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TELECOMMUNICATION
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Recommendation ITU-T G.8151/Y.1374

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Recommendation ITU-T G.8151/Y.1374

Management aspects of the MPLS-TP network element

Summary

Recommendation ITU-T G.8151/Y.1374 addresses management aspects of the MPLS transport profile (MPLS-TP) capable network element containing transport functions of one or more of the layer networks of the MPLS-TP network. The management of the MPLS-TP 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 2012 revision of this Recommendation aligns with the MPLS-TP architecture and requirements jointly developed by IETF and ITU-T, and provides the specification for managing MPLS-TP network elements (NEs) that support the OAM protocol neutral equipment functionality as defined in Recommendation ITU-T G.8121/Y.1381.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.8151/Y.1374	2007-10-22	15
2.0	ITU-T G.8151/Y.1374	2012-07-22	15
2.1	ITU-T G.8151/Y.1374 (2012) Amd.1	2012-10-29	15

FOREWORD

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

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

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

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

NOTE

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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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1 Scope

This Recommendation addresses management aspects of the MPLS transport profile (MPLS-TP) capable network element containing transport functions of one or more of the layer networks of the MPLS-TP network. The management of the MPLS-TP 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 the Recommendation, fault management, configuration management, performance management, and security management are specified. Accounting management is for further study.

The generic requirements for managing transport network elements are specified in [ITU-T G.7710] and the requirements for the management of equipment used in networks supporting an MPLS-TP are specified in [b-IETF RFC 5951]. This Recommendation specifies the requirements for managing the following MPLS-TP specific equipment functional blocks, which are defined in [ITU-T G.8121]:

– MPLS-TP layer connection function;

– MPLS-TP layer trail termination functions;

– MPLS-TP server to MPLS-TP client adaptation functions;

– MPLS-TP server to Ethernet client adaptation functions;

– SDH server to MPLS-TP client adaptation functions;

– PDH server to MPLS-TP client adaptation functions;

– OTN server to MPLS-TP client adaptation functions.

The management of the adaptation of other clients and servers with respect to MPLS-TP 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 MPLS-TP equipment management function within an MPLS-TP network element.

The architecture described in this Recommendation for the management of MPLS-TP 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.

– MPLS-TP layer network entities (MTLNE) refer to trail termination, adaptation and connection functions as described in [ITU-T G.8110.1].

– A network element may only contain MPLS-TP layer network entities.

– A network element may contain both MPLS-TP layer network entities (MTLNE) and client layer network entities (CLNE).

– Client layer entities are managed as part of their own logical domain (e.g., Ethernet management network).

– CLNE and MTLNE may or may not share a common message communication function (MCF) and management application function (MAF) depending on application.

– CLNE and MTLNE may or may not share the same agent.

This Recommendation provides a representation of the MPLS-TP technology using the methodologies that have been used for other transport technologies (e.g., SDH, OTN and Ethernet).

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

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

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

[ITU-T G.7710] Recommendation ITU-T G.7710/Y.1701 (2007) and Corrigendum 1 (2009), *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.8110.1] Recommendation ITU-T G.8110.1/Y.1370.1 (2011), *Architecture of the Multi-Protocol Label Switching transport profile layer network.*

[ITU-T G.8113.1] Recommendation ITU-T G.8113.1/Y.1372.1 (2012), *Operations, administration and maintenance mechanism for MPLS-TP in packet transport networks.*

[ITU-T G.8113.2] Recommendation ITU-T G.8113.2/Y.1372.2 (2012), *Operations, administration and maintenance mechanisms for MPLS-TP networks using the tools defined for MPLS.*

[ITU-T G.8121] Recommendation ITU-T G.8121/Y.1381 (2012), *Characteristics of MPLS-TP 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) and Amendments, *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), *Information technology – Open Systems Interconnection – Systems management overview*.

[ITU-T X.733] Recommendation ITU-T X.733 (1992) and Amendments, *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function*.

[ITU-T X.735] Recommendation ITU-T X.735 (1992) and Amendments, *Information technology – Open Systems Interconnection – Systems management: Log control function*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 agent: [ITU-T X.701].

3.1.2 alarm reporting: [ITU-T M.3100].

3.1.3 alarm reporting control (ARC): [ITU-T M.3100].

3.1.4 atomic function (AF): [ITU-T G.806].

3.1.5 data communication network (DCN): [ITU-T G.7712].

3.1.6 local craft terminal (LCT): [ITU-T G.7710].

3.1.7 managed entity: [ITU-T M.3100].

3.1.8 managed object (MO): [ITU-T X.700].

3.1.9 managed object class (MOC): [ITU-T X.701].

3.1.10 management application function (MAF): [ITU-T G.7710].

3.1.11 management interface: [ITU-T M.3100].

3.1.12 management point (MP): [ITU-T G.806].

3.1.13 manager: [ITU-T X.701].

3.1.14 message communication function (MCF): [ITU-T M.3013].

3.1.15 network element (NE): [ITU-T M.3010].

3.1.16 network element function (NEF): [ITU-T M.3010].

3.1.17 operations system (OS): [ITU-T M.3010].

3.1.18 operations system function (OSF): [ITU-T M.3010].

3.1.19 persistence interval: [ITU-T M.3100].

3.1.20 qualified problem: [ITU-T M.3100].

3.1.21 Q-Interface: [ITU-T M.3010].

3.1.22 reset threshold report: [ITU-T M.3100].

3.1.23 threshold report: [ITU-T M.3100].

3.1.24 timed interval: [ITU-T M.3100].

3.1.25 workstation function (WF): [ITU-T M.3010].

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

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

3.2.2 MPLS-TP management subnetwork (MT.MSN): An MPLS-TP management subnetwork (MT.MSN) consists of a set of separate embedded control channels (ECC) and associated intra-site data communication links which are interconnected to form a data communications network (DCN) within any given MPLS-TP transport topology. For MPLS-TP, the physical channel supporting the ECC is the MPLS-TP management communication channel (MCC) as defined in [ITU-T G.7712]. A MT.MSN represents a MPLS-TP specific local communication network (LCN) portion of a network operator's overall data communication network or TMN.

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

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AcSL	Accepted Signal Label
AF	Atomic Function
AIS	Alarm Indication Signal
ALM	Alarm reporting
ARC	Alarm Reporting Control
CLNE	Client Layer Network Entity
CP	Connection Point
CtrlP	Control Plane
DCN	Data Communication Network
ECC	Embedded Communication Channel
EMF	Equipment Management Function
FCAPS	Fault management, Configuration management, Account management, Performance management and Security management
GNE	Gateway Network Element
IP	Internet Protocol
LAN	Local Area Network
LCN	Local Communication Network
LCT	Local Craft Terminal

MAF	Management Application Function
MCC	Management Communication Channel
MCF	Message Communication Function
MD	Mediation Device
MF	Mediation Function
MI	Management Information
MIB	Management Information Base
MN	Management Network
MO	Managed Object
MOC	Managed Object Class
MP	Management Point
MgmtP	Management Plane
MPLS	Multi-Protocol Label Switching
MPLS-TP	MPLS Transport Profile
MSN	Management Subnetwork
MT.C	MPLS-TP Channel layer
MT.MN	MPLS-TP MN
MT.MSN	MPLS-TP MSN
MT.NE	MPLS-TP NE
MT.P	MPLS-TP Path layer
MT.S	MPLS-TP Section layer
MTM-n	MPLS-TP Transport Module layer n
NALM	No Alarm reporting
NALM-CD	No Alarm reporting, Count Down
NALM-NR	No Alarm reporting, Not Ready
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
PMC	Performance Monitoring Clock
QoS	Quality of Service

SCC	Signalling Communication Channel
RTC	Real Time Clock
TCM	Tandem Connection Monitoring
TMN	Telecommunication Management Network
WAN	Wide Area Network
WS	Workstation
WTR	Wait To Restore

5 Conventions

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

6 MPLS-TP management architecture

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

6.1 MPLS-TP network management architecture

The transport layer network architecture of MPLS-TP is described in [ITU-T G.8110.1]. The management of the MPLS-TP 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, MT.MN and MT.MSN

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

6.1.2 Access to the MT.MSN

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

6.1.3 MT.MSN requirements

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

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

– All MT.NEs are required to terminate the MT.S-MCCs. In OSI terms, this means that each NE must be able to perform the functions of an end system.

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

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

The use of the MT.P-MCCs and MT.C-MCCs for management communications is within the scope of this Recommendation.

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

1) MT.S-MCC (MCC_S).

2) MT.P-MCC (MCC_P).

3) MT.C-MCC (MCC_C).

The general MT.S-, MT.P-, and MT.C-MCCs are described in [ITU-T G.7712].

Figure 6-1 illustrates a network scenario consisting of two operators. Operator B provides an MT.P service to operator A (i.e., Operator B transports the MT.P signal that begins and ends operator A's domain). According to [ITU-T G.8110.1], the MCC_P and the MCC_C signals passed transparently through operator B's network.

