM_MAC_SA[1…M_{1DM}]	Per [ITU-T G.8021]	–
ETHG_FT_Sk_MI_1DM_Pri [1...M_{1DM}]	0..7	7
ETHG_FT_Sk_MI_1DM_Test_ID[1…M_{1DM}]	Non-negative integer (optional)	--
ETHG_FT_Sk_MI_1SL_Enable[1…M_{1SL}]	true, false	false
ETHG_FT_Sk_MI_1SL_MAC_SA[1…M_{1SL}]	Per [ITU-T G.8021]	–
ETHG_FT_Sk_MI_1SL_Test_ID[1…M_{1SL}]	Non-negative integer (optional)	--
ETHG_FT_Sk_MI_MEP_MAC	Per [ITU-T G.8021]	--
Reporting		
ETHG_FT_Sk_MI_SvdCCM	Last received CCM frame that caused defect	–
ETHG_FT_Sk_MI_BW_Report(SA, PortID, NominalBW, CurrentBW)	Per configured at peer source	--
Provisioning		
ETH-LAG_FT_Sk_MI_SSF_Reported	true, false	true

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 ET 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 ET NE.

For the adaptation functions supported by an ET.NE, the ET.NE EMF shall support the following management functions:

– Provisioning the adaptation management information
– Retrieving the adaptation management information
– Notifying the changes of the adaptation management information

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_MEP_MAC	6 byte Unicast MAC address	–
ETHx/ETH_A_So_MI_Client_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_Admin_State	LCK, Normal	Normal
ETHx/ETH_A_So_MI_MEL	0..7	–
ETHx/ETH_A_So_MI_APS_Pri	0..7	7
ETHx/ETH_A_So_MI_CSF_Period	1 s, 1 min	1 s
ETHx/ETH_A_So_MI_CSF_Pri	0..7	7
ETHx/ETH_A_So_MI_CSF_Enable	true, false	true
ETHx/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
ETHx/ETH_A_So_MI_CSFdciEnable	true, false	true
ETHx/ETH_A_Sk **Provisioning**		
ETHx/ETH_A_Sk_MI_MEP_MAC	6 byte Unicast MAC address	–
ETHx/ETH_A_Sk_MI_Client_MEL	0..7	–
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_Admin_State	LCK, Normal	Normal
ETHx/ETH_A_Sk_MI_AIS_Period	1 s, 1 min	1 s
ETHx/ETH_A_Sk_MI_AIS_Pri	0..7	7
ETHx/ETH_A_Sk_MI_MEL	0..7	7
ETHx/ETH_A_Sk_MI_CSF_Reported	true, false	true
ETHx/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	true
ETHx/ETH-m_A_So **Provisioning**		
ETHx/ETH-m_A_So_MI_MEP_MAC	6 byte Unicast MAC address	–
ETHx/ETH-m_A_So_MI_Client_MEL[1…M]	0..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_Admin_State	LCK, Normal	Normal
ETHx/ETH-m_A_So_MI_VLAN_Config[1…M]	(Note)	(Note)
ETHx/ETH-m_A_So_MI_Etype	2 byte integer $\geq$ 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_MI_MEL	0..7	7

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ETHx/ETH-m_A_So **Provisioning**		
ETHx/ETH-m_A_So_MI_CSF_Period	1 s, 1 min	1 s
ETHx/ETH-m_A_So_MI_CSF_Pri	0..7	7
ETHx/ETH-m_A_So_MI_CSF_Enable	true, false	false
ETHx/ETH-m_A_So_MI_CSFrdifdiEnable	true, false	false
ETHx/ETH-m_A_So_MI_CSFdciEnable	true, false	true
ETHx/ETH-m_A_Sk **Provisioning**		
ETHx/ETH-m_A_Sk_MI_Admin_State	LCK, Normal	Normal
ETHx/ETH-m_A_Sk_MI_MEP_MAC	6 byte Unicast MAC address	–
ETHx/ETH-m_A_Sk_MI_Client_MEL[1…M]	0..7	–
ETHx/ETH-m_A_Sk_MI_LCK_Period[1…M]	1 s, 1 min	1 s
ETHx/ETH-m_A_Sk_MI_LCK_Pri[1…M]	0..7	7
ETHx/ETH-m_A_Sk_MI_AIS_Period[1…M]	1 s, 1 min	1 s
ETHx/ETH-m_A_Sk_MI_AIS_Pri[1…M]	0..7	7
ETHx/ETH-m_A_Sk_MI_VLAN_Config[1…M]	(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_PCP_Config	8P0D, 7P1D, 6P2D, 5P3D, 4P4D, DEI	8P0D
ETHx/ETH-m_A_Sk_MI_Etype	2 byte integer ≥ 0x0600	S-Tag: 0x88a8 C-Tag: 0x8100
ETHx/ETH-m_A_Sk_MI_MEL	0..7	–
ETHx/ETH-m_A_Sk_MI_CSF_Reported	true, false	true
ETHx/ETH-m_A_Sk_MI_CSFrdifdiEnable	true, false	true
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_MEP_MAC	6 byte Unicast MAC address	–
ETHG/ETH_A_So_MI_Client_MEL[1…M]	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_Admin_State	LCK, Normal	Normal
ETHG/ETH_A_So_MI_MEL	0..7	–
ETHG/ETH_A_So_MI_APS_Pri	0..7	7
ETHG/ETH_A_So_MI_CSF_Period	1 s, 1 min	1 s

