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

Packet over Transport aspects – MPLS over Transport aspects

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

Internet protocol aspects – Transport

Management aspects of the T-MPLS network element

CAUTION !

PREPUBLISHED RECOMMENDATION

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ITU-T Recommendation G.8151/Y.1374 (G.tmpls-mgmt)

Management aspects of the T-MPLS network element

ITU-T Recommendation G.8151/Y.1374 (G.tmpls-mgmt)

Management aspects of the T-MPLS network element

Summary

This Recommendation addresses management aspects of the Transport MPLS capable network element containing transport functions of one or more of the layer networks of the transport MPLS network. The management of the transport MPLS 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.

1 Scope

This Recommendation addresses management aspects of the Transport MPLS (T-MPLS) capable network element containing transport functions of one or more of the layer networks of the T-MPLS network. The management of the T-MPLS 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. Further more, only the management information (MI) of the following T-MPLS equipment functions are addressed:

- T-MPLS layer connection function,
- T-MPLS layer trail termination functions,
- T-MPLS server to T-MPLS client adaptation functions,
- T-MPLS server to Ethernet client adaptation functions,
- SDH server to T-MPLS client adaptation functions,
- PDH server to T-MPLS client adaptation functions, and
- OTN sever to T-MPLS client adaptation functions.

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

The architecture described in this Recommendation for the management of T-MPLS 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.
- T-MPLS layer network entities (TMLNE) refer to trail termination, adaptation and connection functions as described in [ITU-T G.8110.1/Y.1370.1],
- a network element may only contain T-MPLS layer network entities,
- a network element may contain both T-MPLS layer network entities (TMLNE) 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 TMLNE may or may not share a common message communication function (MCF) and management application function (MAF) depending on application,
– CLNE and TMLNE 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; all 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] ITU-T Recommendation G.805 (2000), *Generic functional architecture of transport networks*.

[ITU-T G.806] ITU-T Recommendation G.806 (2006), *Characteristics of transport equipment – Description methodology and generic functionality*

[ITU-T G.7041/Y.1303] ITU-T Recommendation G.7041/Y.1303 (2005) and Amendment 1 (2006), *Generic framing procedure (GFP)*

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

[ITU-T G.7712/Y.1703] ITU-T Recommendation G.7712/Y.1703 (2003), *Architecture and specification of data communication network*

[ITU-T G.8110.1/Y.1370.1] ITU-T Recommendation G.8110.1/Y.1370.1 (2006), *Architecture of Transport MPLS (T-MPLS) layer network*.

[ITU-T G.8112/Y.1371] ITU-T Recommendation G.8112/Y.1371 (2006), *Interfaces for the Transport MPLS (T-MPLS) Hierarchy*.

[ITU-T G.8114/Y.1373] ITU-T Recommendation G.8114/Y.1373 (ex Y.17tom), (2007), Operation & Maintenance mechanisms for T-MPLS layer networks

[ITU-T G.8121/Y.1741] ITU-T Recommendation G.8121/Y.1741 (2006) and Amendment 1 (2007), *Characteristics of multi protocol label switched (MPLS) equipment functional blocks*

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

[ITU-T M.3010] ITU-T Recommendation M.3010 (2000) and Amendments, *Principles for a telecommunications management network*

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

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

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

[ITU-T X.701] ITU-T Recommendation X.701 (1997), *Information technology – Open Systems Interconnection – Systems management overview*.

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

[ITU-T X.735] ITU-T Recommendation X.735 (1992), 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 The following terms are defined in [ITU-T G.7710/Y.1701]:

- Local Craft Terminal
- Management Application Function (MAF)

3.1.2 The following terms are defined in [ITU-T G.7712/Y.1703]:

- Data Communication Network (DCN)

3.1.3 The following terms are defined in [ITU-T G.806]:

- Atomic Function (AF)
- Management Point (MP)

3.1.4 The following terms are defined in [ITU-T M.3010]:

- Network Element (NE)
- Network Element Function (NEF)
- Operations System (OS)
- Q-Interface
- Workstation Function (WF)

3.1.5 The following term is defined in [ITU-T M.3013]:

- Message Communication Function (MCF)

3.1.6 The following terms are defined in [ITU-T M.3100]:

- Alarm reporting;
- Alarm Reporting Control (ARC);
- Managed entity;
- Management interface;
- Persistence interval;
- Operations System (OS);
- Operations System Function (OSF);
- Qualified problem;
- Reset threshold report;

– Threshold report;
– Timed interval;

3.1.7 The following term is defined in [ITU-T X.700]:

– Managed Object (MO)

3.1.8 The following terms are defined in [ITU-T X.701]:

– Agent
– Manager
– Managed Object Class (MOC)

3.2 Terms defined in this Recommendation

This Recommendation defines or specializes the following terms:

3.2.1 T-MPLS Management Network (TM.MN): An T-MPLS Management Network is a subset of a TMN that is responsible for managing those parts of a network element that contain T-MPLS layer network entities. A TM.MN may be subdivided into a set of T-MPLS Management SubNetworks.

3.2.2 T-MPLS Management SubNetwork (TM.MSN): An T-MPLS **M**anagement SubNetwork (TM.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 T-MPLS transport topology. For T-MPLS, the physical channel supporting the ECC is the T-MPLS Management Communication Channel (MCC) as defined in [ITU-T G.8114/Y.1373]. A TM.MSN represents a T-MPLS specific Local Communication Network (LCN) portion of a network operator's overall Data Communication Network or TMN.

3.2.3 T-MPLS Network Element (TM.NE): That part of a network element that contains entities from one or more T-MPLS layer networks. A TM.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 TM.NE may be contained within an NE that also supports other layer networks. These layer network entities are considered to be managed separately from T-MPLS entities. As such they are not part of the TM.MN or TM.MSN.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

AcSL	Accepted Signal Label
AF	Atomic Function
AIS	Alarm Indication Signal
ALM	ALarM reporting
ARC	Alarm Reporting Control
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
FFS	For Further Study
GNE	Gateway Network Element
IP	Internet Protocol
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
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
MSN	Management SubNetwork
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
T-MPLS	Transport MPLS
TCM	Tandem Connection Monitoring
TM.MN	T-MPLS MN
TM.MSN	T-MPLS MSN
TM.C	T-MPLS Channel layer
TMN	Telecommunication Management Network
TM.NE	T-MPLS NE
TM.P	T-MPLS Path layer
TM.S	T-MPLS Section layer
TTM-n	T-MPLS Transport Module layer n
WAN	Wide Area Network
WS	WorkStation
WTR	Wait To Restore

5 Conventions

In this Recommendation, TM.MN stands for T-MPLS Management Network, TM.MSN for T-MPLS Management Subnetwork, TM.NE for T-MPLS NE, TM.C for T-MPLS Channel layer, TM.P for T-MPLS Path layer, and TM.S for T-MPLS Section layer.