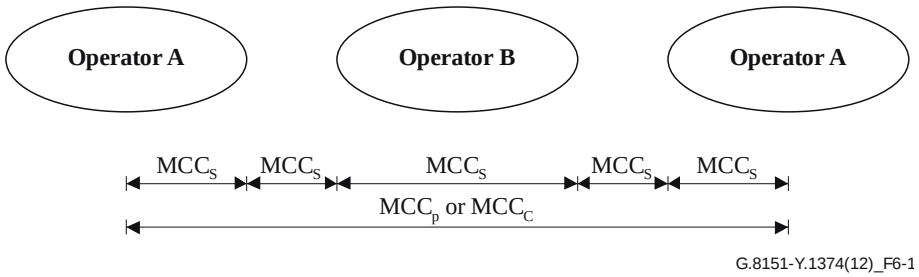

Figure 6-1 – MCC scenarios

The physical layer is terminated in every network element and its related adaptation function provides the MT.S 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 and MCC_C are transported transparently through operator B's domain (The operator B network elements are not shown in Figures 6-2 and 6-3). In these scenarios it is possible that operator B may use the MCC_S within its own domain for the management of its domain.

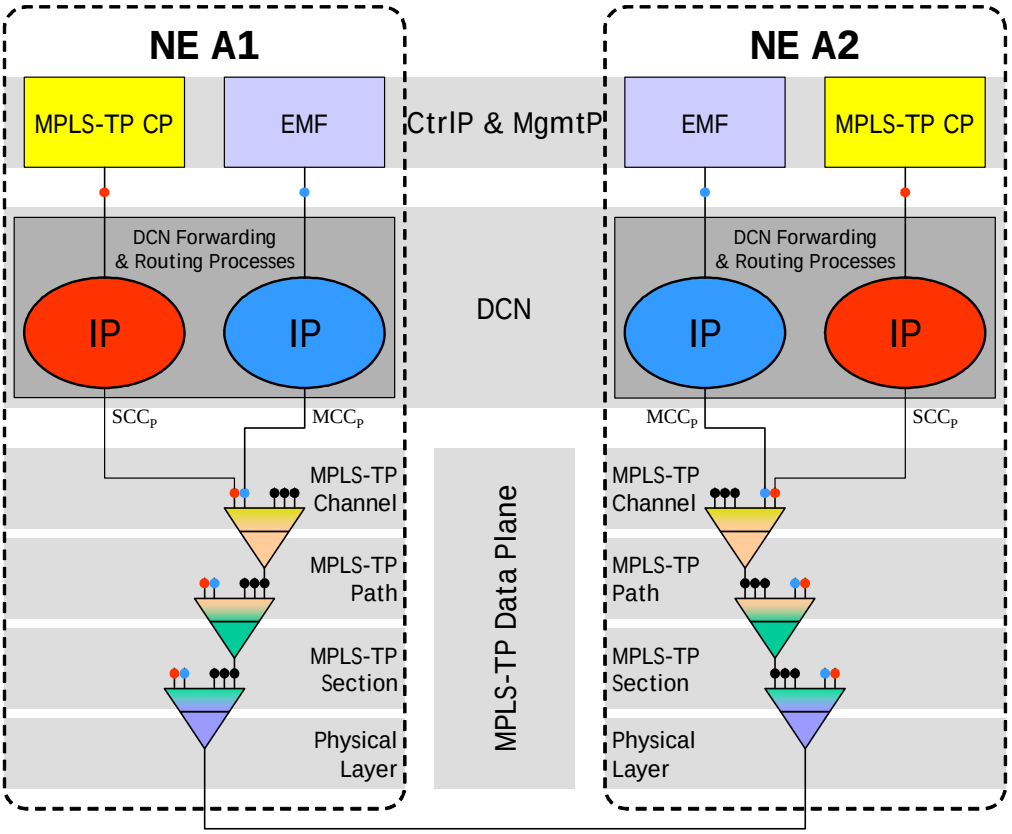

Figure 6-2 – MCC_P scenario example 1

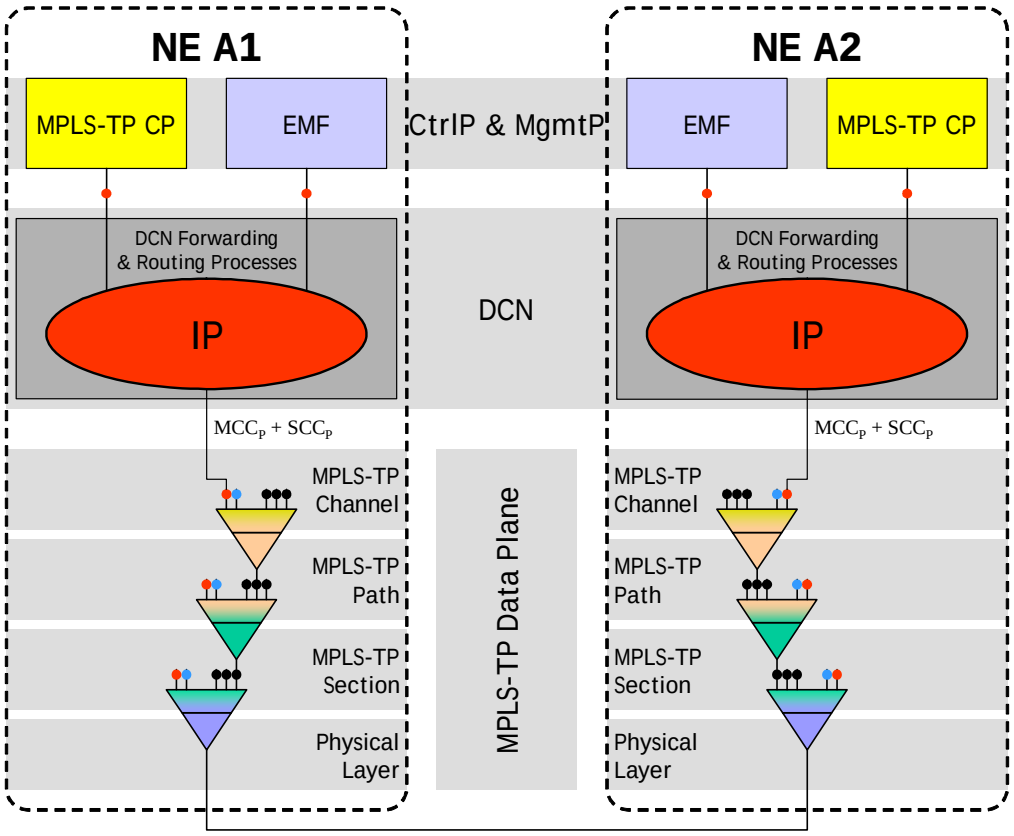

Figure 6-3 – MCC$_P$ scenario example 2

6.1.4.2 MCC physical characteristics

The MT.S-, MT.C- and MT.P-MCCs are logical elements within the MPLS-TP transport module (MTM-n). The MCC provides general management communications between two MPLS-TP network elements with access to the MT.S, MT.P, and MT.C characteristic information respectively. The MT.S-, MT.P-, or MT.C-MCC is provided by the MPLS-TP OAM function at section, path, or channel layer as described in [ITU-T G.7712] or by any other ECC of the MPLS-TP transport network.

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

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

The MT.C management communication channel (MCC$_C$) shall operate as a single message channel between any network elements that terminate the MT.C layer. The MCC$_C$ is transported transparently through MT.NEs that only terminates the MT.S layer or the MT.S and MT.P layers and forwards the MT.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 MPLS-TP equipment management architecture

This clause provides an overview of the minimum functions which are required to support inter-vendor/network communications and single-ended maintenance of MT.NEs within an MSN, or between communicating peer MT.NEs across a network interface. Single-ended maintenance is the ability to access remotely located MT.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 MPLS-TP equipment management function (EMF) (see Figure 6-4) provides the means through which the MPLS-TP 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 MPLS-TP EMF.

The MPLS-TP EMF interacts with the other atomic functions (refer to [ITU-T G.8121]) by exchanging information across the MP reference points. See [ITU-T G.806] and [ITU-T G.8121] for more information on atomic functions and on MPs. The MPLS-TP 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 application functions (MAF) which represent this information as managed objects.