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ETHG/ETH_A_So **Provisioning**		
ETHG/ETH_A_So_MI_CSF_Pri	0..7	7
ETHG/ETH_A_So_MI_CSF_Enable	true, false	false
ETHG/ETH_A_So_MI_CSFrdifdiEnable	true, false	false
ETHG/ETH_A_So_MI_CSFdciEnable	true, false	true
ETHG/ETH_A_Sk **Provisioning**		
ETHG/ETH_A_Sk_MI_MEP_MAC	6 byte Unicast MAC address	–
ETHG/ETH_A_Sk_MI_Client_MEL[1…M]	0..7	–
ETHG/ETH_A_Sk_MI_LCK_Period[1…M]	1 s, 1 min	1 s
ETHG/ETH_A_Sk_MI_LCK_Pri[1…M]	0..7	7
ETHG/ETH_A_Sk_MI_Admin_State	LCK, Normal	Normal
ETHG/ETH_A_Sk_MI_AIS_Period[1…M]	1 s, 1min	1 s
ETHG/ETH_A_Sk_MI_AIS_Pri[1…M]	0..7	7
ETHG/ETH_A_Sk_MI_MEL	0..7	–
ETHG/ETH_A_Sk_MI_CSF_Reported	true, false	true
ETHG/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	true
ETHx/ETHG_A_So **Provisioning**		
ETHx/ETHG_A_So_MI_MEP_MAC	6 byte Unicast MAC address	–
ETHx/ETHG_A_So_MI_Client_MEL[1…M]	0..7	–
ETHx/ETHG_A_So_MI_LCK_Period[1…M] (for each of the 1 through M VLANs)	1 s, 1 min	1 s
ETHx/ETHG_A_So_MI_LCK_Pri[1…M]	0..7	7
ETHx/ETHG_A_So_MI_Admin_State	LCK, Normal	Normal
ETHx/ETHG_A_So_MI_VLAN_Config[1…M]	(Note)	(Note)
ETHx/ETHG_A_So_MI_Etype	2 byte integer ≥ 0x0600	S-Tag: 0x88a8 C-Tag: 0x8100
ETHx/ETHG_A_So_PCP_Config	8P0D, 7P1D, 6P2D, 5P3D, 4P4D, DEI	8P0D
ETHx/ETHG_A_So_MI_MEL	0..7	7
ETHx/ETHG_A_Sk **Provisioning**		
ETHx/ETHG_A_Sk_MI_Admin_State	LCK, Normal	Normal
ETHx/ETHG_A_Sk_MI_MEP_MAC	6 byte Unicast MAC address	–
ETHx/ETHG_A_Sk_MI_Client_MEL[1…M]	0..7	–
ETHx/ETHG_A_Sk_MI_LCK_Period[1…M]	1 s, 1 min	1 s
ETHx/ETHG_A_Sk_MI_LCK_Pri[1…M]	0..7	7
ETHx/ETHG_A_Sk_MI_AIS_Period[1…M]	1 s, 1 min	1 s
ETHx/ETHG_A_Sk_MI_AIS_Pri[1…M]	0..7	7

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ETHx/ETHG_A_Sk **Provisioning**		
ETHx/ETHG_A_Sk_MI_VLAN_Config[1…M]	(Note)	(Note)
ETHx/ETHG_A_Sk_MI_P_Regenerate	(Note)	(Note)
ETHx/ETHG_A_Sk_MI_PVID	(Note)	(Note)
ETHx/ETHG_A_Sk_MI_PCP_Config	8P0D, 7P1D, 6P2D, 5P3D, 4P4D, DEI	8P0D
ETHx/ETHG_A_Sk_MI_Etype	2 byte integer ≥ 0x0600	S-Tag: 0x88a8 C-Tag: 0x8100
ETHx/ETHG_A_Sk_MI_MEL	0..7	–
ETHx/ETHG_A_Sk_MI_Frametype_Config	AllowTaggedOnly; AllowUntaggedOnly; AllowAll	AllowUntagged Only
ETHx/ETHG_A_Sk_MI_Filter_Config	(Note)	(Note)
ETHx/MCC_A_So **Provisioning**		
ETHx/MCC_A_So_MI_MEL	0..7	–
ETHx/MCC_A_So_MI_MEP_MAC	6 byte Unicast MAC address	–
ETHx/MCC_A_So_MI_MCC_Pri	0..7	7
ETHx/MCC_A_So_MI_MEP_ID	0..8191; see Figure 9.2-3 of [ITU-T G.8013]	–
ETHx/MCC_A_So_MI_EDM_Enable	true, false	false
ETHx/MCC_A_So_MI_EDM_Period	For further study	For further study
ETHx/MCC_A_So_MI_EDM_Duration	Integer represents number of seconds	=
ETHx/MCC_A_Sk **Provisioning**		
ETHx/MCC_A_Sk_MI_MEP_MAC	6 byte Unicast MAC address	–
ETHx/MCC_A_Sk_MI_MEL	0..7	–
ETHx/MCC_A_Sk **Reporting**		
ETHx/MCC_A_Sk_MI_EDM_received (MEP_ID, Duration)	Per provisioning at ETHx/MCC_A_So	–
ETHDi/ETH_A_So **Provisioning**		
ETHDi/ETH_A_So_MI_ MEL	0..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 **Provisioning**		
ETHDi/ETH_A_Sk_MI_ MEL	0..7	–

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	**Value range**	**Default value**
ETHn-Np/ETH-LAG-Na_A_So **Provisioning**		
ETHn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_AP_List	(Note)	(Note)
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ ActorAdmin_State	See [IEEE 802.3] clause 30.7.2.1.20	–
ETHn-Np/ETH-LAG-Na_A_So **Reporting**		
ETHn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_ActorSystemID	See [IEEE 802.3] clause 30.7.1.1.4	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_ActorSystemPriority	See [IEEE 802.3] clause 30.7.1.1.5	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_ActorOperKey	See [IEEE 802.3] clause 30.7.1.1.8	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_PartnerSystemID	See [IEEE 802.3] clause 30.7.1.1.10	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_PartnerSystemPriority	See [IEEE 802.3] clause 30.7.1.1.11	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_PartnerOperKey	See [IEEE 802.3] clause 30.7.1.1.12	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_DataRate	See [IEEE 802.3] clause 30.7.1.1.16	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_CollectorMaxDelay	See [IEEE 802.3] clause 30.7.1.1.32	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ActorOperKey	See [IEEE 802.3] clause 30.7.2.1.5	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperSystemPriority	See [IEEE 802.3] clause 30.7.2.1.7	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperSystemID	See [IEEE 802.3] clause 30.7.2.1.9	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperKey	See [IEEE 802.3] clause 30.7.2.1.11	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ActorPort	See [IEEE 802.3] clause 30.7.2.1.14	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ActorPortPriority	See [IEEE 802.3] clause 30.7.2.1.15	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperPort	See [IEEE 802.3] clause 30.7.2.1.17	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperPortPriority	See [IEEE 802.3] clause 30.7.2.1.19	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ActorOperState	See [IEEE 802.3] clause 30.7.2.1.21	–
ETHn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_PartnerOperState	See [IEEE 802.3] clause 30.7.2.1.23	–
ETHn-Np/ETH-LAG-Na_A_Sk **Provisioning**		
ETHn-Np/ETH-LAG-Na_A_Sk_MI_PLLThr[1..Na]	(Note)	(Note)

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ETH-LAG/ETH_A_So **Provisioning**		
ETH-LAG/ETH_A_Sk **Provisioning**		
ETH-LAG/ETH_A_Sk_MI_FilterConfig	(Note)	(Note)
Sn/ETH_A_So **Provisioning**		
Sn/ETH_A_So_MI_Active	true, false	true
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_Active	true, false	true
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
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_MAC_Length	1518, 1522, 2000	2000
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

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
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_MAC_Length	1518, 1522, 2000	2000
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_MAC_Length	1518, 1522, 2000	2000
Sm-X-L/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	true
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

Table 8-3 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
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_MAC_Length	1518, 1522, 2000	2000
Pq/ETH_A_Sk_MI_CSFrdifdiEnable	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_MAC_Length	1518, 1522, 2000	2000
Pq-X-L/ETH_A_Sk_MI_CSFrdifdiEnable	true, false	false
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_CSFEnable	true, false	true
ODUkP/ETH_A_So_MI_CSFrdifdiEnable	true, false	true
ODUkP/ETH_A_Sk **Provisioning**		
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	–
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 function.