6 T-MPLS management architecture

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

6.1 T-MPLS network management architecture

The transport layer networks of Transport-MPLS (T-MPLS) are described in [ITU-T G.8110.1/Y.1370.1], [ITU-T G.8112/Y.1371], and [ITU-T G.8114/Y.1373]. The management of the T-MPLS 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, TM.MN and TM.MSN

The T-MPLS Management Network (TM.MN) may be partitioned into T-MPLS Management SubNetworks (TM.MSNs). The inter-relationship between a management network, its subnetworks

and a TMN as generically described in section 6 of [ITU-T G.7710/Y.1701] is applicable to T-MPLS.

6.1.2 Access to the TM.MSN

See [ITU-T G.7710/Y.1701] section 6.1.2 for the generic requirements.

6.1.3 TM.MSN requirements

See [ITU-T G.7710/Y.1701] section 6.1.3 for the generic requirements.

In addition all TM.NEs must support Message Communication Functions (MCFs). The MCF of a TM.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 TM.NEs are required to terminate the TM.S-MCCs, see 6.1.8. In OSI terms, this means that each NE must be able to perform the functions of an end system.
- TM.NEs may also be required to forward management messages between ports according to routing control information held in the TM.NE. In OSI terms, this means that some TM.NEs may be required to perform the functions of an intermediate system.
- In addition to supporting interfaces for the TM.S-MCC, a TM.NE may also be required to support other DCN interfaces, which may include TM.P-MCCs or TM.C-MCCs or an Ethernet DCN interface.

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

6.1.4 TM.MSN Data Communication Network

Refer to [ITU-T G.7710/Y.1701] section 6.1.4 for the generic requirements.

6.1.4.1 Management Communication Channel

The TM.MN supports three Management Communication Channels (MCCs):

1) TM.S-MCC (MCC_S)

2) TM.P-MCC (MCC_P)

3) TM.C-MCC (MCC_C)

The general TM.S-, TM.P-, and TM.C-MCCs are defined in [ITU-T G.8114/Y.1373].

Figure 6-1 illustrates a network scenario consisting of two operators. Operator B provides a TM.P Service to operator A (i.e. Operator B transports the TM.P signal that begins and ends Operator A's domain). According to Amendment 1 of [ITU-T G.8110.1/Y.1370.1], the MCC_P and the MCC_C signals passed transparently through Operator B's network.

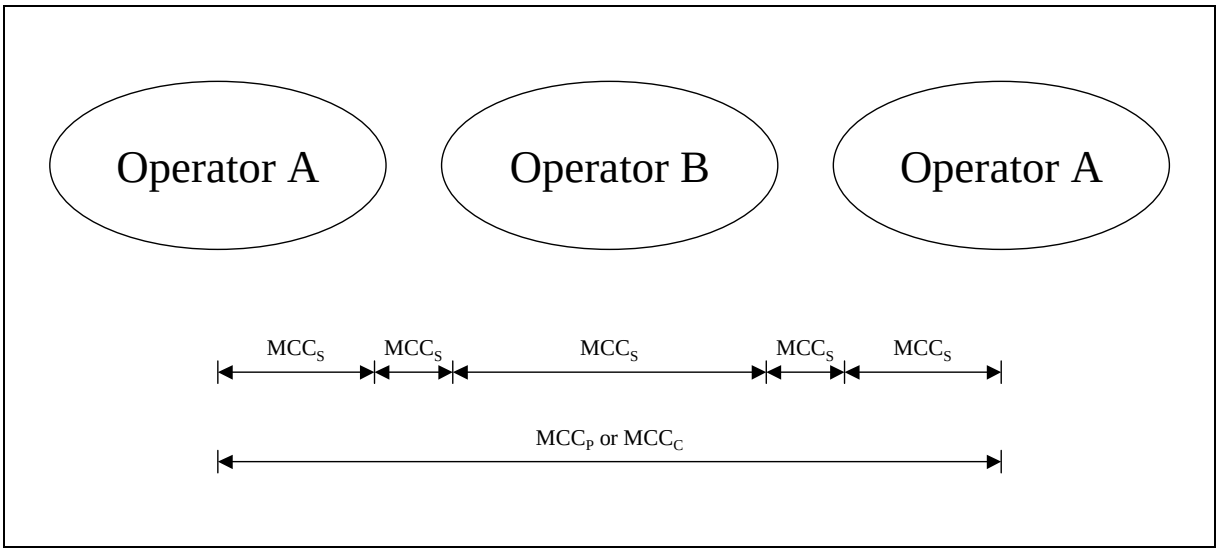

Figure 6-1/G.8151/Y.1374 – MCC scenarios

The physical layer is terminated in every network element and its related adaptation function provides the TM.S signals as well as the MCC_S. Hence, the MCC_S cannot cross administrative domains. In Figure 6-1, Figure 6-2, and Figure 6-3 illustrate scenarios where the MCC_P and MCC_C are transported transparently though Operator B's domain (the Operator B network elements are not shown in Figure 6-2 and Figure 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.