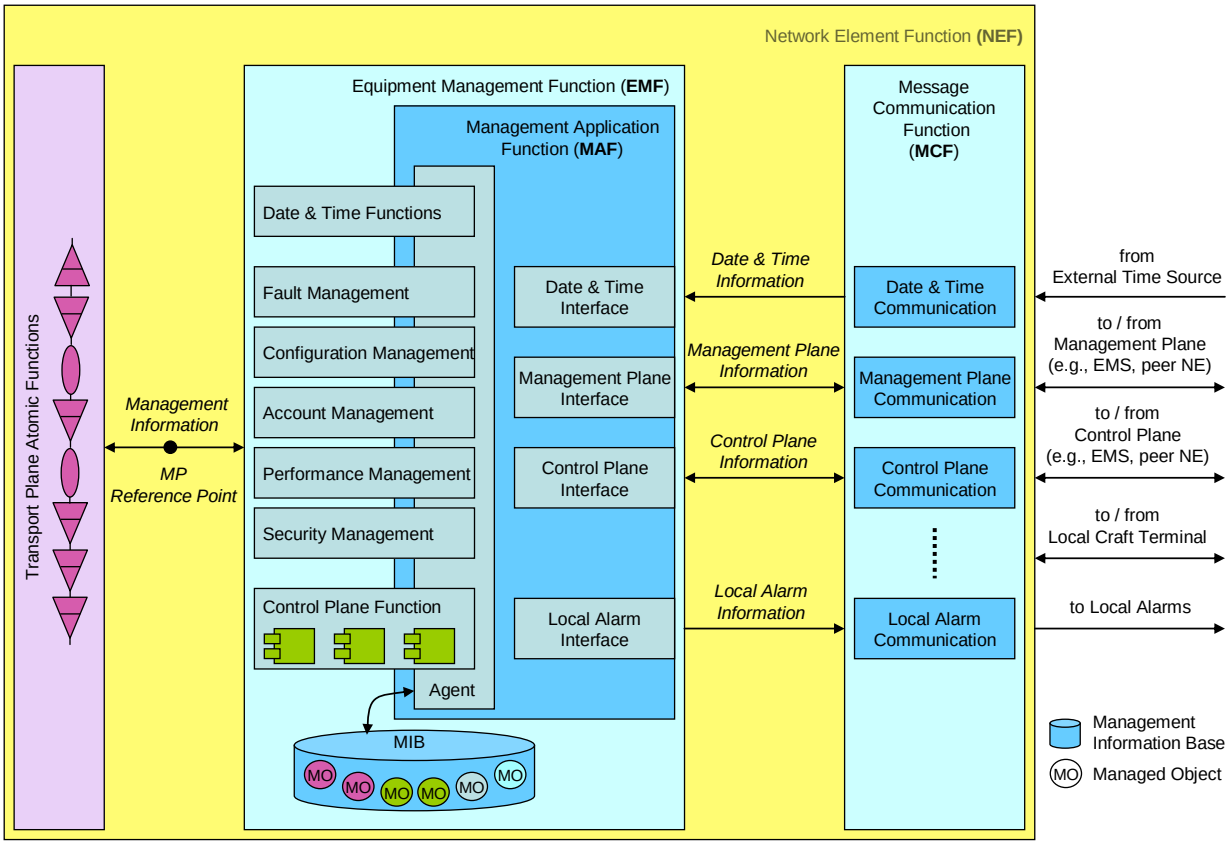

Figure 6-4 –MPLS-TP equipment management function

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

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

6.3 Information flows over management points (MP)

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 MPLS-TP NE and the options selected.

The information flow over the MP reference points that arises from anomalies and defects detected in the atomic functions is described in specific details for each atomic function in [ITU-T G.8121].

The information flow over the MP reference points that arises from provisioning and reporting data is described in specific details for each atomic function in [ITU-T G.8121]. The information listed under the input column refers to the provisioning data that is passed from the MPLS-TP EMF to the atomic functions. The information listed under the output column refers to the reports passed to the MPLS-TP EMF from the atomic functions.

7 Fault (maintenance) management

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

7.1 Fault management applications

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

7.1.1 Supervision

The supervision process describes the way in which the actual occurrence of a disturbance or fault is analysed with the purpose of providing an appropriate indication of performance and/or detected fault condition to maintenance personnel. The supervision philosophy is based on the concepts underlying the functional model of [ITU-T G.805], [ITU-T G.8110.1], 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 MT.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 description of transmission supervision.

For MT.NE, the defects that must be monitored for the purpose of transmission supervision are defined in clause 6.1 of [ITU-T G.8121].

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 environmental 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, count down; This is a substate of NALM-QI and performs the persistence timing count down function when the managed entity is qualified problem free.

NALM-NR No alarm reporting, not ready; This is a substate of NALM-QI and performs a wait function until the managed entity is qualified problem free.

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

NALM-TI No alarm reporting, timed inhibit; alarm reporting is turned off for a specified timed interval.

Alarm reporting may be turned off (using NALM, NALM-TI, or NALM-QI) on a per-managed entity basis to allow sufficient time for customer testing and other maintenance activities in an "alarm free" state. Once a managed entity is ready, alarm reporting is automatically turned on (to ALM). The managed entity may be automatically turned on either by using NALM-TI or NALM-QI and allowing the resource to transition out automatically, or by invoking first the NALM state from an EMS and when maintenance activity is done, invoking the ALM state. This later 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 MPLS-TP 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.

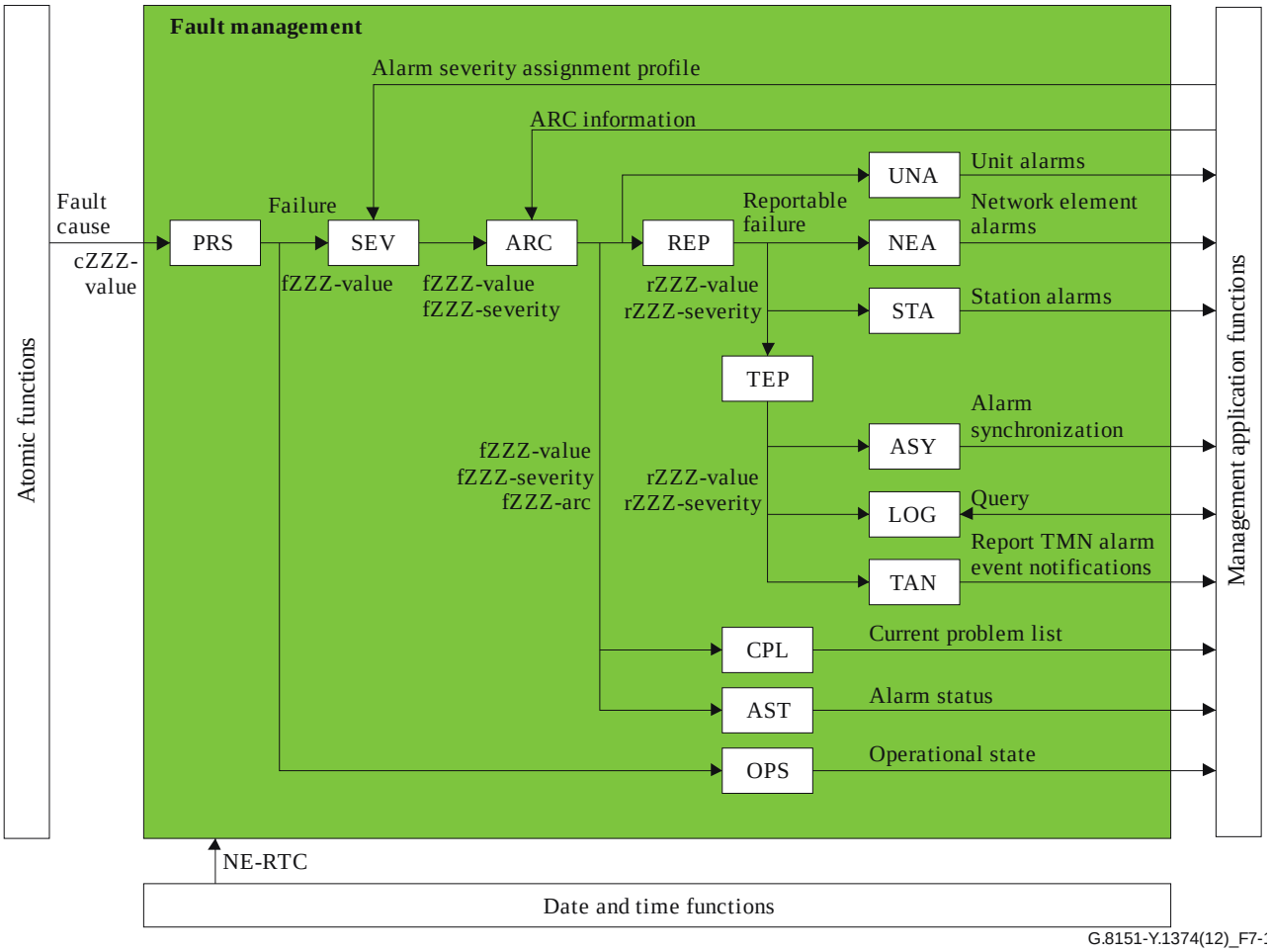

Figure 7-1 – Fault management within the MPLS-TP NEF

7.2.1 Fault cause persistency function – PRS

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

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

Symbol

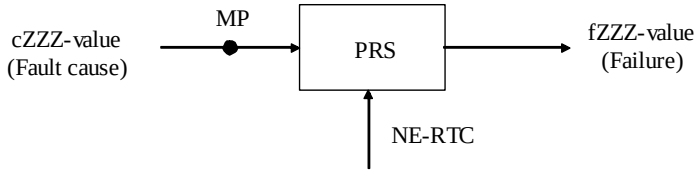

Figure 7-2 – Fault cause persistency function

For MT.NE that supports the following functions specified in [ITU-T G.8121], the EMF PRS process shall support the persistency check for the fault causes listed in Table 7-1.