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

For the connection functions supported by an ET.NE, the ET.NE EMF shall support the following management functions:

– Provisioning the connection management information
– Retrieving the connection management information
– Notifying the changes of the connection management information

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 **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_MI_PS_BridgeType	0 (Selector bridge), 1(Broadcast bridge)	0
ETH_C_MI_PS_SD_Protection	disabled, enabled	disabled

Table 8-4 – Provisioning and reporting for connection functions

MI signal	Value range	Default value
ETH_C **Reporting per SNC/S protection process**		
ETH_C_MI_PS_RequestState	"LO", "SF-P", "FS", "SF", "SD", "MS", "WTR", "EXER", "RR", "DNR", "NR"	–
ETH_C_MI_PS_RequestedSignal	"Null", "Normal"	–
ETH_C_MI_PS_BridgedSignal	"Null", "Normal"	–
ETH_C **Provisioning per Ring protection process**		
ETH_C_MI_RAPS_PortIds[0…1]	(Note)	(Note)
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)
ETH_C_MI_RAPS_HoTime	(Note)	(Note)
ETH_C_MI_RAPS_WTR	(Note)	(Note)
ETH_C_MI_RAPS_GuardTime	(Note)	(Note)
ETH_C_MI_RAPS_ExtCMD	(Note)	(Note)
ETH_C_MI_RAPS_RingID	1to239 (0x01toEF)	1
ETH_C **Reporting per Ring protection process**		
ETH_C_MI_RAPS_NodeState	"-", "Idle", "Protection", "Manual switch", "Forced switch", "Pending"	–
ETH_C_MI_RAPS_PortState[0…1]	"Blocked", "Unblocked"	–
NOTE – According to [ITU-T G.8021].		

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 ET NE.

For the diagnostic functions supported by an ET.NE, the ET.NE EMF shall support the following management functions:

– Provisioning 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

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_LM_Start(DA,P,Period)	For Period: 100 ms, 1 s, 10 s (Also see Notes 1 and 2 for DA and P)	For Period: 100 ms
ETHDe_FT_So_MI_LM_Intermediate_Request	–	–
ETHDe_FT_So_MI_LM_Terminate	–	–
ETHDe_FT_So_MI_LB_Discover(P)	(Note 2)	–
ETHDe_FT_So_MI_LB_Series(DA,DE,P,N,Length,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, Test_ID,Length,Period)	For Period: 100 ms, 1 s, 10 s (Also see Notes 1 and 2 for DA and P)	For Period: 100 ms
ETHDe_FT_So_MI_DM_Intermediate_Request	–	–
ETHDe_FT_So_MI_DM_Terminate	–	–
ETHDe_FT_So_MI_1DM_Start(DA,P, Test_ID,Length,Period)	For Period: 100 ms, 1 s, 10 s (Also see Notes 1 and 2 for DA and P)	For Period: 100 ms
ETHDe_FT_So_MI_1DM_Terminate	–	–
ETHDe_FT_So_MI_TST(DA,DE,P,Pattern, Length, Period)	(Notes 1 and 2)	–
ETHDe_FT_So_MI_TST_Terminate	–	–
ETHDe_FT_So_MI_LT(TA,TTL,P)	(Note 1)	–
ETHDe_FT_So_MI_MEP_MAC	6 byte MAC unicast address	–
ETHDe_FT_So_MI_MEL	0..7	–
ETHDe_FT_So_MI_MEP_ID	0..8191; see Figure 9.2-3 of [ITU-T G.8013]	–
ETHDe_FT_So_MI_SL_Start(DA,P, Test_ID,Length,Period)	For Period: 10 ms, 100 ms, 1 s, 10 s (Also see Notes 1 and 2 for DA and P)	For Period: 100 ms
ETHDe_FT_So_MI_SL_Intermediate_Request	–	–
ETHDe_FT_So_MI_SL_Terminate	–	–

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_1SL_Start(DA,P,Test_ID,Length,Period)	For Period: 10 ms, 100 ms, 1 s, 10 s (Also see Notes 1 and 2 for DA and P)	For Period: 100 ms
ETHDe_FT_So_MI_1SL_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_DM_Result(count,B_FD[],F_FD[],N_FD[])		
ETHDe_FT_So_MI_LB_Series_Result(REC,ERR,OO)	(Note 1)	–
ETHDe_FT_So_MI_LB_Test_Result(Sent, REC, CRC, BER, OO)	(Note 1)	–
ETHDe_FT_So_MI_TST_Result(Sent)	(Note 1)	–
ETHDe_FT_So_MI_LT_Results(Results)	(Note 1)	–
ETHDe_FT_So_MI_SL_Result(N_TF,N_LF,F_TF,F_LF)	(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_1DM_Start(SA, P,Test_ID)	6 byte Unicast MAC address, Non-negative integer	–
ETHDe_FT_Sk_MI_1DM_Intermediate_Request	--	--
ETHDe_FT_Sk_MI_1DM_Terminate	–	–
ETHDe_FT_Sk_MI_TST_Start(SA, pattern)	(Note 1)	–
ETHDe_FT_Sk_MI_TST_Terminate	–	–
ETHDe_FT_Sk_MI_1SL_Start(SA,MEP ID, Test ID)	(Notes 1 and 2)	–
ETHDe_FT_Sk_MI_1SL_Intermediate_Request	--	--
ETHDe_FT_Sk_MI_1SL_Terminate	–	–
Reporting of diagnostic flow termination sink for MEP		
ETHDe_FT_Sk_MI_1DM_Result(count,N_FD[])	(Note 1)	–
ETHDe_FT_Sk_MI_1SL_Result(N_TF,N_LF)	(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_MIP_MAC	6 byte MAC unicast address	–

Table 8-5 – Provisioning and reporting for diagnostic functions

MI signal	Value range	Default value
Provisioning of diagnostic flow termination sink for MIP		
ETHDi_FT_Sk_MI_MEL	0..7	–
ETHDi_FT_Sk_MI_MIP_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.		

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 ET NE.