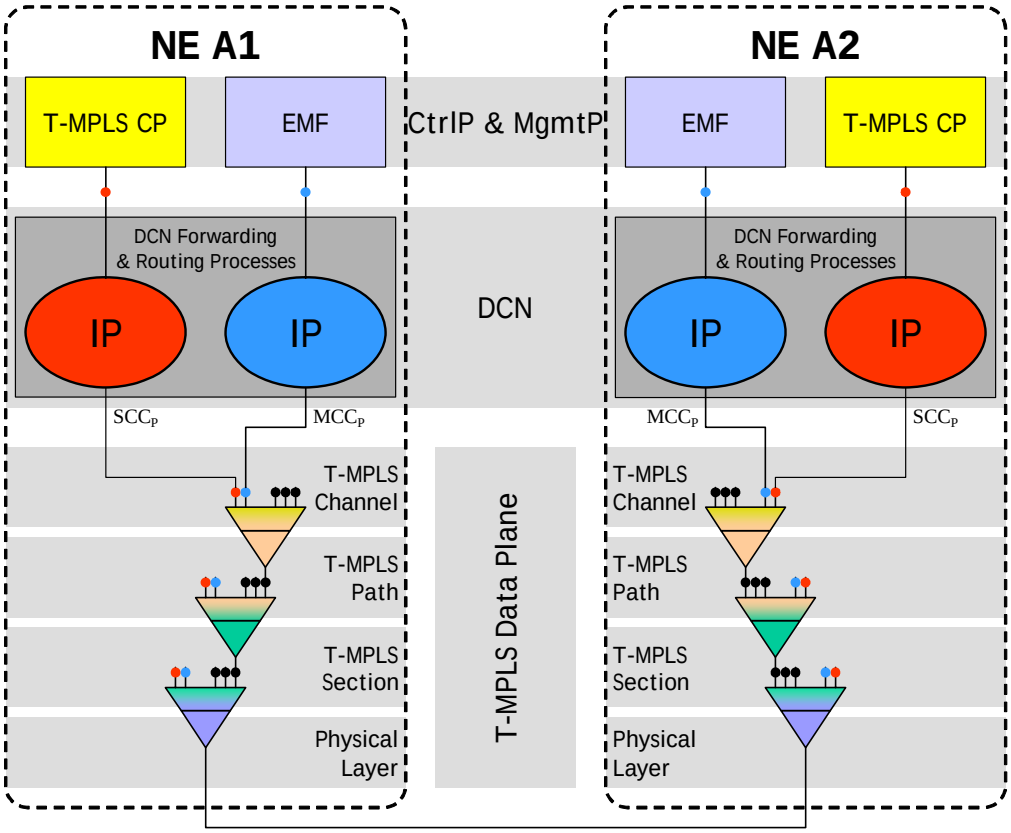

Figure 6-2/G.8151/Y.1374 – MCC$_P$ Scenario Example

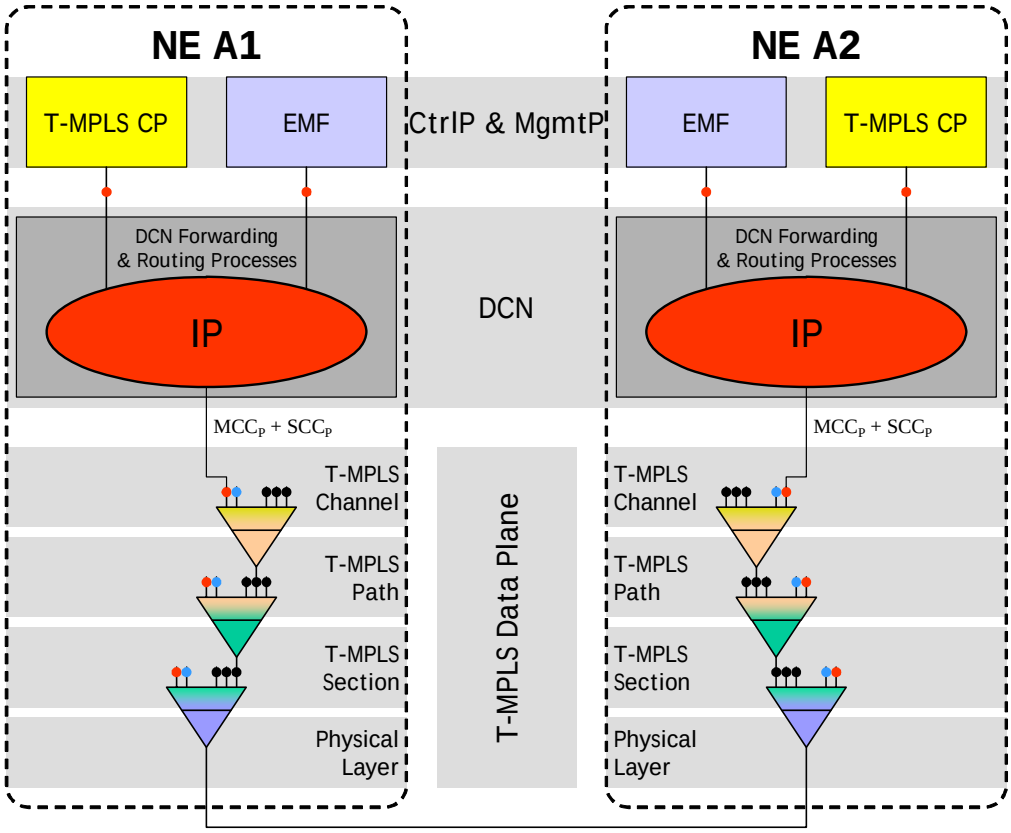

Figure 6-3/G.8151/Y.1374 – MCC_P Scenario Example

6.1.4.2 MCC physical characteristics

The TM.S-, TM.C- and TM.P-MCCs are logical elements within the T-MPLS Transport Module (TTM-n). The MCC provides general management communications between two T-MPLS network elements with access to the TM.S, TM.P, and TM.C characteristic information respectively. The TM.S-, TM.P-, or TM.C-MCC is provided by the T-MPLS OAM function at section, path, or channel layer as defined in [ITU-T G.8114/Y.1373] or by any other ECC of the T-MPLS transport network that is under study for [ITU-T G.7712/Y.1703].

The TM.S Management Communication Channel (MCC_S) shall operate as a single message channel between TM.S termination points. The bit rate of the MCC_S shall be configurable. Further details are under study for [ITU-T G.7712/Y.1703].

The TM.P Management Communication Channel (MCC_P) shall operate as a single message channel between any network elements that terminate the TM.P layer. The MCC_P is transported transparently through TM.NEs that only terminate the TM.S layer and forward the TM.P signal. The bit rate of the MCC_P shall be configurable. Further details are under study for [ITU-T G.7712/Y.1703].

The TMC Management Communication Channel (MCC_C) shall operate as a single message channel between any network elements that terminate the TM.C layer. The MCC_C is transported transparently through TM.NEs that only terminate the TM.S layer or the TM.S and TM.P layers and forward the TM.C signal. The bit rate of the MCC_C shall be configurable. Further details are under study for [ITU-T G.7712/Y.1703].

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/Y.1703].

6.1.5 Management of DCN

See [ITU-T G.7710/Y.1701] section 6.1.5 for the generic requirements.

6.1.6 Remote log-in

See [ITU-T G.7710/Y.1701] section 6.1.6 for the generic requirements.

6.1.7 Relationship between technology domains

See [ITU-T G.7710/Y.1701] section 6.1.7 for the generic requirements.

6.2 T-MPLS equipment management architecture

This section provides an overview of the minimum functions which are required to support inter-vendor/network communications and single-ended maintenance of TM.NEs within an MSN, or between communicating peer TM.NEs across a network interface. Single-ended maintenance is the ability to access remotely located TM.NEs to perform maintenance functions (see the Performance Management Applications, section 11.1of [ITU-T G.7710/Y.1701]).

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 T-MPLS Equipment Management Function (EMF) (see Figure 6-4) provides the means through which the T-MPLS 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 T-MPLS EMF.

