

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.8151/Y.1374

Amendment 1
(04/2016)

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 OF
THINGS AND SMART CITIES

Internet protocol aspects – Transport

Management aspects of the MPLS-TP network
element

Amendment 1

Recommendation ITU-T G.8151/Y.1374 (2015) –
Amendment 1

ITU-T

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

Recommendation ITU-T G.8151/Y.1374

Management aspects of the MPLS-TP network element

Amendment 1

Summary

Recommendation ITU-T G.8151/Y.1374 addresses management aspects of the multi-protocol label switching (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 edition 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 operation, administration and maintenance (OAM) protocol neutral equipment functionality as defined in Recommendation ITU-T G.8121/Y.1381.

This Amendment 1 to the 2015 edition:

- Adds cFOP related MI signals for Fault Cause Persistency function in Table 7-1, Alarm Reporting Control function in Table 7-2, Operational State function in Table 7-3 to align with ITU-T G.8121/Y.1381.
- Adds the APS related MI signals for provisioning and reporting for connection functions in Table 8-4 to align with ITU-T G.8121/Y.1381.
- Removes APS related MI signals for provisioning and reporting for adaptation functions Table 8-2 to align with ITU-T G.8121/Y.1381.
- Adds new MI signals of intermediate request for LMo, DMo, SLo, and 1DMo to Table 8-3 to align with ITU-T G.8121/Y.1381.
- Adds new MI signals for proactive measurements to Table 8-1, to align with ITU-T G.8121/Y.1381, as:
- Adds MT_TT_ {So/Sk}_1SLp
- Adds MT_TT_ {So/Sk}_MI_1LMp_Enable (Also Removed MT_TT_ {So/Sk}_LMC_Enable from Table 8-1.1)
- Adds [1...M] to MT_TT_ {So/Sk}_ {LMp/DMp/1DMp/1SLp}_OAM_Tool
- Renames ODCV to CV in Table 8-3.2 to align with ITU-T G.8121.2/Y.1381.2.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.8151/Y.1374	2007-10-22	15	11.1002/1000/9188
2.0	ITU-T G.8151/Y.1374	2012-07-22	15	11.1002/1000/11518
2.1	ITU-T G.8151/Y.1374 (2012) Amd. 1	2012-10-29	15	11.1002/1000/11811
2.2	ITU-T G.8151/Y.1374 (2012) Amd. 2	2013-10-07	15	11.1002/1000/12017
3.0	ITU-T G.8151/Y.1374	2015-01-13	15	11.1002/1000/12386
3.1	ITU-T G.8151/Y.1374 (2015) Amd. 1	2016-04-13	15	11.1002/1000/12825

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

FOREWORD

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

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

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

NOTE

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

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T G.8151/Y.1374

Management aspects of the MPLS-TP network element

Amendment 1

Editorial note: This is a complete-text publication. Modifications introduced by this amendment are shown in revision marks relative to Recommendation ITU-T G.8151 (2015).

1 Scope

This Recommendation addresses management aspects of the multi-protocol label switching (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 edition 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 (NEs) 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;
- Synchronous digital hierarchy (SDH) server to MPLS-TP client adaptation functions;
- Plesiochronous digital hierarchy (PDH) server to MPLS-TP client adaptation functions;
- Optical transport network (OTN) sever to MPLS-TP client adaptation functions;
- Ethernet MAC layer (ETH) sever 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 on 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 (MTLNEs) 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 MTLNEs and client layer network entities (CLNEs);