For the traffic conditioning and shaping functions supported by an ET.NE, the ET.NE EMF shall support the following management functions:

– Provisioning 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

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 **Provisioning**		
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].		

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.

For the XXX_Reported functions supported by an ET.NE, the ET.NE EMF shall support the following management functions:

– Provisioning the trail termination management information

– Retrieving the trail termination management information

Table 8-7 – Notifying the changes of the trail termination management information – 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 ET EMF comprise the local real-time clock (RTC) function and the performance monitoring clock (PMC) function. The message communication function within the ET 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 fault, configuration, account, performance and security management (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 ET NEF functional requirements for these applications are specified in the following clauses.

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 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 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 (RTC) 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 (PMC) 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. ET 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 ET 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 4 different OAM PDU generation mechanisms: single instance, repetitive instance, single series and repetitive series. To describe these mechanisms, the following terms are used:
   – OAM PDU generation type:

     Generation pattern of the on-demand OAM message

     Valid types are: single instance, repetitive instance, single series and repetitive series.

– Message period (x)

  Frequency of the OAM message generation within a series.

  Note that a value of zero (i.e., x = 0) means that only one OAM message per measurement interval is generated.

– Measurement interval (y)

  Defines discrete non overlapping periods of time during which measurements are performed (i.e., OAM messages are generated) and reports are gathered at the end of the measurement intervals.

  Note that a value of zero means a degenerated measurement interval with a single OAM message and the report is sent as immediately as possible.

– Repetition period (z)

  Defines the time between the start of two measurement intervals. This IS applicable for the repetitive instance type and MAY be applicable for the repetitive series type.

  Note that a value of zero means not applicable (NA), which is for the cases of single instance, single series, or repetitive series without extra gap in between the measurement intervals (i.e., also as known as continuous series).

– Start time

  Defines the start of the on-demand session

– Stop time

  Defines the stop of the on-demand session

– Session Duration

  Stop time – Start time.

Note that session duration is not a configuration parameter. That is, it is not needed in the configuration.

The four on-demand measurements are illustrated in Figure 10-1. In each mechanism, the mandatory parameters (i.e., the required minimum set of parameters) are in red font. The optional parameters are in black font. Optional parameters are not needed but may be used for validation purposes.

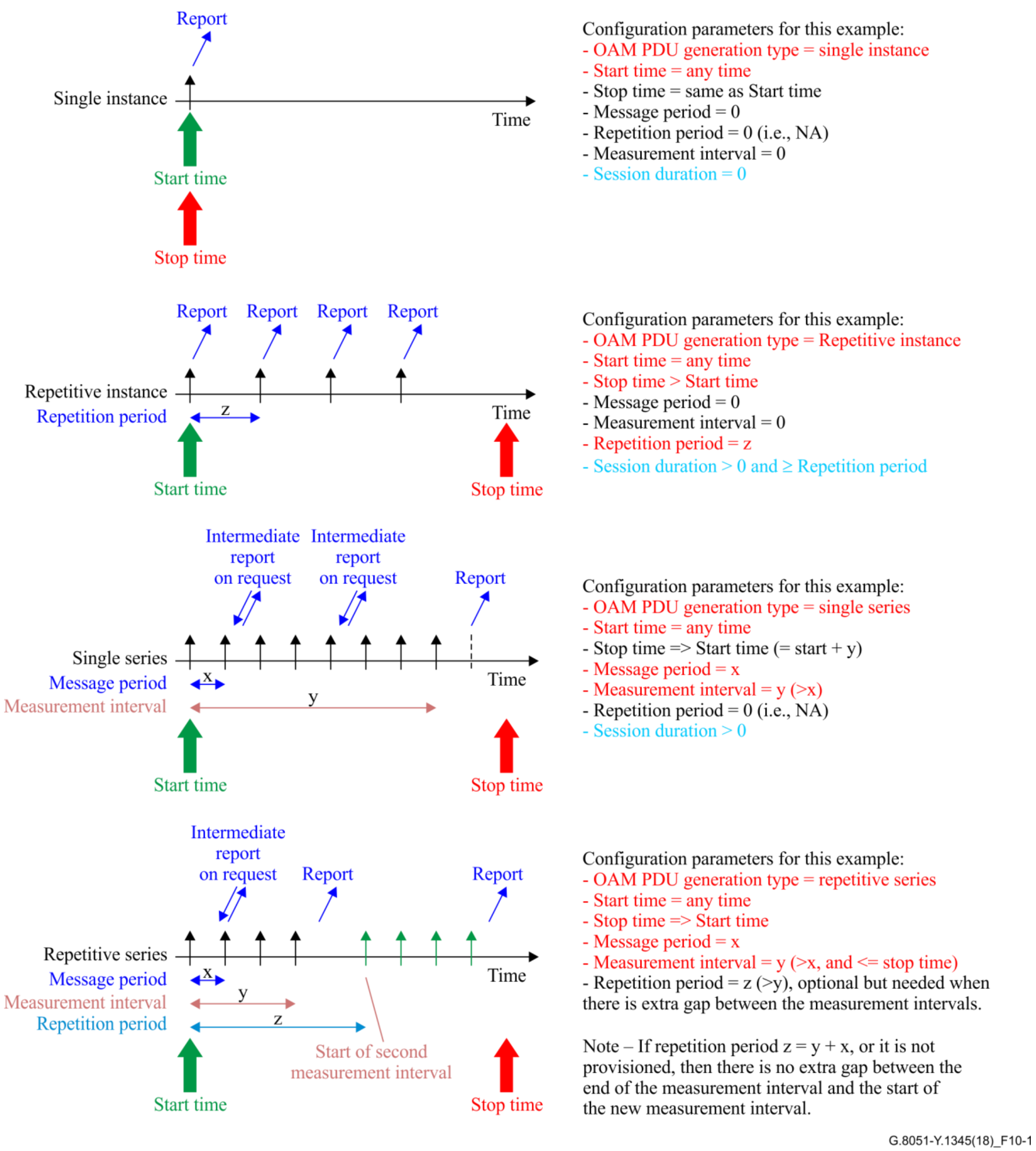

Figure 10-1 – On-demand OAM PDU generation mechanisms

Note that in the repetitive series case, if the repetition period z = y + x, or the value is not provisioned, then there is no extra gap between the end of the measurement interval and the start of the new measurement interval. This pattern is also known as the continuous series cases. The repetition period (z) is needed if there is extra gap between the measurement intervals.