The T-MPLS EMF interacts with the other atomic functions (refer to [ITU-T G.8121/Y.1741]) by exchanging information across the MP reference points. See [ITU-T G.806] and [ITU-T G.8121/Y.1741] for more information on Atomic Functions and on MPs. The T-MPLS 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.

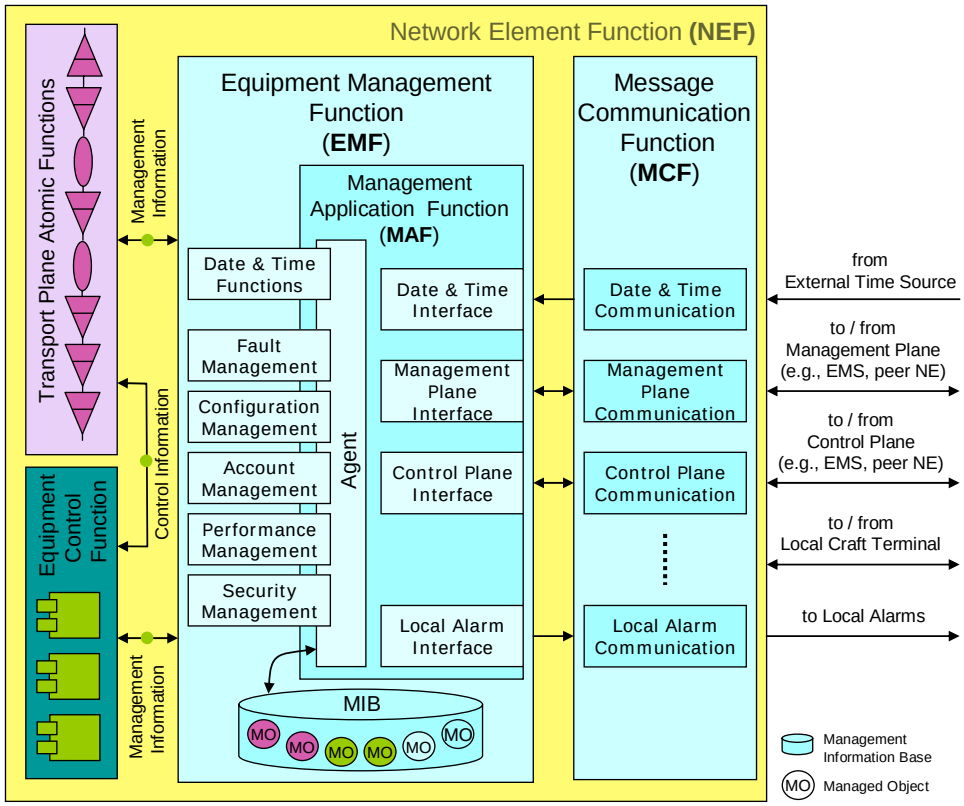

Figure 6.4/G.8151/Y.1374 – T-MPLS Equipment Management Function

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 T-MPLS 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/Y.1741].

The information flow over the MP reference points that arises from configuration and provisioning data is described in specific details for each atomic function in [ITU-T G.8121/Y.1741]. The information listed under Set refers to configuration and provisioning data that is passed from the T-

MPLS EMF to the atomic functions. The information listed under Get refers to status reports made in response to a request from the T-MPLS EMF for such information.

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/Y.1701] 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 analyzed 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/Y.1370.1], 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/Y.1701] for additional discussion of these categories.

The TM.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 [ITU-T G.7710/Y.1701] for a description of transmission supervision.

7.1.1.2 Quality of Service Supervision

See [ITU-T G.7710/Y.1701] for a description of quality of service supervision.

7.1.1.3 Processing Supervision

See [ITU-T G.7710/Y.1701] for a description of processing supervision.

7.1.1.4 Hardware Supervision

See [ITU-T G.7710/Y.1701] for a description of equipment supervision.

7.1.1.5 Environment Supervision

See [ITU-T G.7710/Y.1701] for a description of environmental supervision.

7.1.2 Validation

See [ITU-T G.7710/Y.1701] for a description of fault cause validation.

7.1.3 Alarm Handling

7.1.3.1 Severity Assignment

See [ITU-T G.7710/Y.1701] for a description of severity categories.

7.1.3.2 Alarm Reporting Control

Alarm Reporting Control (ARC) provides an automatic in-service provisioning capability.

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

ALM ALarM reporting; Alarm reporting is turned on.

NALM No ALarM reporting; Alarm reporting is turned off.

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

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

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

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

Alarm reporting may be turned off (using NALM, NALM-TI, or NALM-QI) on a per-managed entity basis to allow sufficient time for customer testing and other maintenance activities in an "alarm free" state. Once a managed entity is ready, alarm reporting is automatically turned on (to ALM). The managed entity may be automatically turned on either by using NALM-TI or NALM-QI and allowing the resource to transition out automatically, or by invoking first the NALM state from an EMS and when maintenance activity is done, invoking the ALM state. This 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/Y.1701] 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/Y.1701] for a description of local reporting.

7.1.3.4.2 TMN Reporting

See [ITU-T G.7710/Y.1701] for a description of TMN reporting.

7.2 Fault Management functions

Figure 7-1 contains the functional model of Fault Management inside the T-MPLS 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.