Inputs and outputs

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

Atomic function ([ITU-T G.8121])	Input	Output
MT_TT_Sk	cSSF cLCK cLOC cMMG cUNM cUNP cUNC cDEG cRDI	fSSF fLCK fLOC fMMG fUNM fUNP fUNC fDEG fRDI
Sn/MT_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
Sn-X-L/MT_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
Sm/MT_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
Sm-X-L/MT_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
Pq/MT_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM

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

Atomic function ([ITU-T G.8121])	Input	Output
Pq-X-L/MT_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
ODUkP/MT_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
ODUkP-X-L/MT_A_Sk	cVcPLM cLFD cEXM cUPM	fVcPLM fLFD fEXM fUPM

See [ITU-T G.7710] for the mapping of failure (fXXX) to the generic probable cause to be used in alarm reporting.

Process

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

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

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

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

7.2.2 Severity assignment function – SEV

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

7.2.3 Alarm reporting control function – ARC

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

The alarms that can be controlled with this function are defined for each atomic function in [ITU-T G.8121].

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, count down; this is a substate of NALM-QI and performs the persistence timing count down function when the managed entity is qualified problem free.

NALM-NR No alarm reporting, not ready; this is a substate of NALM-QI and performs a wait function until the managed entity is qualified problem free.

NALM-QI No alarm reporting, qualified inhibit; alarm reporting is turned off until the managed entity is qualified problem free for a specified persistence interval.

NALM-TI No alarm reporting, timed inhibit; alarm reporting is turned off for a specified timed interval.

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

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

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

For MT.NE that supports the following functions specified in [ITU-T G.8121], the EMF ARC process shall support the ARC function for the failures listed in Table 7-2.

Table 7-2 – ARC specifications for MPLS-TP

Atomic function	Qualified problems	QoS reporting	Default state value
MT_TT_Sk	fSSF fLCK fLOC fMMG fUNM fUNP fUNC fDEG fRDI	For further study	ALM
Sn/MT_A_Sk	fPLM fLFD fEXM fUPM	For further study	ALM
Sn-X-L/MT_A_Sk	fPLM fLFD fEXM fUPM	For further study	ALM
Sm/MT_A_Sk	fPLM fLFD fEXM fUPM	For further study	ALM
Sm-X-L/MT_A_Sk	fPLM fLFD fEXM fUPM	For further study	ALM
Pq/MT_A_Sk	fPLM fLFD fEXM fUPM	For further study	ALM
Pq-X-L/MT_A_Sk	fPLM fLFD fEXM fUPM	For further study	ALM

Table 7-2 – ARC specifications for MPLS-TP

Atomic function	Qualified problems	QoS reporting	Default state value
ODUkP/MT_A_Sk	fPLM fLFD fEXM fUPM	For further study	ALM
ODUkP-X-L/MT_A_Sk	fVcPLM fLFD fEXM fUPM	For further study	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 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 notification function – TAN

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

For MT.NE that supports the following functions specified in [ITU-T G.8121], the EMF OPS process shall support the failures listed in Table 7-3, which lists the failures that could influence the operational state of the related objects.

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

Atomic function	Failure input (fZZZ-value)	Operational state output (enabled/disabled)
MT_TT_Sk	fSSF fLCK fLOC fMMG fUNM fUNP fUNC fDEG fRDI	Enabled Enabled Enabled Enabled Enabled Enabled Enabled Enabled Enabled
Sn/MT_A_Sk	fPLM fLFD fEXM fUPM	Enabled Enabled Enabled Enabled
Sn-X-L/MT_A_Sk	fPLM fLFD fEXM fUPM	Enabled Enabled Enabled Enabled
Sm/MT_A_Sk	fPLM fLFD fEXM fUPM	Enabled Enabled Enabled Enabled
Sm-X-L/MT_A_Sk	fPLM fLFD fEXM fUPM	Enabled Enabled Enabled Enabled
Pq/MT_A_Sk	fPLM fLFD fEXM fUPM	Enabled Enabled Enabled Enabled
Pq-X-L/MT_A_Sk	fPLM fLFD fEXM fUPM	Enabled Enabled Enabled Enabled
ODUkP/MT_A_Sk	fPLM fLFD fEXM fUPM	Enabled Enabled Enabled Enabled

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

Atomic function	Failure input (fZZZ-value)	Operational state output (enabled/disabled)
ODUkP-X-L/MT_A_Sk	fVcPLM fLFD fEXM fUPM	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. MPLS-TP 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 the generic management requirements for protection switching. The MPLS-TP specific management requirements will be provided after the protection switching process is defined in [ITU-T G.8121].

8.4 Trail termination

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

This function allows a user to provision and monitor the operation of the MPLS-TP trail termination process.

The MI signals listed in the table(s) of this clause are communicated between the EMF and the MPLS-TP trail termination process across the management point within the MT.NE.

For MT.NE that supports the MT_TT function specified in [ITU-T G.8121], the EMF shall support the following management functions for the MI listed in Table 8-1:

– 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 8-1 – Provisioning and reporting for termination functions

MI signal	Value range	Default value
MT_TT_So Provisioning		
MT_TT_So_MI_GAL_Enable	True, false	(Note 4)
MT_TT_So_MI_TTLVALUE	0..255	255
MT_TT_So_MI_MEG_ID	String; values are OAM protocol-specific	(Note 1)
MT_TT_So_MI_MEP_ID	String; values are OAM protocol-specific	(Note 1)
MT_TT_So_MI_CC_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_So_MI_RDI_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_So_MI_CC_Enable	True, false	False
MT_TT_So_MI_CVp_Enable	True, false (Note 3)	False
MT_TT_So_MI_CC_CoS	0, 1, 2, 3, 4, 5, 6, 7	7
MT_TT_So_MI_CC_Period	3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min	100 ms
MT_TT_So_MI_LMp_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_So_MI_LMp_Enable [1...M_{LMp}]	True, false	False
MT_TT_So_MI_LMp_Period [1...M_{LMp}]	100 ms, 1 s, 10 s	100 ms
MT_TT_So_MI_LMp_CoS[1... M_{LMp}]	0, 1, 2, 3, 4, 5, 6, 7	–
MT_TT_So_MI_DMp_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_So_MI_DMp_Enable [1...M_{DMp}]	True, false	False
MT_TT_So_MI_DMp_Period [1...M_{DMp}]	100 ms, 1 s, 10 s	100 ms
MT_TT_So_MI_DMp_Test_ ID[1...M_{DMp}]	(Note 2)	–
MT_TT_So_MI_DMp_CoS [1...M_{DMp}]	0, 1, 2, 3, 4, 5, 6, 7	–
MT_TT_So_MI_DMp_Length [1...M_{DMp}]	Non-negative integer representing number of bytes for the length of the padding TLV.	0
MT_TT_So_MI_1DMp_OAM _Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_So_MI_1DMp_ Enable[1...M_{1DMp}]	True, false	False
MT_TT_So_MI_1DMp_Period [1...M_{1DMp}]	100 ms, 1 s, 10 s	100 ms

Table 8-1 – Provisioning and reporting for termination functions

MI signal	Value range	Default value
MT_TT_So_MI_1DMp_Test_ID[1...M_{1DMp}]	(Note 2)	–
MT_TT_So_MI_1DMp_CoS [1...M_{1DMp}]	0, 1, 2, 3, 4, 5, 6, 7	–
MT_TT_So_MI_1DMp_ Length[1...M_{1DMp}]	Non-negative integer representing number of bytes for the length of the padding TLV.	0
MT_TT_So_MI_SLp_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_So_MI_SLp_Enable [1...M_{SLp}]	True, false	False
MT_TT_So_MI_SLp_Period [1...M_{SLp}]	100 ms, 1 s, 10 s	100 ms
MT_TT_So_MI_SLp_Test_ID [1...M_{SLp}]	(Note 2)	–
MT_TT_So_MI_SLp_CoS [1...M_{SLp}]	0, 1, 2, 3, 4, 5, 6, 7	–
MT_TT_So_MI_SLp_Length [1...M_{SLp}]	Non-negative integer representing number of bytes for the length of the padding TLV.	0
MT_TT_Sk Provisioning		
MT_TT_Sk_MI_GAL_Enable	True, false	(Note 4)
MT_TT_Sk_MI_MEG_ID	String; values are OAM protocol-specific	(Note 2)
MT_TT_Sk_MI_PeerMEP_ID	String; values are OAM protocol-specific	Empty list
MT_TT_Sk_MI_CC_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_Sk_MI_RDI_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_Sk_MI_CC_Enable	True, false	False
MT_TT_Sk_MI_CVp_Enable	True, false (Note 3)	False
MT_TT_Sk_MI_CC_Period	3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min	100 ms
MT_TT_Sk_MI_CC_CoS	0, 1, 2, 3, 4, 5, 6, 7	7
MT_TT_Sk_MI_Get_SvdCC	Last received CC frame(s) that caused defect	–
MT_TT_Sk_MI_LMp_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_Sk_MI_LMp_Enable [1...M_{LMp}]	True, false	False
MT_TT_Sk_MI_LMp_CoS [1...M_{LMp}]	0, 1, 2, 3, 4, 5, 6, 7	–