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) Measurement interval; default = 0

e) Repetition period; default = 0

8) Parallel measurement jobs, one per priority, can be established

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 managed element (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 on-demand PM measurement job of "single series" and "repetitive series" types

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) On-demand loss measurement can be measured by directly counting the data traffic (e.g., using the [ITU-T G.8013] defined loss measurement message (LMM)/loss measurement reply (LMR)) or can be inferred by counting the synthetic traffic (e.g., using the [ITU-T G.8013] defined SLM/SLR or 1SL). If on-demand loss measurement is supported, for each measurement interval, the Ethernet NE should:

– Receive from the transport plane the measurements (i.e., N_TF, N_LF, F_TF, F_LF) at the end of each measurement interval.

  Note that according to the definition of near-end and far-end frame loss in clause 8.1 of [ITU-T G.8013], for a MEP, N_TF and N_LF refer to the transmitted and lost ingress frames while F_TF and F_LF refer to the transmitted and lost egress frames.

  Note that 1SL can provide only near-end measurement (i.e., N_TF, N_LF).

– Store the measurements (TN_TF, TN_LF, TF_TF, TF_LF) and calculate the frame loss ratios (FLRs) (TN_FLR=TN_LF/TN_TF, TF_FLR=TF_LF/TF_TF). The measurements and FLRs shall be reported to the management system.

– At the instruction of the management system, the NE shall be able to request from the transport plane the intermediate (i.e., before the end of the measurement interval) measurements, calculate the intermediate FLRs and report the intermediate results (TN_TF, TN_LF, TN_FLR, TF_TF, TF_LF, TF_FLR) 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) Proactive loss measurement can be measured by directly counting the data traffic (e.g., using the [ITU-T G.8013] defined CCM or LMM/LMR) or can be inferred by counting the synthetic traffic (e.g., using the [ITU-T G.8013] defined SLM/SLR or 1SL). If proactive loss measurement is supported, for each loss measurement session the Ethernet NE should:

– Receive from the transport plane the measurements (i.e., pN_TF, pN_LF, pF_TF, pF_LF) for each OAM period.

Note that 1SL can support only near-end measurement (i.e., N_TF, N_LF).

- Calculate the FLRs (N_FLR=pN_LF/pN_TF, F_FLR=pF-LF/pF_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.
- The FLR measurements of a monitored entity measured during an SES shall be included in the computation of its FLR statistics, unless the SES is part of the unavailable time period.

  Note: This is in line with the definition made in Note 1 of section 1 in [ITU-T Y.1563].
- 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 measurement interval, the Ethernet NE should:

- Receive from the transport plane the array of near-end measurements (count, N_FD[]) at the end of each measurement interval.
- Store the measurements, compute the corresponding array of N_FDV[] and report the near-end measurements (count, N_FD[], N_FDV[]) to the management system.
- At the instruction of the management system, the NE shall be able to request from the transport plane the intermediate measurements, calculate the intermediate N_FDV[] and report the intermediate results (count, N_FD[], N_FDV[]) 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 near-end measurements (pN_FD, pN_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].

  NOTE – Version 1 of the 1DM PDU format has been defined in the 2011 revision of [ITU-T G.8013] to support both proactive and on-demand 1-way DM applications, in which proactive and on-demand 1DM applications are distinguished by using the Type bit of the Flags field of the 1DM PDU. Proactive 1DM application is configured at the ETHx Flow Termination functions (ETHx_FT) with the Type bit is set to 1, while the on-demand 1DM application is configured at the ETH Diagnostic Flow Termination Function (ETHDe_FT) with the Type bit being set to 0. See clause 8.1.11 of [ITU-T G.8021] for details.

20) If on-demand 2-way DM (i.e., delay measurement message (DMM)/delay measurement reply (DMR)) is supported, for each on-demand 2-way DM measurement interval, the Ethernet NE should:

- Receive from the transport plane the array of near-end, far-end and bidirectional measurements (count, N_FD[], F_FD[], B_FD[]) at the end of each measurement interval.

– Store the measurements, compute the corresponding array of FDV[] and report the near-end, far-end and bidirectional (2-way) measurements (count, N_FD[], F_FD[], B_FD[]; N_FDV[], F_FDV[], B_FDV[]) to the management system.

– At the instruction of the management system, the NE shall be able to request from the transport plane the intermediate measurements, calculate the intermediate FDV[] and report the intermediate results (count, N_FD[], F_FD[], B_FD[]; N_FDV[], F_FDV[], B_FDV[]) 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 near-end, far-end and bidirectional 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].

NOTE – Version 1 of the 1DM PDU format has been defined in the 2011 revision of [ITU-T G.8013] to support both proactive and on-demand 1-way DM applications, in which proactive and on-demand 1DM applications are distinguished by using the Type bit of the Flags field of the 1DM PDU. Proactive 1DM application is configured at the ETHx Flow Termination functions (ETHx_FT) with the Type bit is set to 1, while the on-demand 1DM application is configured at the ETH Diagnostic Flow Termination Function (ETHDe_FT) with the Type bit being set to 0. See clause 8.1.11 of [ITU-T G.8021] for details.

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).

For illustrative purposes, Figure 10-2 through Figure 10-5 below illustrate the derivation of the loss measurement from the counter values provided by the single-ended and dual-ended mechanisms.