- Client layer entities are managed as part of their own logical domain (e.g., Ethernet management network);
- CLNEs and MTLNEs may or may not share a common message communication function (MCF) and management application function (MAF) depending on the application;
- CLNE and MTLNE may or may not share the same agent;
- Server layer network entities (SLNEs) and MTLNEs 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; 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.707] Recommendation ITU-T G.707/Y.1322 (2007), *Network node interface for the synchronous digital hierarchy (SDH)*.
- [ITU-T G.709] Recommendation ITU-T G.709/Y.1331 (2012), *Interfaces for the optical transport network*.
- [ITU-T G.805] Recommendation ITU-T G.805 (2000), *Generic functional architecture of transport networks*.
- [ITU-T G.806] Recommendation ITU-T G.806 (2012), *Characteristics of transport equipment – Description methodology and generic functionality*.
- [ITU-T G.7041] Recommendation ITU-T G.7041/Y.1303 (2011), *Generic framing procedure*.
- [ITU-T G.7044] Recommendation ITU-T G.7044/Y.1347 (2011), *Hitless adjustment of ODUflex(GFP)*.
- [ITU-T G.7710] Recommendation ITU-T G.7710/Y.1701 (2012), *Common equipment management function requirements*.
- [ITU-T G.7712] Recommendation ITU-T G.7712/Y.1703 (2010), *Architecture and specification of data communication network*.
- [ITU-T G.8013] Recommendation ITU-T G.8013/Y.1731 (~~2013~~[2015](#)), *OAM functions and mechanisms for Ethernet based networks*.
- [ITU-T G.8051] Recommendation ITU-T G.8051/Y.1345 (2013), *Management aspects of the Ethernet Transport (ET) capable network element*.
- [ITU-T G.8110.1] Recommendation ITU-T G.8110.1/Y.1370.1 (2011), *Architecture of Multi-Protocol Label Switching transport profile layer network*.
- [ITU-T G.8113.1] Recommendation ITU-T G.8113.1/Y.1372.1 (2016~~1~~), *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 (2015~~2~~), *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 (2016⁶³), *Characteristics of MPLS-TP equipment functional blocks.*
- [ITU-T G.8121.1] Recommendation ITU-T G.8121.1/Y.1381.1 (2016⁶³), *Characteristics of MPLS-TP equipment functional blocks supporting ITU-T G.8113.1/Y.1372.1 OAM mechanisms.*
- [ITU-T G.8121.2] Recommendation ITU-T G.8121.2/Y.1381.2 (2016⁶³), *Characteristics of MPLS-TP equipment functional blocks supporting ITU-T G.8113.2/Y.1372.2 OAM mechanisms.*
- [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.*
- [ITU-T Y.1563] Recommendation ITU-T Y.1563 (2009), *Ethernet frame transfer and availability performance.*

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:** [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:** [ITU-T M.3010]
- 3.1.18 **operations system function:** [ITU-T M.3010]
- 3.1.19 **persistence interval:** [ITU-T M.3100]
- 3.1.20 **Q interface:** [ITU-T M.3010]
- 3.1.21 **qualified problem:** [ITU-T M.3100]
- 3.1.22 **timed interval:** [ITU-T M.3100]
- 3.1.23 **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 telecommunication management network (TMN) that is responsible for managing the 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 (ECCs) and associated intra-site data communication links, which are interconnected to form a data communication 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 an MPLS-TP specific local communication network (LCN) portion of a network operator's overall DCN or telecommunication management network (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 (NEFs) and may also support an operations system function (OSF). It contains managed objects (MOs), a message communication function (MCF) and a management application function (MAF). The functions of a MT.NE may be contained within a network element (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 MPLS-TP management network (MT.MN) or MPLS-TP management subnetwork (MT.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
CC	Continuity Check
CLNE	Client Layer Network Entity
CoS	Class of Service
CP	Connection Point
CTP	Connection Termination Point
CtrlP	Control Plane
DCN	Data Communication Network
DEG	Degraded
DLM	Direct Loss Measurement
ECC	Embedded Communication Channel
E-LSP	Explicitly TC-encoded-PSC LSP
EMF	Equipment Management Function
EML	Element Management Layer
EMS	Element Management System
ETH	Ethernet MAC Layer
FCAPS	Fault Management, Configuration Management, Account Management, Performance Management and Security Management
FLR	Frame Loss Ratio
GNE	Gateway Network Element
ILM	Inferred Loss Measurement
IP	Internet Protocol
LAN	Local Area Network
LCK	Locked
LCN	Local Communication Network
LCT	Local Craft Terminal
L-LSP	Label-only-inferred PSC LSP
LSP	Label Switched Path
MAC	Media Access Control
MAF	Management Application Function
MCC	Management Communication Channel
MCF	Message Communication Function
MD	Mediation Device
MEP	Maintenance entity group End Point
MF	Mediation Function
MI	Management Information
MIB	Management Information Base



