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SERIES M: TELECOMMUNICATION MANAGEMENT,
INCLUDING TMN AND NETWORK MAINTENANCE

Telecommunications management network

**Multi-technology network management –
Introduction and supporting documentation**

ITU-T Recommendation M.3170.0



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TELECOMMUNICATION MANAGEMENT, INCLUDING TMN AND NETWORK MAINTENANCE

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ITU-T Recommendation M.3170.0

Multi-technology network management – Introduction and supporting documentation

Summary

The TM Forum's multi-technology network management (MTNM) solution suite realizes a TMN interface between the NML and EML according to ITU-T Recommendation M.3010 for the FCAPS management of multi-technology fixed transport, access and aggregation telecommunications networks.

This Recommendation provides a physical and logical overview of the MTNM solution suite where the logical overview focuses on the MTNM business objectives and the suite of MTNM supporting documents. This Recommendation also explains the chosen approach to reference the TMF MTNM deliverables in ITU-T Recommendations such that they get hooked into ITU-T's management architectures and frameworks without the need to change any TM Forum deliverable.

Source

ITU-T Recommendation M.3170.0 was approved on 16 March 2007 by ITU-T Study Group 4 (2005-2008) under the ITU-T Recommendation A.8 procedure.

Keywords

Common Object Request Broker Architecture (CORBA), element management (EM), EM layer (EML), EM system (EMS), enhanced Telecom Operations Map (eTOM), FCAPS (fault, configuration, accounting, performance and security) management, interface, management interface specification methodology (MISM), multi-technology network management (MTNM), network element (NE), NE layer (NEL), network management (NM), NM layer (NML), NM system (NMS), next generation network(s) (NGN), NGN management (NGNM), operations system (OS), Q interface, requirements, analysis and design (RAD) (and conformance), service-oriented CORBA, tele(com(munications)) management (TM), TM Forum (TMF), TM network (TMN).

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

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Introduction

This Recommendation provides an overview of the M.3170-series of ITU-T Recommendations, which relate TM Forum's MTNM v3.0 specifications to ITU-T's TMN and NGNM architectures and frameworks and prove that MTNM is TMN compliant, TMN interface protocol conformant, and *Level B* TMN interface information conformant according to [ITU-T M.3010].

ITU-T Recommendation M.3170.0

Multi-technology network management – Introduction and supporting documentation

1 Scope

This Recommendation provides a physical and logical overview of the TeleManagement Forum's multi-technology network management (MTNM) solution suite v3.0 [TMF MTNM v3.0] where the logical overview focuses on the MTNM business objectives and the suite of MTNM supporting documents. This Recommendation also explains the chosen approach to referencing the MTNM deliverables in ITU-T Recommendations such that they get hooked into ITU-T's management architectures and frameworks without the need to change any TM Forum deliverable.

The MTNM solution suite v3.0, a TM Forum-approved document set ([TMF513], [TMF608], [TMF814], [TMF814A]), is an implementation standard of a TMN interface between the NML and the EML according to [ITU-T M.3010] for the FCAPS management of multi-technology fixed transport, access and aggregation networks. The MTNM implementation view specifies a CORBA-based TMN Q interface between an NMS (CORBA client or TMN manager) and an EMS (CORBA server or TMN agent which is in contact to the NEL).

This Recommendation is a part of a series of Recommendations dealing with MTNM, and which has the following structure:

M.3170.0 Multi-technology network management: Introduction and supporting documentation.

M.3170.1 Multi-technology network management: Business agreement (TMF513).

M.3170.2 Multi-technology network management: Information agreement (TMF608).

M.3170.3 Multi-technology network management: CORBA IDL solution set (TMF814) with implementation statement templates and guidelines (TMF814A).

The MTNM specifications fulfil the very strong industry demand for a full-featured, commercially available, scaleable and non-proprietary element and network management interface implementation standard, which allows multi-vendor, multi-technology and multi-domain management systems to interoperate easily and seamlessly in an open architecture environment, thereby distinctly reducing the integration tax and overall operational expenses. As widely recognized achievements, the TM Forum's multi-company MTNM project has:

- first, created a UML-based interface between the TMN network management layer (NML) and element management layer (EML), which provides the protocol-neutral foundation of such a "commercial out of the box integration" element and network management solution; and
- secondly, developed the UML model of the system view into a CORBA-based, highly interoperable implementation view that allows for low cost integration of MTNM systems.