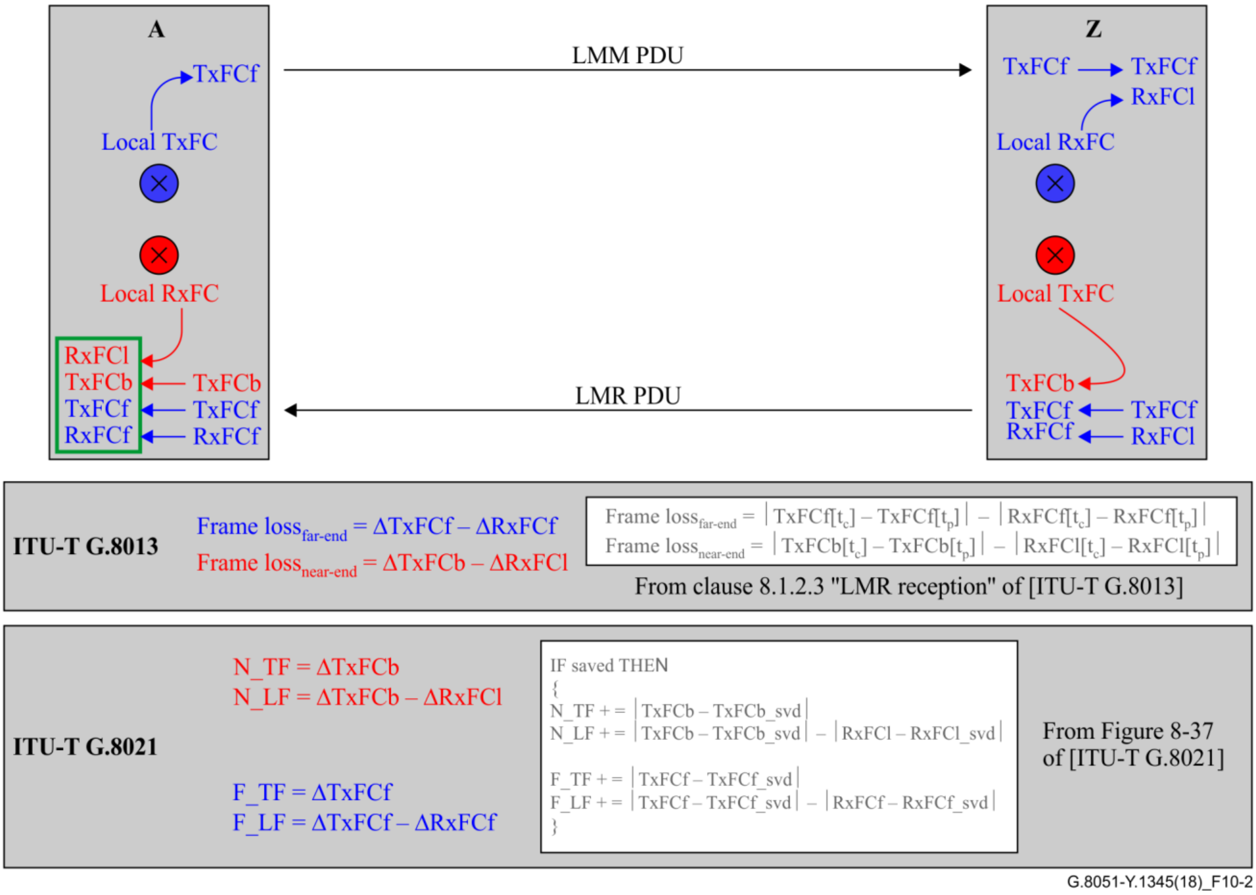

Figure 10-2 – Single-ended loss measurement using LMM/LMR

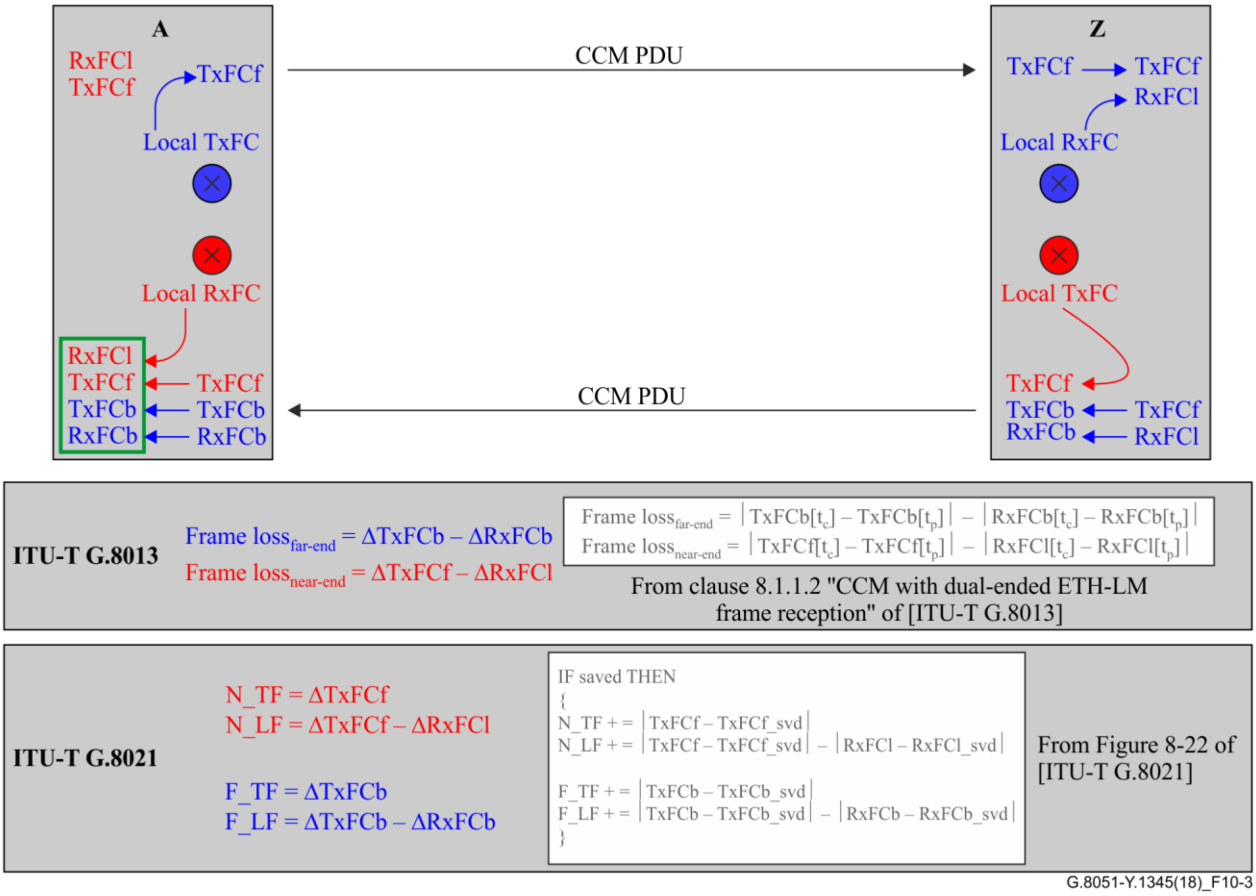

Figure 10-3 – Dual-ended loss measurement using CCM

(Note that for loss measurement, CCM is proactive only)