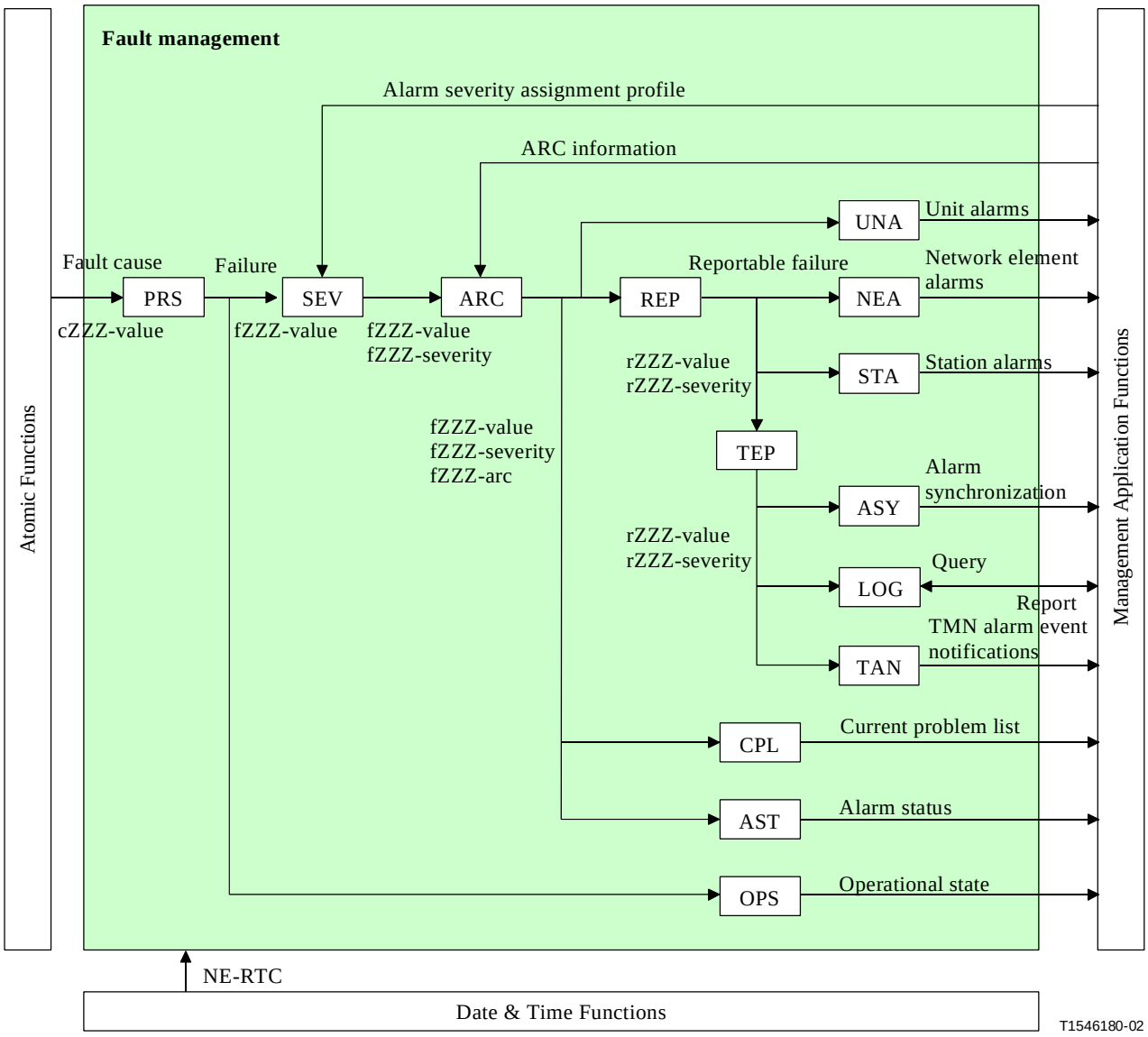

Figure 7-1/G.8151/Y.1374– Fault management within the T-MPLS NEF

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

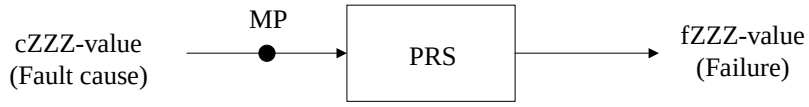

Figure 7-2/G.8151/Y.1374– Fault Cause Persistency function

Inputs and outputs

Table 7-1/G.8151/Y.1374– Inputs/outputs for the fault cause persistency function

Process (G.8121)	**Input**	**Output**
TM2_TT_Sk	cSSF cLCK cLOC[i] cMMG cUNM cUNP cUNPhb cDEG cRDI ~~cUnxCV~~ ~~cSSF~~	fSSF fLCK fLOC[i] fMMG fUNM fUNP fUNPhb fDEG fRDI ~~fUnxCV~~ ~~fSSF~~
Sn/TM_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
Sn-X-L/TM_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
Sm/TM_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
Sm-X-L/TM_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
Pq/TM_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
Pq-X-L/TM_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM

Process (G.8121)	**Input**	**Output**
ODUkP/TM_A_Sk	cPLM cLFD cEXM cUPM	fPLM fLFD fEXM fUPM
ODUkP-X-L/TM_A_Sk	cVcPLM cLFD cEXM cUPM	fVcPLM fLFD fEXM fUPM

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/Y.1701] 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/Y.1741].

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

ALM ALarM reporting; Alarm reporting is turned on.

NALM No ALarM reporting; Alarm reporting is turned off.

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

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

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

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

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

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

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

Table 7-2/G.8151/Y.1374– ARC specifications for T-MPLS

Atomic Function	Qualified Problems	QoS Reporting	Default State Value
TM2_TT_Sk	FFS	FFS	FFS
Sn/TM_A_Sk	FFS	FFS	FFS
Sn-X-L/TM_A_Sk	FFS	FFS	FFS
Sm/TM_A_Sk	FFS	FFS	FFS
Sm-X-L/TM_A_Sk	FFS	FFS	FFS
Pq/TM_A_Sk	FFS	FFS	FFS
Pq-X-L/TM_A_Sk	FFS	FFS	FFS
ODUkP/TM_A_Sk	FFS	FFS	FFS
ODUkP-X-L/TM_A_Sk	FFS	FFS	FFS

7.2.4 Reportable Failure function – REP

See [ITU-T G.7710/Y.1701] for a description of the reportable failure function.

7.2.5 Unit Alarms function – UNA

See [ITU-T G.7710/Y.1701] for a description of the unit alarms function.

7.2.6 Network Element Alarms function – NEA

See [ITU-T G.7710/Y.1701] for a description of the network element alarms function.

7.2.7 Station Alarms function – STA

See [ITU-T G.7710/Y.1701] for a description of the station alarms function.

7.2.8 TMN Event Pre-processing function – TEP

See [ITU-T G.7710/Y.1701] for a description of the TMN event pre-processing function.

7.2.9 Alarm Synchronization function – ASY

See [ITU-T G.7710/Y.1701] 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/Y.1701] for a description of the logging function.

7.2.11 TMN Alarm Event Notification function – TAN

See [ITU-T G.7710/Y.1701] for a description of the TMN alarm event notification function.

7.2.12 Current Problem List function – CPL

See [ITU-T G.7710/Y.1701] for a description of the current problem list function

7.2.13 Alarm Status function – AST

See [ITU-T G.7710/Y.1701] for a description of the alarm status function

7.2.14 Operational State function – OPS

See [ITU-T G.7710/Y.1701] for a description of the operational state function.

7.2.15 External Events

For further study

8 Configuration management

See [ITU-T G.7710/Y.1701] for the generic requirements for configuration management. T-MPLS specific specifications, if needed, are explicitly described.

8.1 Hardware

See [ITU-T G.7710/Y.1701] for a description of hardware management.

8.2 Software

See [ITU-T G.7710/Y.1701] for a description of software management.

8.3 Protection Switching

For further study

8.4 Trail Termination

See [ITU-T G.7710/Y.1701] for a description of trail termination management.

This function allows a user to provision and monitor the operation of the T-MPLS Trail Termination process.

The MI signals listed in the following table are communicated between the EMF and the T-MPLS Trail Termination process across the management point within the TM.NE.