MIP	Maintenance entity group Intermediate Point
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
MTLNE	MPLS-TP Layer Network Entity
MTM-n	MPLS-TP Transport Module layer n
N/A	Not Applicable
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 and Maintenance
OAMP	Operations, Administration, Maintenance and Provisioning
OS	Operations System
OSF	Operations System Function
OSI	Open Systems Interconnection
OTN	Optical Transport Network
PDH	Plesiochronous Digital Hierarchy
PHB	Per Hop Behaviour
PMC	Performance Monitoring Clock
PSC	PHB Scheduling Class
PW	Pseudowire

QoS	Quality of Service
RTC	Real-Time Clock
RTR	Reset Threshold Report
SCC	Signalling Communication Channel
SDH	Synchronous Digital Hierarchy
SES	Severely Errored Seconds
SLNE	Server Layer Network Entity
TC	Traffic Class
TCM	Tandem Connection Monitoring
TLV	Type Length Value
TMN	Telecommunication Management Network
TR	Threshold Report
TTL	Time-To-Live
TTP	Trail Termination Point
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 telecommunication management network (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 management communication channels (MCCs), or over other data communication network (DCN) interfaces. In addition:

- All MT.NEs are required to terminate the MT.S-MCCs. In open systems interconnection (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, 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 in 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.

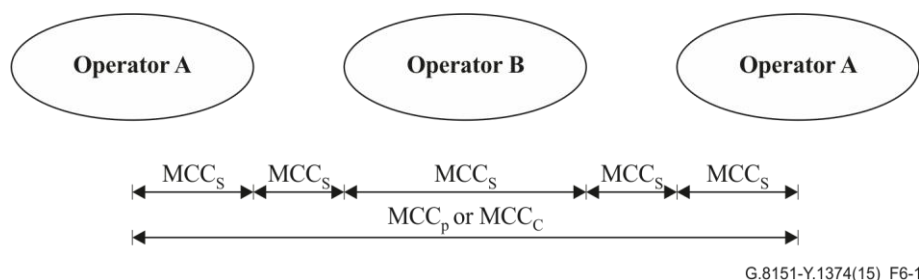


Figure 6-1 – MCC scenarios

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.