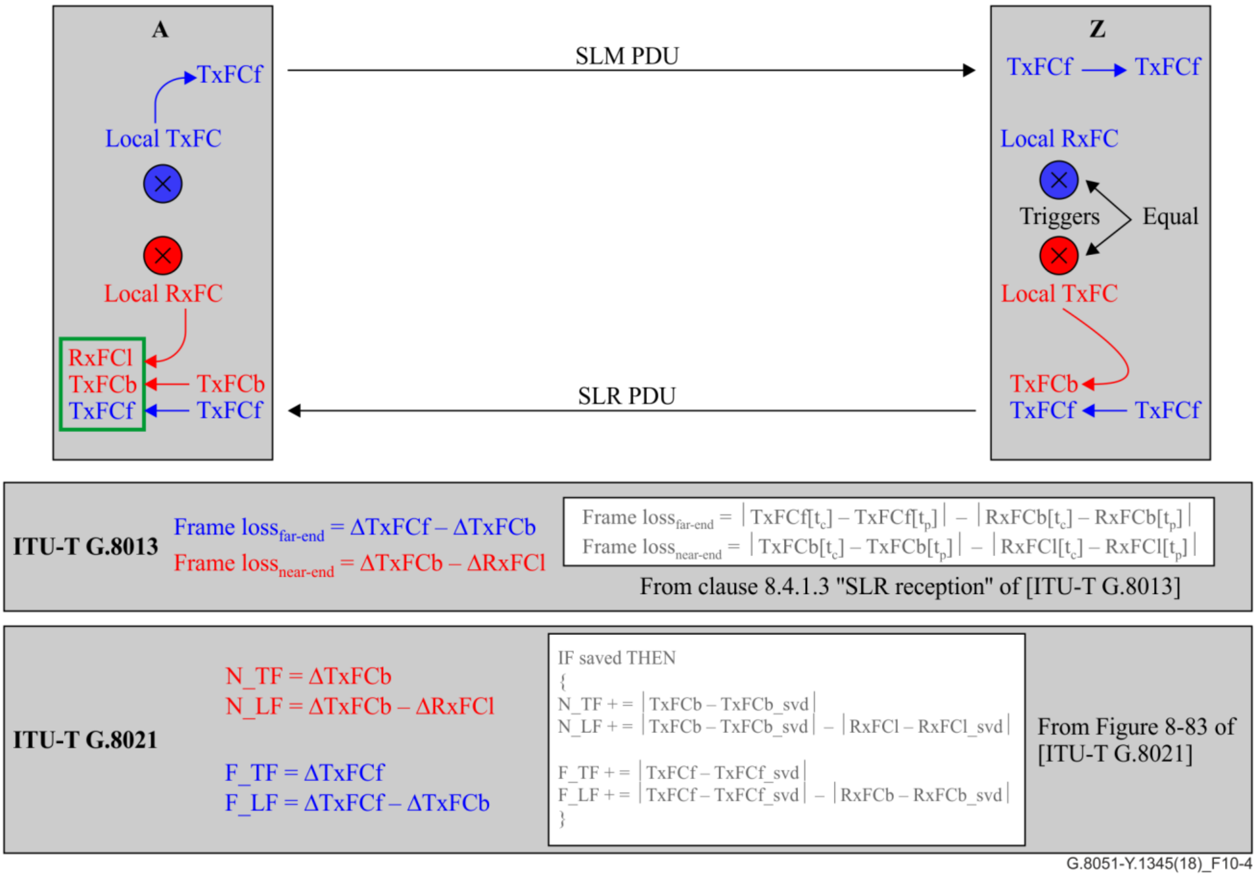

Figure 10-4 – Single-ended loss measurement using SLM/SLR

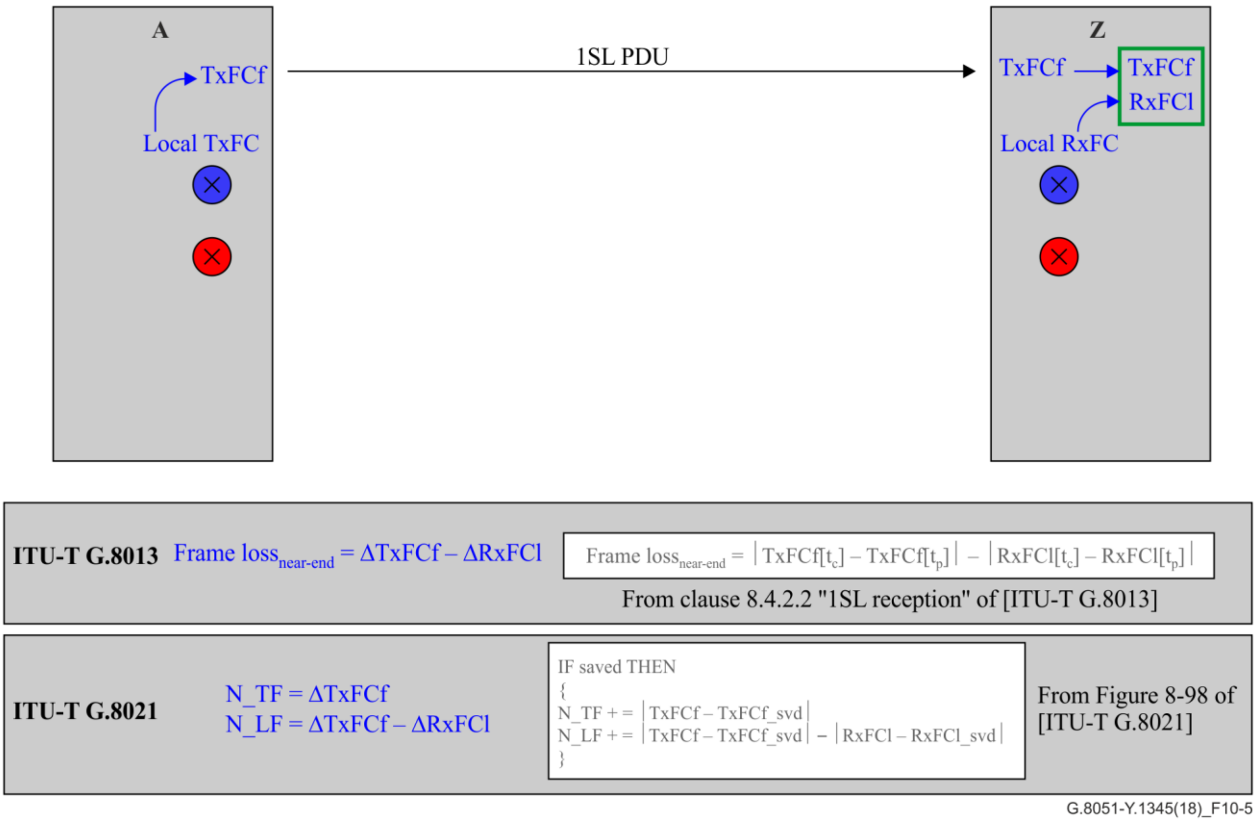

Figure 10-5 – Dual-ended loss measurement using 1SL

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

Table 10-1 – PM management information

PM management information	ITU-T G.8021 function
ETH_FT_Sk_MI_pN_LF ETH_FT_Sk_MI_pN_TF ETH_FT_Sk_MI_pF_LF ETH_FT_Sk_MI_pF_TF ETH_FT_Sk_MI_pF_DS ETH_FT_Sk_MI_pN_DS ETH_FT_Sk_MI_pB_FD ETH_FT_Sk_MI_pB_FDV ETH_FT_Sk_MI_pF_FD ETH_FT_Sk_MI_pF_FDV ETH_FT_Sk_MI_pN_FD ETH_FT_Sk_MI_pN_FDV	ETHx_FT_Sk
ETHx_FT_Sk_MI_pN_TF ETHx_FT_Sk_MI_pN_LF ETHx_FT_Sk_MI_pF_TF ETHx_FT_Sk_MI_pF_LF	ETHDe_FT_So
ETHG_FT_Sk_MI_pN_TF ETHG_FT_Sk_MI_pN_LF ETHG_FT_Sk_MI_pF_TF ETHG_FT_Sk_MI_pF_LF ETHG_FT_Sk_MI_pF_DS ETHG_FT_Sk_MI_pN_DS ETHG_FT_Sk_MI_pB_FD ETHG_FT_Sk_MI_pB_FDV ETHG_FT_Sk_MI_pF_FD ETHG_FT_Sk_MI_pF_FDV ETHG_FT_Sk_MI_pN_FD ETHG_FT_Sk_MI_pN_FDV	ETHG_FT_Sk
ETHn-Np/ETH-LAG-Na_A_So_MI_pAggOctetsTxOK[1..Na] ETHn-Np/ETH-LAG-Na_A_So_MI_pAggFramesTxOK[1..Na]	ETHn-Np/ETH-LAG-Na_A_So
ETHn-Np/ETH-LAG-Na_A_Sk_MI_pAggOctetsRxOK[1..Na] ETHn-Np/ETH-LAG-Na_A_Sk_MI_pAggFramesRxOK[1..Na] ETHn-Np/ETH-LAG-Na_A_Sk_MI_pFramesReceivedOK[1..Np] ETHn-Np/ETH-LAG-Na_A_Sk_MI_pOctetsReceivedOK[1..Np] ETHn-Np/ETH-LAG-Na_A_Sk_MI_pFCSErrors[1..Np]	ETHn-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
ODU2P/ETHPP-OS_A_Sk_MI_pFCSErrors ODU2P/ETHPP-OS_A_Sk_MI_pCRC16Errors	ODU2P/ETHPP-OS_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.

Appendix I

MI signals/parameters for PM tools in ITU-T G.8021

(This appendix does not form an integral part of this Recommendation.)

Tables I.1 and I.2 summarize the MI signals defined in [ITU-T G.8021] for the proactive and on-demand performance monitoring tools.

Table I.1 – MI signals for proactive PM (ETHx_FT)

OAM Type	dir	MI signals								
		Enable	MAC		ID		Length	Period	Pri	Others
			DA	SA	Test	MEP				
CC	So	✓LMC (*1)	(*6)				(*5)	✓	✓	
	Sk	✓LMC (*1)						✓ (*7)	✓ (*7)	GetSvdCCM, SvtCCM
LM	So	✓LML (*1)	✓		(*3)		(*5)	✓	✓	
	Sk									DEGM, M, DEGTHER, TFMIN
1SL	So	✓	✓		✓		✓	✓	✓	
	Sk	✓		✓ (*2)	✓	(*4)				
SL	So	✓	✓		✓		✓	✓	✓	
	Sk									
1DM	So	✓	✓		✓		✓	✓	✓	
	Sk	✓		✓ (*2)	✓					
DM	So	✓	✓		✓		✓	✓	✓	
	Sk									

Table I.1 – MI signals for proactive PM (ETHx_FT)

NOTES:

*1 MI_{LMC,LML}_Enable are used to activate the loss measurement process by proactive CCM/ LMx, respectively. Since the calculation of CCM is performed at sink side, the MI_LMC_Enable signal is required at sink side (as well as source side, where other protocols have). Note that the latest [ITU-T G.8021] has removed the functionality of MI signals for the allocation of the local counter resources.