Table 8-1 – Provisioning and reporting for termination functions

MI signal	Value range	Default value
MT_TT_Sk_MI_LM_DEGM	2-10; see Table 7-1 of [ITU-T G.806]	10
MT_TT_Sk_MI_LM_M	2-10	10
MT_TT_Sk_MI_LM_ DEGTHR	0% .. 100%; see Table 7-1 of [ITU-T G.806]	30%
MT_TT_Sk_MI_LM_TFMIN	FFS	FFS
MT_TT_Sk_MI_1second	–	–
MT_TT_Sk_MI_DMp_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_Sk_MI_DMp_Enable [1…M_{DMp}]	True, false	False
MT_TT_Sk_MI_DMp_CoS [1…M_{DMp}]	0, 1, 2, 3, 4, 5, 6, 7	–
MT_TT_Sk_MI_1DMp_ OAM_Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_Sk_MI_1DMp_ Enable[1...M_{1DMp}]	True, false	False
MT_TT_Sk_MI_1DMp_Test_ ID[1...M_{1DMp}]	(Note 2)	–
MT_TT_Sk_MI_SLp_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_Sk_MI_SLp_Enable [1…M_{SLp}]	True, false	False
MT_TT_Sk_MI_SLp_CoS [1…M_{SLp}]	0, 1, 2, 3, 4, 5, 6, 7	–
MT_TT_Sk_MI_AIS_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_Sk_MI_LCK_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MT_TT_Sk Reporting		
MT_TT_Sk_MI_SvdCC	Last received CC packet(s) that causes the defect	–
NOTE 1 – A value must be provided at provisioning. NOTE 2 – The Test ID field is optional when this proactive measurement tool is used. NOTE 3 – The combination of MT_TT_So_MI_CC_Enable = false and MT_TT_So_MI_CVp_Enable = true is not allowed. NOTE 4 – MI_GAL_Enable must be set to true on LSPs, to false on PWs using CW, and to true on Sections. Setting it to true on PWs not using CW is for further study.		

8.5 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 MPLS-TP adaptation processes.

The MI signals listed in the following table are communicated between the EMF and the adaptation processes across the management point within the MPLS-TP NE.

For MT.NE that supports the adaptation functions specified in [ITU-T G.8121], the EMF shall support the following management functions for the MI listed in Table 8-2 below:

– Provisioning the flow forwarding management information.
– Retrieving the flow forwarding management information.
– Notifying the changes of the flow forwarding management information.

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
MT/MT_A_So Provisioning		
MT/MT_A_So_MI_Admin_State	LCK, normal	Normal
MT/MT_A_So_MI_Label[1…M]	16 to (2^{20} – 1)	(Note 2)
MT/MT_A_So_MI_LSPType [1…M]	E-LSP, L-LSP	(Note 1)
MT/MT_A_So_MI_CoS[1…M]	(Note 1)	(Note 1)
MT/MT_A_So_MI_PHB2EXP Mapping[1…M]	(Note 1)	(Note 1)
MT/MT_A_So_MI_QoSEncoding Mode[1…M]	A, B	(Note 2)
MT/MT_A_So_MI_LCK_Period [1…M]	1 s, 1 min	1 s
MT/MT_A_So_MI_LCK_CoS [1…M]	0..7	7
MT/MT_A_So_MI_GAL_Enable [1...M]	True, false	(Note 3)
MT/MT_A_Sk Provisioning		
MT/MT_A_Sk_MI_Admin_State	LCK, normal	Normal
MT/MT_A_Sk_MI_Label[1…M]	16 to (2^{20} – 1)	(Note 2)
MT/MT_A_Sk_MI_LSPType [1…M]	E-LSP, L-LSP	(Note 1)
MT/MT_A_Sk_MI_CoS[1…M]	(Note 1)	(Note 1)
MT/MT_A_Sk_MI_ TC2PHBMapping[1…M]	(Note 1)	(Note 1)
MT/MT_A_Sk_MI_QoSDecoding Mode[1…M]	A, B	(Note 2)
MT/MT_A_Sk_MI_AIS_Period [1...M]	1 s, 1 min	1 s
MT/MT_A_Sk_MI_AIS_CoS [1...M]	0..7	7
MT/MT_A_Sk_MI_LCK_Period [1...M]	1 s, 1 min	1 s

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
MT/MT_A_Sk_MI_LCK_CoS [1...M]	0..7	7
MT/MT_A_Sk_MI_GAL_Enable [1...M]	True, false	(Note 3)
MTDi/MT_A_Sk Provisioning		
MTDi/MT_A_Sk_MI_DS_MP_ Type (Note 4)	MEP, MIP	–
MT/ETH_A_So Provisioning		
MT/ETH_A_So_MI_Admin_State	LCK, normal	Normal
MT/ETH_A_So_MI_FCSEnable	True, false	True
MT/ETH_A_So_MI_CWEnable	True, false	True
MT/ETH_A_So_MI_SQUse	True, false	False
MT/ETH_A_So_MI_PRI2CoS Mapping	(Note 1)	(Note 1)
MT/ETH_A_So_MI_MEP_MAC*	6 byte unicast MAC address	–
MT/ETH_A_So_MI_Client_MEL*	0..7	7
MT/ETH_A_So_MI_LCK_Period*	1 s, 1 min	1 s
MT/ETH_A_So_MI_LCK_Pri*	0..7	7
MT/ETH_A_So_MI_MEL*	0..7	7
MT/ETH_A_Sk Provisioning		
MT/ETH_A_Sk_MI_FCSEnable	True, false	True
MT/ETH_A_Sk_MI_CWEnable	True, false	False
MT/ETH_A_Sk_MI_SQUse	True, false	False
MT/ETH_A_Sk_MI_CoS2PRI Mapping	(Note 1)	(Note 1)
MT/ETH_A_Sk_MI_MEL* *(NOTE – * ETH OAM related)*	0..7	7
MT/ETH_A_Sk_MI_Admin_State	LCK, normal	Normal
MT/ETH_A_Sk_MI_LCK_Period*	1 s, 1 min	1 s
MT/ETH_A_Sk_MI_LCK_Pri*	0..7	7
MT/ETH_A_Sk_MI_Client_MEL*	0..7	7
MT/ETH_A_Sk_MI_MEP_MAC*	6 byte unicast MAC address	–
MT/ETH_A_Sk_MI_AIS_Pri*	0..7	7
MT/ETH_A_Sk_MI_AIS_Period*	1 s, 1 min	1 s
MT/SCC_A_So Provisioning		
MT/SCC_A_So_MI_Active	True, false	True
MT/SCC_A_So_MI_ECC_CoS	0..7	7
MT/SCC_A_So_MI_GAL_Enable	True, false	(Note 3)