Table 8-1/G.81~~0~~51/Y.1374 – Provisioning and reporting for termination functions

MI Signal	Value Range	Default Value
Provisioning		
TM2_TT_So_MI_CV_Enable	true, false	~~true~~false

MI Signal	Value Range	Default Value
TM2_TT_So_MI_CV_MEG_ID	13 byte string	--
TM2_TT_So_MI_CV_MEP_ID	13 bit string	--
TM2_TT_So_MI_CV_PHB	Note-1	Note-1
TM2_TT_So_MI_CV_Period	3.33 msec, 10 msec, 100 msec, 1sec, 10 sec, 1 min, 10 min	1sec
TM2_TT_So_MI_TTLVALUE ~~(See G.8114)~~	0..255	255~~1~~
Provisioning		
TM2_TT_Sk_MI_CV_MEG_ID	13 byte string	--
~~TM2_TT_Sk_MI_CV_MEP_ID~~	~~13 bit string~~	~~--~~
TM2_TT_Sk_MI_CV_PeerMEP_ID[]	List of 13 bit string	Empty list
TM2_TT_Sk_MI_CV_Enable	true, false	~~true~~false
TM2_TT_Sk_MI_CV_Period	3.33 msec, 10 msec, 100 msec, 1sec, 10 sec, 1 min, 10 min	1sec
TM2_TT_Sk_MI_CV_PHB	Note-1	Note-1
TM2_TT_Sk_MI_LM_Enable	true, false	false
TM2_TT_Sk_MI_Get_SvdCV	--	--
TM2_TT_Sk_MI_LM_DEGM	2-10; See Table 7-1/G.806	10
TM2_TT_Sk_MI_LM_M	2-10	10
TM2_TT_Sk_MI_LM_DEGTHR	0% .. 100%; See Table 7-1/G.806	30%
TM2_TT_Sk_MI_1second	--	--
TM2_TT_Sk_MI_SSF_Reported	true, false	false
TM2_TT_Sk_MI_RDI_Reported	true, false	false
Reporting		
TM2_TT_Sk_MI_SvdCV	Last received CV frame that caused defect	--

Note-1: According to [ITU-T G.8121/Y.1741].

The EMF shall support the following 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

8.5 Adaptation

See section 8.5 of [ITU-T G.7710/Y.1701] 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 T-MPLS 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 T-MPLS NE.

Table 8-2/G.8151/Y.1374 – Provisioning and reporting for adaptation functions

MI Signal	Value Range	Default Value
Provisioning		
TM/TM_A_So_MI_SCCType (See Table 6-3 of G.7041)	0..255	32
TM/TM_A_So_MI_Label [1…M]	16 to (2**20)-1	--
TM/TM_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	--
TM/TM_A_So_MI_PSC[1…M]	Note-1	Note-1
TM/TM_A_So_MI_PHB2EXPMapping[1…M]	Note-1	Note-1
TM/TM_A_So_MI_QoSEncodingMode[1…M]	A, B	--
Provisioning		
TM/TM_A_Sk_MI_SCCType	0..255	32
TM/TM_A_Sk_MI_Label [1…M]	16 to (2**20)-1	--
TM/TM_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	--
TM/TM_A_Sk_MI_PSC[1…M]	Note-1	Note-1
TM/TM_A_Sk_MI_ EXP2PHBMapping[1…M]	Note-1	Note-1
TM/TM_A_Sk_MI_QoSDecodingMode[1…M]	A, B	--
Provisioning		
TM/ETH_A_So_MI_FCSEnable	true, false	true
TM/ETH_A_So_MI_CIIEnable	true, false	false
TM/ETH_A_So_MI_SQUse	true, false	false
TM/ETH_A_So_MI_PRI2PSCMapping	Note-1	Note-1
Provisioning		
TM/ETH_A_Sk_MI_FCSEnable	true, false	true
TM/ETH_A_Sk_MI_CIIEnable	true, false	false
TM/ETH_A_Sk_MI_SQCheck	true, false	false
TM/ETH_A_Sk_MI_QoSTransitMode	X, Y	--
TM/ETH_A_Sk_MI_PSC2PRIMapping	Note-1	Note-1
Provisioning		
Sn/TM_A_So_MI_SCCType	0..255	32
Sn/TM_A_So_MI_Label[1…M]	16 to (2**20)-1	--
Sn/TM_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	--
Sn/TM_A_So_MI_PSC[1…M]	Note-1	Note-1

MI Signal	Value Range	Default Value
Sn/TM_A_So_PHB2EXPMapping[1…M]	Note-1	Note-1
Sn/TM_A_So_MI_QoSEncodingMode[1…M]	A, B	--
Provisioning		
Sn/TM_A_Sk_MI_SCCType	0..255	32
Sn/TM_A_Sk_MI_Label[1…M]	16 to (2**20)-1	--
Sn/TM_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	--
Sn/TM_A_Sk_MI_PSC[1…M]	Note-1	Note-1
Sn/TM_A_Sk_MI_EXP2PHBMapping[1…M]	Note-1	Note-1
Sn/TM_A_Sk_MI_QoSDecodingMode[1…M]	A, B	--
Reporting		
Sn/TM_A_Sk_MI_AcSL (see Table 9-11 of G.707)	0..255	--
Sn/TM_A_Sk_MI_AcEXI (see Table 6-2 of G.7041)	0..15	--
Sn/TM_A_Sk_MI_LastValidUPI (see Table 6-3 of G.7041)	0..255	--
Provisioning		
Sn-X-L/TM_A_So_MI_SCCType (See Table 6-3 of G.7041)	0..255	32
Sn-X-L/TM_A_So_MI_Label[1…M]	16 to (2**20)-1	--
Sn-X-L/TM_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	--
Sn-X-L/TM_A_So_MI_PSC[1…M]	Note-1	Note-1
Sn-X-L/TM_A_So_PHB2EXPMapping[1…M]	Note-1	Note-1
Sn-X-L/TM_A_So_MI_QoSEncodingMode[1…M]	A, B	--
Provisioning		
Sn-X-L/TM_A_Sk_MI_SCCType (See Table 6-3 of G.7041)	0..255	32
Sn-X-L/TM_A_Sk_MI_Label[1…M]	16 to (2**20)-1	--
Sn-X-L/TM_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	--
Sn-X-L/TM_A_Sk_MI_PSC[1…M]	Note-1	Note-1
Sn-X-L/TM_A_Sk_MI_EXP2PHBMapping[1…M]	Note-1	Note-1
Sn-X-L/TM_A_Sk_MI_QoSDecodingMode[1…M]	A, B	--
Reporting		
Sn-X-L/TM_A_Sk_MI_AcSL (see Table 9-11 of G.707)	0..255	--
Sn-X-L/TM_A_Sk_MI_AcEXI (see Table 6-2 of G.7041)	0..15	--
Sn-X-L/TM_A_Sk_MI_LastValidUPI (see Table 6-3 of G.7041)	0..255	--
Provisioning		
Sm/TM_A_So_MI_SCCType	0..255	32
Sm/TM_A_So_MI_Label[1…M]	16 to (2**20)-1	--
Sm/TM_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	--
Sm/TM_A_So_MI_PSC[1…M]	Note-1	Note-1
Sm/TM_A_So_PHB2EXPMapping[1…M]	Note-1	Note-1
Sm/TM_A_So_MI_QoSEncodingMode[1…M]	A, B	--
Provisioning		