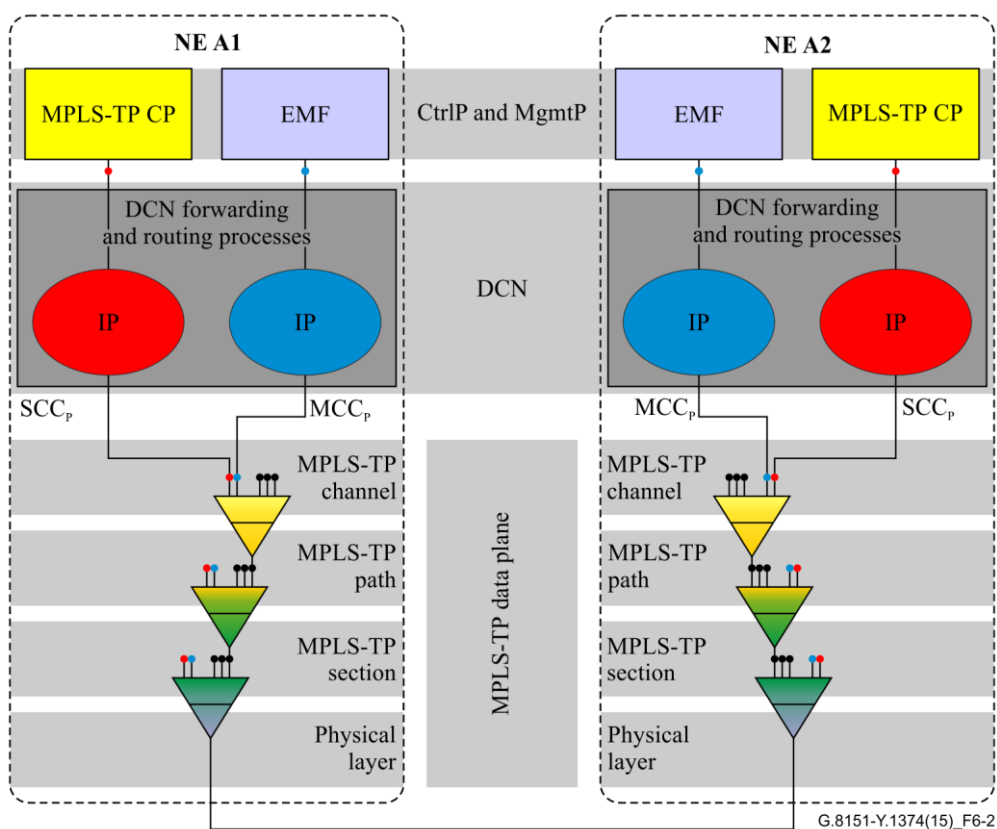


Figure 6-2 – MCC_P scenario example 1

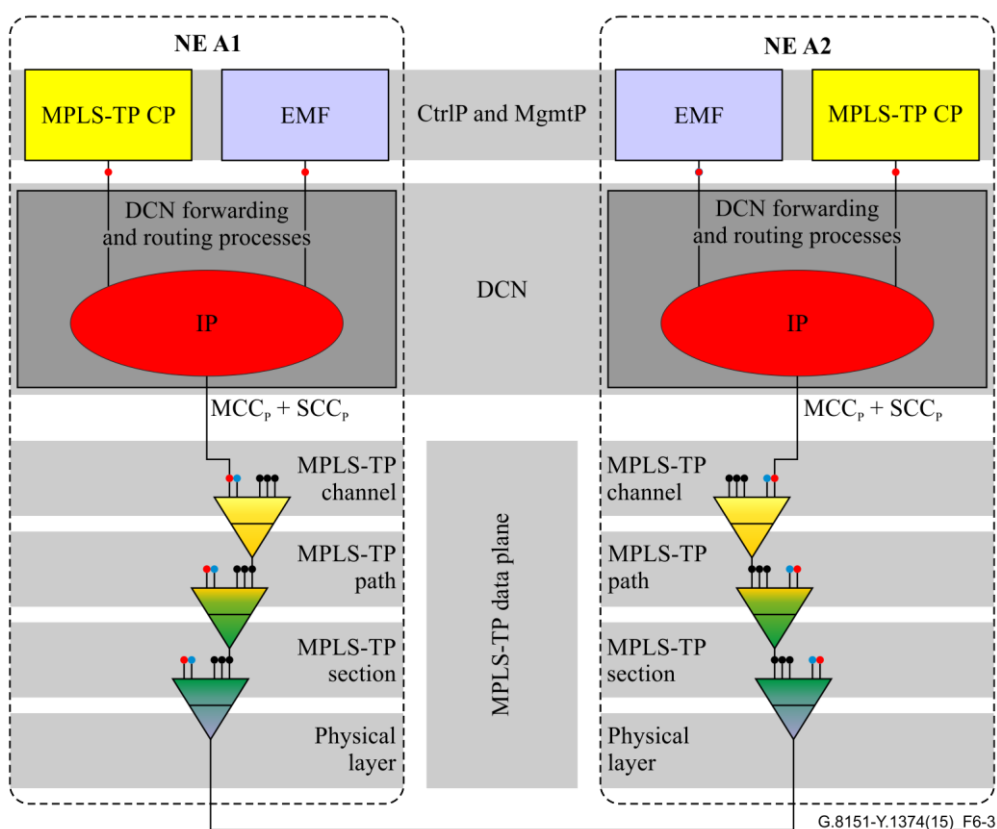


Figure 6-3 – MCC_P scenario example 2

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 layer n (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 operations, administration and maintenance (OAM) function at section, path or channel layer as described in [ITU-T G.7712] or by any other embedded communication channel (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 a management subnetwork (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 clause 10.1 of [ITU-T G.7710]).

Note 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 (AFs) (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 management points (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.