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
MT/SCC_A_Sk Provisioning		
MT/SCC_A_Sk_MI_Active	True, false	True
MT/SCC_A_Sk_GAL_Enable	True, false	(Note 3)
MT/MCC_A_So Provisioning		
MT/MCC_A_So_MI_Active	True, false	True
MT/MCC_A_So_MI_ECC_CoS	0..7	7
MT/MCC_A_So_MI_GAL_Enable	True, false	(Note 3)
MT/MCC_A_Sk Provisioning		
MT/MCC_A_Sk_MI_Active	True, false	True
MT/MCC_A_Sk_MI_GAL_Enable	True, false	(Note 3)
Sn/MT_A_So Provisioning		
Sn/MT_A_So_MI_SCCType	0..255	32
Sn/MT_A_So_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Sn/MT_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	–
Sn/MT_A_So_MI_CoS[1…M]	0..7	–
Sn/MT_A_So_PHB2TCMapping [1…M]	(Note 1)	–
Sn/MT_A_So_MI_QoSEncoding Mode[1…M]	A, B	–
Sn/MT_A_Sk Provisioning		
Sn/MT_A_Sk_MI_SCCType	0..255	32
Sn/MT_A_Sk_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Sn/MT_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	(Note 1)
Sn/MT_A_Sk_MI_CoS[1…M]	(Note 1)	(Note 1)
Sn/MT_A_Sk_MI_TC2PHB Mapping[1…M]	(Note 1)	(Note 1)
Sn/MT_A_Sk_MI_QoSDecoding Mode[1…M]	A, B	(Note 1)
Sn/MT_A_Sk_MI _LCK_Period[1…M]	1 s, 1 min	1 s
Sn/MT_A_Sk_MI _LCK_CoS[1…M]	0..7	–
Sn/MT_A_Sk_MI_LCK_OAM_Tool [1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Sn/MT_A_Sk_MI _Admin_State	LCK, normal	Normal
Sn/MT_A_Sk_MI _AIS_Period[1…M]	1 s, 1 min	1 s
Sn/MT_A_Sk_MI _AIS_CoS[1…M]	0..7	–
Sn/MT_A_Sk_MI _AIS_OAM_Tool[1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
Sn/MT_A_Sk_MI _GAL_enable[1…M]	True, false	(Note 3)
Sn/MT_A_Sk Reporting		
Sn/MT_A_Sk_MI_AcSL (see Table 9-11 of G.707)	0..255	–
Sn/MT_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Sn/MT_A_Sk_MI_LastValidUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
Sn-X-L/MT_A_So Provisioning		
Sn-X-L/MT_A_So_MI_SCCType (see Table 6-3 of [ITU-T G.7041])	0..255	32
Sn-X-L/MT_A_So_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Sn-X-L/MT_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	–
Sn-X-L/MT_A_So_MI_CoS[1…M]	0..7	(Note 1)
Sn-X-L/MT_A_So_PHB2TCMapping [1…M]	(Note 1)	(Note 1)
Sn-X-L/MT_A_So_MI_QoSEncoding Mode[1…M]	A, B	(Note 1)
Sn-X-L/MT_A_Sk Provisioning		
Sn-X-L/MT_A_Sk_MI_SCCType (see Table 6-3 of [ITU-T G.7041])	0..255	32
Sn-X-L/MT_A_Sk_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Sn-X-L/MT_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	–
Sn-X-L/MT_A_Sk_MI_CoS[1…M]	0..7	(Note 1)
Sn-X-L/MT_A_Sk_MI_TC2PHBMapping [1…M]	(Note 1)	(Note 1)
Sn-X-L/MT_A_Sk_MI_QoSDecoding Mode[1…M]	A, B	(Note 1)
Sn-X-L/MT_A_Sk_MI _LCK_Period[1…M]	1 s, 1 min	1 s
Sn-X-L/MT_A_Sk_MI _LCK_CoS[1…M]	0..7	–

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
Sn-X-L/MT_A_Sk_MI _LCK_OAM_Tool [1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Sn-X-L/MT_A_Sk_MI _Admin_State	LCK, normal	Normal
Sn-X-L/MT_A_Sk_MI _AIS_Period[1…M]	1 s, 1 min	1 s
Sn-X-L/MT_A_Sk_MI _AIS_CoS[1…M]	0..7	–
Sn-X-L/MT_A_Sk_MI _AIS_OAM_Tool [1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Sn-X-L /MT_A_Sk_MI _GAL_Enable [1…M]	True, false	(Note 3)
Sn-X-L/MT_A_Sk Reporting		
Sn-X-L/MT_A_Sk_MI_AcSL (see Table 9-11 of G.707)	0..255	–
Sn-X-L/MT_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Sn-X-L/MT_A_Sk_MI_LastValidUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
Sm/MT_A_So Provisioning		
Sm/MT_A_So_MI_SCCType	0..255	32
Sm/MT_A_So_MI_Label[1…M]	16 to ($2^{20} – 1$)	(Note 2)
Sm/MT_A_So_MI_LSPType [1…M]	E-LSP, L-LSP	–
Sm/MT_A_So_MI_CoS[1…M]	0..7	–
Sm/MT_A_So_PHB2TCMapping [1…M]	(Note 1)	(Note 1)
Sm/MT_A_So_MI_QoSEncoding Mode[1…M]	A, B	(Note 1)
Sm/MT_A_Sk Provisioning		
Sm/MT_A_Sk_MI_SCCType	0..255	32
Sm/MT_A_Sk_MI_Label[1…M]	16 to ($2^{20} – 1$)	(Note 2)
Sm/MT_A_Sk_MI_LSPType [1…M]	E-LSP, L-LSP	–
Sm/MT_A_Sk_MI_CoS[1…M]	0..7	–
Sm/MT_A_Sk_MI_TC2PHB Mapping[1…M]	(Note 1)	(Note 1)
Sm/MT_A_Sk_MI_QoSDecoding Mode[1…M]	A, B	(Note 1)
Sm/MT_A_Sk_MI _LCK_Period[1…M]	1 s, 1 min	1 s

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
Sm/MT_A_Sk_MI _LCK_CoS[1…M]	0..7	–
Sm/MT_A_Sk_MI _LCK_OAM_Tool [1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Sm/MT_A_Sk_MI_Admin_State	LCK, normal	Normal
Sm/MT_A_Sk_MI _AIS_Period[1…M]	1 s, 1 min	1 s
Sm/MT_A_Sk_MI _AIS_CoS[1…M]	0..7	–
Sm/MT_A_Sk_MI _AIS_OAM_Tool[1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Sm/MT_A_Sk_MI _GAL_Enable[1…M]	True, false	(Note 3)
Sm/MT_A_Sk Reporting		
Sm/MT_A_Sk_MI_AcSL (see Table 9-12 and Table 9-13 of G.707)	0..255	–
Sm/MT_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Sm/MT_A_Sk_MI_LastValidUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
Sm-X-L/MT_A_So Provisioning		
Sm-X-L/MT_A_So_MI_SCCType	0..255	32
Sm-X-L/MT_A_So_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Sm-X-L/MT_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	–
Sm-X-L/MT_A_So_MI_CoS[1…M]	0..7	–
Sm-X-L/MT_A_So_PHB2TCMapping [1…M]	(Note 1)	(Note 1)
Sm-X-L/MT_A_So_MI_QoSEncoding Mode[1…M]	A, B	(Note 1)
Sm-X-L/MT_A_Sk Provisioning		
Sm-X-L/MT_A_Sk_MI_SCCType	0..255	32
Sm-X-L/MT_A_Sk_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Sm-X-L/MT_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	–
Sm-X-L/MT_A_Sk_MI_CoS[1…M]	0..7	–

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
Sm-X-L/MT_A_Sk_MI_TC2PHBMapping [1…M]	(Note 1)	(Note 1)
Sm-X-L/MT_A_Sk_MI_QoSDecoding Mode[1…M]	A, B	(Note 1)
Sm-X-L/MT_A_Sk_MI _LCK_Period[1…M]	1 s, 1 min	1 s
Sm-X-L/MT_A_Sk_MI _LCK_CoS[1…M]	0..7	–
Sm-X-L/MT_A_Sk_MI _LCK_OAM_Tool [1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Sm-X-L/MT_A_Sk_MI _Admin_State	LCK, normal	Normal
Sm-X-L/MT_A_Sk_MI _AIS_Period[1…M]	1 s, 1 min	1 s
Sn-X-L/MT_A_Sk_MI _AIS_CoS[1…M]	0..7	–
Sm-X-L/MT_A_Sk_MI _AIS_OAM_Tool [1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Sm-X-L/MT_A_Sk_MI _GAL_Enable[1…M]	True, false	(Note 3)
Sm-X-L/MT_A_Sk Reporting		
Sm-X-L/MT_A_Sk_MI_AcSL	0..255	–
Sm-X-L/MT_A_Sk_MI_AcEXI	0..15	–
Sm-X-L/MT_A_Sk_MI_LastValidUPI	0..255	–
Pq/MT_A_So Provisioning		
Pq/MT_A_So_MI_SCCType	0..255	32
Pq/MT_A_So_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Pq/MT_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	–
Pq/MT_A_So_MI_CoS[1…M]	0..7	–
Pq/MT_A_So_PHB2TCMapping [1…M]	(Note 1)	(Note 1)
Pq/MT_A_So_MI_QoSEncoding Mode[1…M]	A, B	(Note 1)
Pq/MT_A_Sk Provisioning		
Pq/MT_A_Sk_MI_SCCType	0..255	32
Pq/MT_A_Sk_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Pq/MT_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	–
Pq/MT_A_Sk_MI_CoS[1…M]	0..7	–
Pq/MT_A_Sk_MI_TC2PHB Mapping[1…M]	(Note 1)	(Note 1)

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
Pq/MT_A_Sk_MI_QoSDecoding Mode[1…M]	A, B	(Note 1)
Pq/MT_A_Sk_MI _LCK_Period[1…M]	1 s, 1 min	1 s
Pq/MT_A_Sk_MI _LCK_CoS[1…M]	0..7	–
Pq/MT _A_Sk_MI _LCK_Tool[1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Pq/MT_A_Sk_MI _Admin_State	LCK, normal	Normal
Pq/MT_A_Sk_MI _AIS_Period[1…M]	1 s, 1 min	1 s
Pq/MT_A_Sk_MI _AIS_CoS[1…M]	0..7	–
Pq/MT _A_Sk_MI _AIS_Tool[1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Pq/MT _A_Sk_MI_GAL_Enable [1…M]	True, false	(Note 3)
Pq/MT_A_Sk Reporting		
Pq/MT_A_Sk_MI_AcSL (see clause 2.1.2 of G.832)	0..7	–
Pq/MT_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
Pq/MT_A_Sk_MI_LastValidUPI (see Table 6-3 of [ITU-T G.7041))	0..255	–
Pq-X-L/MT_A_So Provisioning		
Pq-X-L/MT_A_So_MI_SCCType	0..255	32
Pq-X-L/MT_A_So_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Pq-X-L/MT_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	–
Pq-X-L/MT_A_So_MI_CoS[1…M]	o..7	–
Pq-X-L/MT_A_So_PHB2TCMapping [1…M]	(Note 1)	(Note 1)
Pq-X-L/MT_A_So_MI_QoSEncoding Mode[1…M]	A, B	(Note 1)
Pq-X-L/MT_A_Sk Provisioning		
Pq-X-L/MT_A_Sk_MI_SCCType	0..255	32
Pq-X-L/MT_A_Sk_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
Pq-X-L/MT_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	–