MI Signal	Value Range	Default Value
Sm/TM_A_Sk_MI_SCCType	0..255	32
Sm/TM_A_Sk_MI_Label[1…M]	16 to (2**20)-1	--
Sm/TM_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	--
Sm/TM_A_Sk_MI_PSC[1…M]	Note-1	Note-1
Sm/TM_A_Sk_MI_EXP2PHBMapping[1…M]	Note-1	Note-1
Sm/TM_A_Sk_MI_QoSDecodingMode[1…M]	A, B	--
Reporting		
Sm/TM_A_Sk_MI_AcSL (see Table 9-12 and Table 9-13 of G.707)	0..255	--
Sm/TM_A_Sk_MI_AcEXI (see Table 6-2 of G.7041)	0..15	--
Sm/TM_A_Sk_MI_LastValidUPI (see Table 6-3 of G.7041)	0..255	--
Provisioning		
Sm-X-L/TM_A_So_MI_SCCType	0..255	32
Sm-X-L/TM_A_So_MI_Label[1…M]	16 to (2**20)-1	--
Sm-X-L/TM_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	--
Sm-X-L/TM_A_So_MI_PSC[1…M]	Note-1	Note-1
Sm-X-L/TM_A_So_PHB2EXPMapping[1…M]	Note-1	Note-1
Sm-X-L/TM_A_So_MI_QoSEncodingMode[1…M]	A, B	--
Provisioning		
Sm-X-L/TM_A_Sk_MI_SCCType	0..255	32
Sm-X-L/TM_A_Sk_MI_Label[1…M]	16 to (2**20)-1	--
Sm-X-L/TM_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	--
Sm-X-L/TM_A_Sk_MI_PSC[1…M]	Note-1	Note-1
Sm-X-L/TM_A_Sk_MI_EXP2PHBMapping[1…M]	Note-1	Note-1
Sm-X-L/TM_A_Sk_MI_QoSDecodingMode[1…M]	A, B	--
Reporting		
Sm-X-L/TM_A_Sk_MI_AcSL	0..255	--
Sm-X-L/TM_A_Sk_MI_AcEXI	0..15	--
Sm-X-L/TM_A_Sk_MI_LastValidUPI	0..255	--
Provisioning		
Pq/TM_A_So_MI_SCCType	0..255	32
Pq/TM_A_So_MI_Label[1…M]	16 to (2**20)-1	--
Pq/TM_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	--
Pq/TM_A_So_MI_PSC[1…M]	Note-1	Note-1
Pq/TM_A_So_PHB2EXPMapping[1…M]	Note-1	Note-1
Pq/TM_A_So_MI_QoSEncodingMode[1…M]	A, B	--
Provisioning		
Pq/TM_A_Sk_MI_SCCType	A, B	--
Pq/TM_A_Sk_MI_Label[1…M]	A, B	--

MI Signal	Value Range	Default Value
Pq/TM_A_Sk_MI_LSPType[1…M]	A, B	--
Pq/TM_A_Sk_MI_PSC[1…M]	Note-1	Note-1
Pq/TM_A_Sk_MI_EXP2PHBMapping[1…M]	Note-1	Note-1
Pq/TM_A_Sk_MI_QoSDecodingMode[1…M]	A, B	--
Reporting		
Pq/TM_A_Sk_MI_AcSL (see Clause 2.1.2 of G.832)	0..7	--
Pq/TM_A_Sk_MI_AcEXI (see Table 6-2 of G.7041)	0..15	--
Pq/TM_A_Sk_MI_LastValidUPI (see Table 6-3 of G.7041)	0..255	--
Provisioning		
Pq-X-L/TM_A_So_MI_SCCType	0..255	32
Pq-X-L/TM_A_So_MI_Label[1…M]	16 to (2**20)-1	--
Pq-X-L/TM_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	--
Pq-X-L/TM_A_So_MI_PSC[1…M]	Note-1	Note-1
Pq-X-L/TM_A_So_PHB2EXPMapping[1…M]	Note-1	Note-1
Pq-X-L/TM_A_So_MI_QoSEncodingMode[1…M]	A, B	--
Provisioning		
Pq-X-L/TM_A_Sk_MI_SCCType	0..255	32
Pq-X-L/TM_A_Sk_MI_Label[1…M]	16 to (2**20)-1	--
Pq-X-L/TM_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	--
Pq-X-L/TM_A_Sk_MI_PSC[1…M]	Note-1	Note-1
Pq-X-L/TM_A_Sk_MI_EXP2PHBMapping[1…M]	Note-1	Note-1
Pq-X-L/TM_A_Sk_MI_QoSDecodingMode[1…M]	A, B	--
Reporting		
Pq-X-L/TM_A_Sk_MI_AcSL	0..7	--
Pq-X-L/TM_A_Sk_MI_AcEXI	0..15	--
Pq-X-L/TM_A_Sk_MI_LastValidUPI	0..255	--
Provisioning		
ODUkP/TM_A_So_MI_Active	true, false	false
ODUkP/TM_A_So_MI_SCCType	0..255	32
ODUkP/TM_A_So_MI_Label[1…M]	16 to (2**20)-1	--
ODUkP/TM_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	--
ODUkP/TM_A_So_MI_PSC[1…M]	Note-1	Note-1
ODUkP/TM_A_So_PHB2EXPMapping[1…M]	Note-1	Note-1
ODUkP/TM_A_So_MI_QoSEncodingMode[1…M]	A, B	--
Provisioning		
ODUkP/TM_A_Sk_MI_Active	true, false	false
ODUkP/TM_A_Sk_MI_SCCType	0..255	32
ODUkP/TM_A_Sk_MI_Label[1…M]	16 to (2**20)-1	--
ODUkP/TM_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	--