*2 MI_MAC_SA for 1SL/1DM is used to verify that the received PDU is properly sent from the expected peer node.

*3 MI_Test_ID is not specified in LM until now.

*4 MI_ MEP_ID was removed during [ITU-T G.8021] v4 AAP because MEP_ID carried in PDU is not evaluated at sink side

*5 MI_Length is not applicable for CC/LM because the length of both PDUs is always fixed.

*6 MI_MAC_DA is not explicitly specified for CCM protocol because it uses the multicast class 1 address as the default MAC DA.

*7 MI_Period/Priority are configured for sink side of CCM process (as well as the source side) to detect the mismatch defects (dUNP and dUNPr). Note that other protocols do not need to specify neither of MI signals at sink side.

Table I.2 – MI signals/parameters for on-demand PM (ETHDe_FT)

OAM Type	dir	MI_ Enable	MI_Start ()							MIs for retrieval		
			MAC		ID		Length	Period	Pri	MI_ Termi-nate	MI_Intermediate_Request	MI_ Result()
			DA	SA	Test	MEP						
LM	So	(*1)	✓		(*3)		(*5)	✓	✓	✓	✓	✓ (N_TF, N_LF, F_TF, F_LF)
	Sk	(*1)										
1SL	So		✓		✓		✓	✓	✓	✓		
	Sk			✓ (*2)	✓	(*4)				✓	✓	✓ (N_TF, N_LF)
SL	So		✓		✓		✓	✓	✓	✓	✓	✓ (N_TF, N_LF, F_TF, F_LF)
	Sk											
1DM	So		✓		✓		✓	✓	✓	✓		
	Sk			✓ (*2)	✓					✓	✓	✓ (count, N_FD[])

Table I.2 – MI signals/parameters for on-demand PM (ETHDe_FT)

OAM Type	dir	MI_ Enable	MI_Start ()							MIs for retrieval		
			MAC		ID		Length	Period	Pri	MI_ Terminate	MI_Intermediate_Request	MI_ Result()
			DA	SA	Test	MEP						
DM	So		✓		✓		✓	✓	✓	✓	✓	✓ (count, B_FD[], F_FD[], N_FD[])
	Sk											

NOTES:

*1 MI_Enable is no longer used to allocate the counter resources for loss measurement. Note that the latest [ITU-T G.8021] has removed MI signals for the allocation of the local counter resources.

*2 The parameter 'SA' for MI_{1SL,1DM}_Start() is used to verify that the received PDU is properly sent from the expected peer node.

*3 The parameter 'Test_ID' for MI_LM_Start() is not specified in LM until now.

*4 The parameter 'MEP_ID' for MI_1SL_Start() was removed during [ITU-T G.8021] v4 AAP because MEP_ID carried in PDU is not evaluated at sink side.

*5 The parameter 'Length' is not applicable for CC/LM because the length of both PDUs is always fixed

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Printed in Switzerland
Geneva, 2018