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
Pq-X-L/MT_A_Sk_MI_CoS[1…M]	0..7	–
Pq-X-L/MT_A_Sk_MI_TC2PHBMapping[1…M]	(Note 1)	(Note 1)
Pq-X-L/MT_A_Sk_MI_QoSDecoding Mode[1…M]	A, B	(Note 1)
Pq-X-L/MT_A_Sk_MI _LCK_Period[1…M]	1 s, 1 min	1 s
Pq-X-L/MT_A_Sk_MI _LCK_CoS[1…M]	0..7	–
Pq-X-L/MT _A_Sk_MI _LCK_Tool[1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Pq-X-L/MT_A_Sk_MI _Admin_State	LCK, normal	Normal
Pq-X-L/MT_A_Sk_MI _AIS_Period[1…M]	1 s, 1 min	1 s
Pq-X-LMT_A_Sk_MI _AIS_CoS[1…M]	0..7	–
Pq-X-L/MT _A_Sk_MI _AIS_Tool[1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
Pq-X-L//MT _A_Sk_MI _GAL_Enable[1…M]	True, false	(Note 3)
Pq-X-L/MT_A_Sk Reporting		
Pq-X-L/MT_A_Sk_MI_AcSL	0..7	–
Pq-X-L/MT_A_Sk_MI_AcEXI	0..15	–
Pq-X-L/MT_A_Sk_MI_LastValidUPI	0..255	–
ODUkP/MT_A_So Provisioning		
ODUkP/MT_A_So_MI_Active	True, false	False
ODUkP/MT_A_So_MI_SCCType	0..255	32
ODUkP/MT_A_So_MI_Label [1…M]	16 to $(2^{20} – 1)$	(Note 2)
ODUkP/MT_A_So_MI_LSPType [1…M]	E-LSP, L-LSP	–
ODUkP/MT_A_So_MI_CoS[1…M]	0..7	–
ODUkP/MT_A_So_PHB2TC Mapping[1…M]	(Note 1)	(Note 1)
ODUkP/MT_A_So_MI_QoS EncodingMode[1…M]	A, B	(Note 1)
ODUkP/MT_A_Sk Provisioning		
ODUkP/MT_A_Sk_MI_Active	True, false	False
ODUkP/MT_A_Sk_MI_SCCType	0..255	32

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ODUkP/MT_A_Sk_MI_Label [1…M]	16 to (2^{20} – 1)	(Note 2)
ODUkP/MT_A_Sk_MI_LSPType [1…M]	E-LSP, L-LSP	–
ODUkP/MT_A_Sk_MI_CoS[1…M]	0..7	–
ODUkP/MT_A_Sk_MI_TC2PHB Mapping[1…M]	(Note 1)	(Note 1)
ODUkP/MT_A_Sk_MI_QoS DecodingMode[1…M]	A, B	(Note 1)
ODUkP/MT_A_Sk_MI _LCK_Period[1…M]	1 s, 1 min	1 s
ODUkP/MT_A_Sk_MI_LCK_CoS [1…M]	0..7	–
ODUkP/MT _A_Sk_MI _LCK_Tool[1…M]	[G.8113.1], [G.8113.2]	N/A
ODUkP/MT_A_Sk_MI_Admin_ State	LCK, normal	Normal
ODUkP/MT_A_Sk_MI_AIS_Period [1…M]	1 s, 1 min	1 s
ODUkP/MT_A_Sk_MI_AIS_CoS [1…M]	0..7	–
ODUkP/MT _A_Sk_MI _AIS_Tool[1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
ODUkP/MT_A_Sk_MI_GAL_ Enable[1…M]	True, false	(Note 3)
ODUkP/MT_A_Sk Reporting		
ODUkP/MT_A_Sk_MI_AcPT (see Table 15-8 of G.709)	0..255	–
ODUkP/MT_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
ODUkP/MT_A_Sk_MI_LastValid UPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
ODUkP-X-L/MT_A_So Provisioning		
ODUkP-X-L/MT_A_So_MI_Active	True, false	False
ODUkP-X-L/MT_A_So_MI_SCCType	0..255	32
ODUkP-X-L/MT_A_So_MI_Label[1…M]	16 to (2^{20} – 1)	(Note 2)
ODUkP-X-L/MT_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	–
ODUkP-X-L/MT_A_So_MI_CoS[1…M]	0..7	–

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ODUkP-X-L/MT_A_So_PHB2TCMapping [1…M]	(Note 1)	(Note 1)
ODUkP-X-L/MT_A_So_MI_QoSEncoding Mode[1…M]	A, B	(Note 1)
ODUkP-X-L/MT_A_Sk Provisioning		
ODUkP-X-L/MT_A_Sk_MI_Active	True, false	False
ODUkP-X-L/MT_A_Sk_MI_SCCType	0..255	32
ODUkP-X-L/MT_A_Sk_MI_Label[1…M]	16 to $(2^{20} – 1)$	(Note 2)
ODUkP-X-L/MT_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	–
ODUkP-X-L/MT_A_Sk_MI_CoS[1…M]	0..7	–
ODUkP-X-L/MT _A_Sk_MI _LCK_Tool[1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
ODUkP-X-L/MT_A_Sk_MI_TC2PHBMapping [1…M]	(Note 1)	(Note 1)
ODUkP-X-L/MT_A_Sk_MI_QoSDecoding Mode[1…M]	A, B	(Note 1)
ODUkP-X-L/MT_A_Sk_MI_LCK_Period [1…M]	1 s, 1 min	1 s
ODUkP-X-L/MT_A_Sk_MI_LCK_CoS[1…M]	0..7	–
ODUkP-X-L/MT _A_Sk_MI _AIS_Tool[1…M]	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
ODUkP-X-L/MT_A_Sk_MI_ Admin_State	LCK, normal	Normal
ODUkP-X-L/MT_A_Sk_MI_AIS_ Period[1…M]	1 s, 1 min	1 s
ODUkP-X-L/MT_A_Sk_MI_AIS_CoS[1…M]	0..7	(Note 3)
ODUkP-X-L/MT _A_Sk_MI_GAL_Enable[1…M]	True, false	–
ODUkP-X-L/MT_A_Sk Reporting		
ODUkP-X-L/MT_A_Sk_MI_AcVcPT (see Table 15-8 of G.709)	0..255	–

Table 8-2 – Provisioning and reporting for adaptation functions

MI signal	Value range	Default value
ODUkP-X-L/MT_A_Sk_MI_AcEXI (see Table 6-2 of [ITU-T G.7041])	0..15	–
ODUkP-X-L/MT_A_Sk_MI_LastValidUPI (see Table 6-3 of [ITU-T G.7041])	0..255	–
ETH/MT_A_So Provisioning		
ETH/MT_A_So_MI_Label [1…M]	16 to (2^{20} – 1)	(Note 2)
ETH/MT_A_So_MI_ LSPType[1…M]	E-LSP, L-LSP	(Note 1)
ETH/MT_A_So_MI_CoS[1…M]	(Note 1)	(Note 1)
ETH/MT_A_So_PHB2TCMapping [1…M]	(Note 1)	(Note 1)
ETH/MT_A_So_MI_ QoSEncodingMode[1…M]	A, B	(Note 2)
ETH/MT_A_So_MI_Etype		
ETH/MT_A_Sk Provisioning		
ETH/MT_A_Sk_MI _LCK _Enable[1…M]	true, false	true
ETH/MT_A_Sk_MI _LCK _Period[1…M]	1 s, 1 min	1 s
ETH/MT_A_Sk_MI _LCK _CoS[1…M]	0..7	7
ETH/MT_A_Sk_MI _Admin_State	LCK, Normal	Normal
ETH/MT_A_Sk_MI_AIS_Enable [1…M]	true, false	true
ETH/MT_A_Sk_MI _AIS_Period[1…M]	1 s, 1 min	1 s
ETH/MT_A_Sk_MI _AIS_CoS[1…M]	0..7	7

NOTE 1 – According to [ITU-T G.8121].

NOTE 2 – A value must be provided at provisioning.

NOTE 3 – MI_GAL_Enable must be set to true on LSPs, to false on PWs using CW, and to true on Sections. Setting it to true on PWs not using CW is for further study.

NOTE 4 – This MI should be properly configured by the EMF on the basis of the MPLS-TP connection configuration within the node but not exposed to the operator as a configuration parameter in the NE/EMS management interface. See clause 9.4.2.2.2 of [ITU-T G.8121] and its Appendix I for examples of configuration of this MI.