MI Signal	Value Range	Default Value
ODUkP/TM_A_Sk_MI_PSC[1…M]	Note-1	Note-1
ODUkP/TM_A_Sk_MI_EXP2PHBMapping[1…M]	Note-1	Note-1
ODUkP/TM_A_Sk_MI_QoSDecodingMode[1…M]	A, B	--
Reporting		
ODUkP/TM_A_Sk_MI_AcPT (see Table 15-8 of G.709)	0..255	--
ODUkP/TM_A_Sk_MI_AcEXI (see Table 6-2 of G.7041)	0..15	--
ODUkP/TM_A_Sk_MI_LastValidUPI (see Table 6-3 of G.7041)	0..255	--
Provisioning		
ODUkP-X-L/TM_A_So_MI_Active	true, false	false
ODUkP-X-L/TM_A_So_MI_SCCType	0..255	32
ODUkP-X-L/TM_A_So_MI_Label[1…M]	16 to (2**20)-1	--
ODUkP-X-L/TM_A_So_MI_LSPType[1…M]	E-LSP, L-LSP	--
ODUkP-X-L/TM_A_So_MI_PSC[1…M]	Note-1	Note-1
ODUkP-X-L/TM_A_So_PHB2EXPMapping[1…M]	Note-1	Note-1
ODUkP-X-L/TM_A_So_MI_QoSEncodingMode[1…M]	A, B	--
Provisioning		
ODUkP-X-L/TM_A_Sk_MI_Active	true, false	false
ODUkP-X-L/TM_A_Sk_MI_SCCType	0..255	32
ODUkP-X-L/TM_A_Sk_MI_Label[1…M]	16 to (2**20)-1	--
ODUkP-X-L/TM_A_Sk_MI_LSPType[1…M]	E-LSP, L-LSP	--
ODUkP-X-L/TM_A_Sk_MI_PSC[1…M]	Note-1	Note-1
ODUkP-X-L/TM_A_Sk_MI_EXP2PHBMapping[1…M]	Note-1	Note-1
ODUkP-X-L/TM_A_Sk_MI_QoSDecodingMode[1…M]	A, B	--
Reporting		
ODUkP-X-L/TM_A_Sk_MI_AcVcPT (see Table 15-8 of G.709)	0..255	--
ODUkP-X-L/TM_A_Sk_MI_AcEXI (see Table 6-2 of G.7041)	0..15	--
ODUkP-X-L/TM_A_Sk_MI_LastValidUPI (see Table 6-3 of G.7041)	0..255	--

Note-1: According to [ITU-T G.8121/Y.1741]

The EMF shall support the following functions:

- Provisioning the flow forwarding management information
- Retrieving the flow forwarding management information
- Notifying the changes of the flow forwarding management information

8.6 Connection

See section 8.6 of [ITU-T G.7710/Y.1701] for a description of connection management.

This function allows a user to provision the operation of a T-MPLS Connection process.

The MI signals listed in the following table are communicated from the EMF to the Connection process through the management point.

Table 8-3/G.8151/Y.1374 – Provisioning and reporting for connection functions

MI Signal	Value Range	Default Value
Provisioning (Per matrix connection)		
TM_C_MI_ConnectionType	Protected, unprotected	--
TM_C_MI_Return_CP_ID	NULL (for unidirectional), or the Connection point (CP) identifier (for bidirectional)	--
TM_C_MI_ConnectionPortIds	Set of connection point identifiers	--

Note-1: According to [ITU-T G.8121/Y.1741]

The EMF shall support the following functions:

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

8.7 DEG Thresholds

For further study

8.8 XXX_Reported

See section 8.8 of [ITU-T G.7710/Y.1701] for a description of XXX_Reported management.

Table 9-4 below provides the MI signals that need to be provisioned for consequential defect/failure.

Table 8-4/G.8151/Y.1374– Consequential defect/failure related provisioning

MI signal	Value range	Default value
MI_SSF_Reported	true, false	false
MI_BDI_Reported	true, false	false

8.9 Alarm Severity

See section 8.9 of [ITU-T G.7710/Y.1701] for a description of alarm severity.

8.10 Alarm Reporting Control (ARC)

See section 8.10 of [ITU-T G.7710/Y.1701] for a description of alarm report control.

8.11 PM Thresholds

For further study

8.12 TCM Activation

For further study

8.13 Date & Time

The Date and Time Functions within the T-MPLS EMF comprise the local Real Time Clock (RTC) function and the Performance Monitoring Clock (PMC) function. The Message Communication Function within the T-MPLS 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, e.g. to time stamp event reports. They obtain this information from the Date & Time Function.

8.13.1 Date & Time Applications

Section 8.13.1 of [ITU-T G.7710/Y.1701] identifies three Date & Time applications. These are:

– Time stamping

– Performance Monitoring Clock signals

– Activity scheduling

The T-MPLS NEF functional requirements for these applications are specified in the following subsections.

8.13.1.1 Time-stamping

See section 8.13.1.1 of [ITU-T G.7710/Y.1701] for a description of the time-stamping application.

8.13.1.2 Performance Monitoring Clock Signals

See section 8.13.1.2 of [ITU-T G.7710/Y.1701] for a description of the PMC signals.

8.13.1.3 Activity Scheduling

See section 8.13.1.3 of [ITU-T G.7710/Y.1701] for a description of the activity scheduling.

8.13.2 Date & Time Functions

There are three Date & 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.

8.13.2.1 Local Real Time Clock Function

The local Real Time Clock function is specified in section 8.13.2.1 of [ITU-T G.7710/Y.1701].

8.13.2.2 Local Real Time Clock alignment function with External Time Reference

The Local Real Time Clock alignment function with External Time Reference is specified in section 8.13.2.2 of [ITU-T G.7710/Y.1701].

8.13.2.3 Performance Monitoring Clock Function

The Performance Monitoring Clock function is specified in section 8.13.2.3 of [ITU-T G.7710/Y.1701].

9 Accounting Management

For further study

10 Performance Management

See [ITU-T G.7710/Y.1701] Clause 10 for the generic requirements for performance management. T-MPLS specific management requirements are described below.

10.1 Performance management applications

See [ITU-T G.7710/Y.1701] Clause 10.1 for the generic description for performance management applications.

10.2 Performance monitoring functions

See [ITU-T G.7710/Y.1701] Clause 10.2 for generic requirements of performance monitoring functions.

T-MPLS NE provides the following PM management information.

Table 10-1/G.8151/Y.1374 – PM Management Information

PM Management Information	G.8121 Function
TM2_TT_Sk_MI_pN_FL TM2_TT_Sk_MI_pN_TF TM2_TT_Sk_MI_pF_FL TM2_TT_Sk_MI_pF_TF TM2_TT_Sk_MI_pF_DS TM2_TT_Sk_MI_pN_DS	TM2_TT_Sk

The EMF shall support the following functions:

– Notifying of the PM management information

11 Security management

See [ITU-T G.7710/Y.1701] for a description of security management.