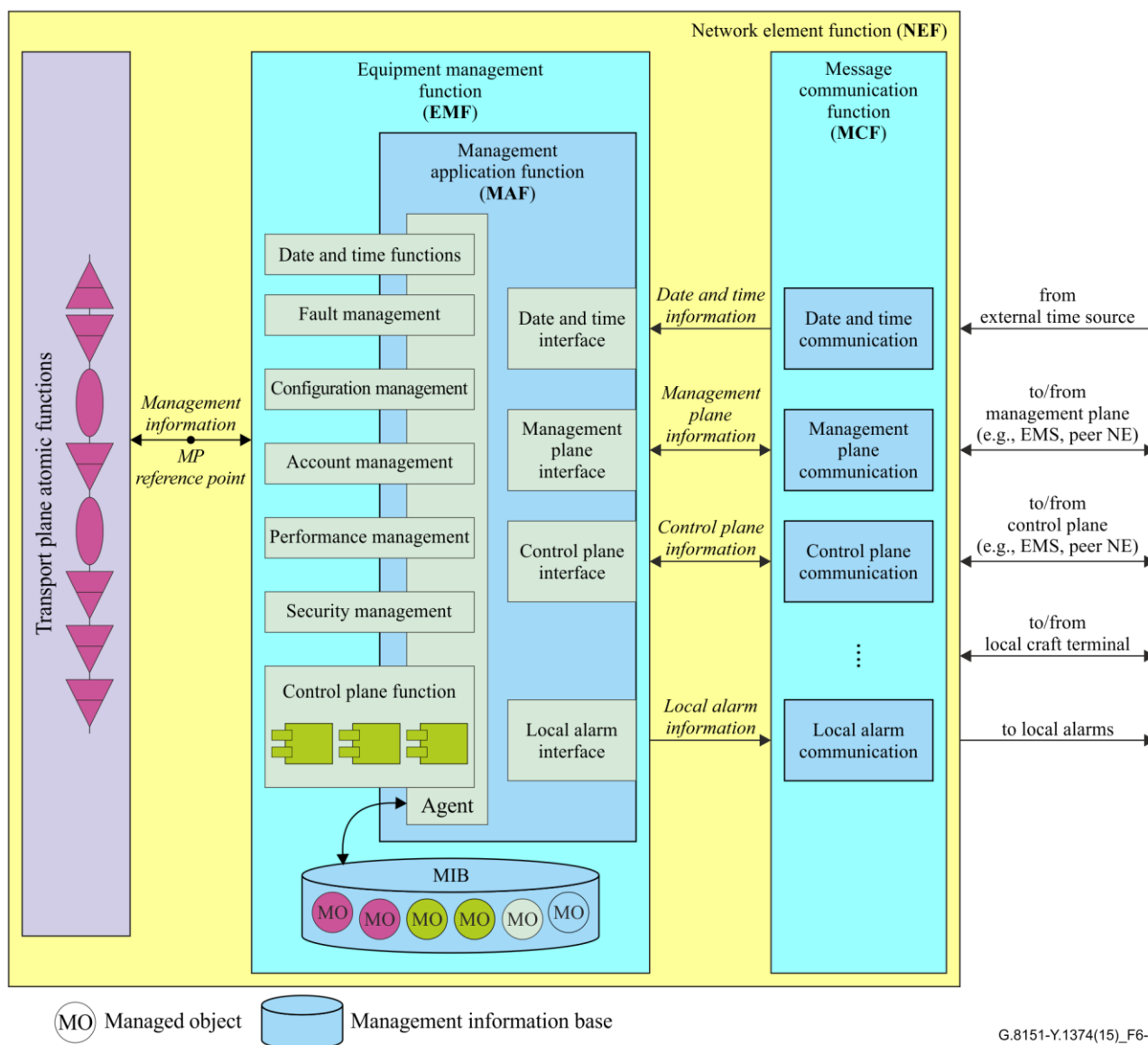


Figure 6-4 – MPLS-TP equipment management function

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 to the message communication function (MCF).

6.3 Information flows over management points

The information flows described in this clause are functional. The existence of these information flows in the equipment will depend on the functionality provided by the 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 columns in the tables in clauses 9, 10 and 11 of [ITU-T G.8121] and in the tables in clause 9 of [ITU-T G.8121.1] and [ITU-T G.8121.2] refers to the provisioning data that is passed from the MPLS-TP EMF to the atomic functions. The information listed under the Output column of those tables 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 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] and the alarm reporting function of [ITU-T X.733].

The five basic supervision categories are related to transmission, quality of service (QoS), 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.