8.6 Diagnostic

This clause provides the requirements for the management of the MT diagnostic trail termination functions (MTDe_TT).

For MT.NE that supports the MTDe_TT function specified in [ITU-T G.8121], the EMF shall support the following management functions for the MIs listed in Table 8-3 below:

– 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 8-3 – Provisioning and reporting for diagnostic trail termination function

MI signal	Value range	Default value
MTDe_TT_So Provisioning		
MTDe_TT_So_MI_GAL_Enable	True, false	(Note 3)
MTDe_TT_So_MI_TTLVALUE	0..255	255
MTDe_TT_So_MI_CV_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_So_MI_CV_Series (Note 6)		
MTDe_TT_So_MI_1TH_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_So_MI_1TH_Start (CoS, Length, Period)	CoS: 0..7 Length: 0..L (Note 5) Period: For further study	Default value of Length: 0
MTDe_TT_So_MI_1TH_ Terminate	–	–
MTDe_TT_So_MI_LMo_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_So_MI_LMo_Start (CoS, Period) [1...MLMo]	CoS: 0..7 Period: 100 ms, 1 s, 10 s	–
MTDe_TT_So_MI_LMo_ Terminate[1...M_{LMo}]	–	–
MTDe_TT_So_MI_DMo_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_So_MI_DMo_Start (CoS, Test_ID, Length, Period) [1...M_{DMo}]	CoS: 0..7 Test_ID: (Note 2) Length: 0..L (Note 5) Period: 1 s, 10 s, 1 min	Default value of Length: 0 Default value of Period: 1 min
MTDe_TT_So_MI_DMo_ Terminate[1...M_{DMo}]	–	–
MTDe_TT_So_MI_1DMo_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A

Table 8-3 – Provisioning and reporting for diagnostic trail termination function

MI signal	Value range	Default value
MTDe_TT_So_MI_1DMo_Start (CoS, Test_ID, Length, Period) [1...M_{1DMo}]	CoS: 0..7 Test_ID: (Note 2) Length: 0..L (Note 5) Period: 100 ms, 1 s, 10 s	Default value of Length: 0
MTDe_TT_So_MI_1DMo_ Terminate[1...M_{1DMo}]	–	–
MTDe_TT_So_MI_SLo_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_So_MI_SLo_Start (CoS, Test_ID, Length, Period) [1...M_{SLo}]	CoS: 0..7 Test_ID: (Note 2) Length: 0..L (Note 5) Period: 0.1 ms, 0.5 ms, 1 ms, 3.3 ms, 10 ms, 100 ms	Default value of Length: 0 Default value of Period: 10 ms
MTDe_TT_So_MI_SLo_ Terminate[1...M_{SLo}]	–	–
MTDe_TT_So_MI_Admin_State	LCK, Normal	Normal
MTDe_TT_So_MI_Lock_Intsruct _Enable	true, false	true
MTDe_TT_So Reporting		
MTDe_TT_So_MI_CV_Series_ Result (Note 6)	–	–
MTDe_TT_So_MI_1TH_Result (Sent)	–	–
MTDe_TT_So_MI_LMo_Result (N_TF, N_LF, F_TF, F_LF) [1...M_{LMo}]	–	–
MTDe_TT_So_MI_DMo_Result (count,B_FD[], F_FD[], N_FD[]) [1...M_{DMo}]	–	–
MTDe_TT_So_MI_SLo_Result (N_TF, N_LF, F_TF, F_LF) [1...M_{SLo}]	–	–
MTDe_TT_Sk Provisioning		
MTDe_TT_Sk_MI_GAL_Enable	True, false	(Note 3)
MTDe_TT_Sk_MI_CV_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_Sk_MI_1TH_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_Sk_MI_1TH_Start	–	–
MTDe_TT_Sk_MI_1TH_ Terminate	–	–
MTDe_TT_Sk_MI_LMo_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A

Table 8-3 – Provisioning and reporting for diagnostic trail termination function

MI signal	Value range	Default value
MTDe_TT_Sk_MI_DMo_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_Sk_MI_1DMo_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_Sk_MI_1DMo_Start (Test_ID)[1...M_{1DMo}]	(Note 2)	–
MTDe_TT_Sk_MI_1DMo_ Terminate[1...M_{1DMo}]	–	–
MTDe_TT_Sk_MI_SLo_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDe_TT_Sk Reporting		
MTDe_TT_Sk_MI_1TH_Result (REC, CRC, BER, OO)	–	–
MTDe_TT_Sk_MI_1DMo_Result (count, N_FD[])[1...M_{DMo}]]	–	–
MTDe_TT_Sk_MI_Admin_State_ Request	Trigger to LCK, Trigger to Normal	–
MTDi_TT_So Provisioning		
MTDi_TT_So_MI_GAL_Enable	True, false	(Note 3)
MTDi_TT_So_MI_TTLVALUE	0..255	255
MTDe_TT_So_MI_MIP_ID	String; values are OAM protocol-specific	(Note 1)
MTDi_TT_So_MI_CV_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
MTDi_TT_Sk Provisioning		
MTDi_TT_Sk_MI_GAL_Enable	True, false	(Note 3)
MTDe_TT_Sk_MI_MIP_ID	String; values are OAM protocol-specific	(Note 1)
MTDi_TT_Sk_MI_CV_OAM_ Tool	[ITU-T G.8113.1], [ITU-T G.8113.2]	N/A
NOTE 1 – A value must be provided at provisioning. NOTE 2 – The Test ID field is optional when this proactive measurement tool is used. NOTE 3 – MI_GAL_Enable must be set to true on LSPs, to false on PWs using CW, and to true on Sections. Setting it to true on PWs not using CW is for further study. NOTE 4 – The value of n depends on implementation, e.g., 2^{32}. NOTE 5 – The value of L depends on implementation, e.g., 2^{32}. NOTE 6 – The CV_Series_Result parameters are OAM protocol-specific.		

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 MPLS-TP Connection process.

The MI signals listed in this clause are communicated from the EMF to the connection process through the management point.

For MT.NE that supports the MT_C function specified in [ITU-T G.8121], the EMF shall support the following management functions for the MIs listed in Table 8-4 below:

– Provisioning the trail termination management information.

– Retrieving the trail termination management information.

– Notifying the changes of the trail termination management information.

Table 8-4 – Provisioning and reporting for connection functions

MI signal	Value range	Default value
MT_C Provisioning (Per matrix connection)		
MT_C_MI_ConnectionType	Protected, unprotected	Unprotected
MT_C_MI_Return_CP_ID	NULL (for unidirectional), or the Connection point (CP) identifier (for bidirectional)	–
MT_C_MI_ConnectionPortIds	Set of connection point identifiers	–
NOTE – According to [ITU-T G.8121].		

8.8 DEG thresholds

For further study.

8.9 XXX_Reported

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

Table 8-5 below provides the MI signals that need to be provisioned for consequential defect/failure.

Table 8-5 – Consequential defect/failure related provisioning

MI signal	Value range	Default value
MI_SSF_Reported	True, false	False
MI_BDI_Reported	True, false	False

8.10 Alarm severity

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

8.11 Alarm reporting control (ARC)

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

8.12 PM thresholds

For further study.

8.13 TCM activation

For further study.

8.14 Date and Time

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

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

8.14.1 Date and Time applications

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 MPLS-TP NEF functional requirements for these applications are specified in the following clauses.

8.14.1.1 Time-stamping

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

8.14.1.2 Performance monitoring clock signals

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

8.14.1.3 Activity scheduling

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

8.14.2 Date and Time functions

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

8.14.2.1 Local real time clock function

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

8.14.2.2 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].

8.14.2.3 Performance monitoring clock function

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

9 Accounting management

For further study.

10 Performance management

See clause 10 of [ITU-T G.7710] for the generic requirements for performance management. MPLS-TP 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 generic requirements of performance monitoring functions.

MPLS-TP NE shall provide the following PM management information (see Table 10-1).

Table 10-1 – PM management information

PM Management Information	ITU-T G.8121 Function
MT_TT_Sk_MI_pN_LF MT_TT_Sk_MI_pN_TF MT_TT_Sk_MI_pF_LF MT_TT_Sk_MI_pF_TF MT_TT_Sk_MI_pF_DS MT_TT_Sk_MI_pN_DS MT_TT_Sk_MI_pB_FD MT_TT_Sk_MI_pB_FDV MT_TT_Sk_MI_pN_FD MT_TT_Sk_MI_pN_FDV MT_TT_Sk_MI_pF_FD MT_TT_Sk_MI_pF_FDV	MT_TT_Sk
MT/ETH_A_Sk_MI_pFCSErrors	MT/ETH_A_Sk

The EMF shall support the following functions:

– Notifying of the PM management information.

11 Security management

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

Bibliography

[b-IETF RFC 5951] IETF RFC 5951 (2010), *MPLS-TP Network Management Requirements*.

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