This Recommendation provides an overview of the MTNM solution suite and presents the chosen approach to relate the MTNM deliverables to ITU-T's TMN and NGNM architectures and frameworks in such a way that the MTNM NML-EML interface and the MTNM document set can be shown to be TMN conformant and compliant according to [ITU-T M.3010].

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] ITU-T Recommendation G.805 (2000), *Generic functional architecture of transport networks*.
- [ITU-T G.809] ITU-T Recommendation G.809 (2003), *Functional architecture of connectionless layer networks*.
- [ITU-T G.852.2] ITU-T Recommendation G.852.2 (1999), *Enterprise viewpoint description of transport network resource model*.
- [ITU-T M.3010] ITU-T Recommendation M.3010 (2000), *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.3020] ITU-T Recommendation M.3020 (2007), *TMN interface specification methodology*.
- [ITU-T M.3050.x] ITU-T Recommendations M.3050.x (2004), *Enhanced Telecom Operations Map (eTOM)*.
NOTE 1 – This series of Recommendations has the following structure:
M.3050.0 (2004), eTOM – Introduction.
M.3050.1 (2004), eTOM – The business process framework.
M.3050.2 (2004), eTOM – Process decompositions and descriptions.
M.3050.3 (2004), eTOM – Representative process flows.
M.3050.4 (2004), eTOM – B2B integration: Using B2B inter-enterprise integration with the eTOM.
M.3050 Supplement 1 (2004), eTOM – ITIL application note.
M.3050 Supplement 2 (2004), eTOM – Public B2B Business Operations Map (BOM).
M.3050 Supplement 3 (2004), eTOM to M.3400 mapping.
- [ITU-T M.3060] ITU-T Recommendation M.3060/Y.2401 (2006), *Principles for the Management of Next Generation Networks*.
- [ITU-T M.3100] ITU-T Recommendation M.3100 (2005), *Generic network information model*.
- [ITU-T Q.816.x] ITU-T Recommendations Q.816.x (2001-2007), *CORBA-based TMN services*.
NOTE 2 – This series of Recommendations has the following structure:
Q.816 (2001), *CORBA-based TMN services*.
Q.816.1 (2001), *CORBA-based TMN services: Extensions to support coarse-grained interfaces*.
Q.816.2 (2007), *CORBA-based TMN services: Extensions to support service-oriented interfaces*.

- [ITU-T X.735] ITU-T Recommendation X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems Management – Log control function*.
- [ITU-T X.780.x] ITU-T Recommendations X.780.x (2001-2007), *TMN guidelines for defining CORBA managed objects*.
 NOTE 3 – This series of Recommendations has the following structure:
 X.780 (2001), *TMN guidelines for defining CORBA managed objects*.
 X.780.1 (2001), *TMN guidelines for defining coarse-grained CORBA managed object interfaces*.
 X.780.2 (2007), *TMN guidelines for defining service-oriented CORBA managed objects and façade objects*.
- [ITU-T X.781] ITU-T Recommendation X.781 (2001), *Requirements and guidelines for Implementation Conformance Statements proformas associated with CORBA-based systems*.
- [ITU-T Y.110] ITU-T Recommendation Y.110 (1998), *Global Information Infrastructure principles and framework architecture*.
- [ITU-T Y.2011] ITU-T Recommendation Y.2011 (2004), *General principles and general reference model for Next Generation Networks*.
- [ITU-T Y.2012] ITU-T Recommendation Y.2012 (2006), *Functional requirements and architecture of the NGN release 1*.
- [TMF MTNM v2.1] TM Forum, *Multi-Technology Network Management (MTNM) Solution Suite Version 2.1* (2002) (consisting of [TMF513], [TMF608], [TMF814], [TMF814A v2.1]), except for the tables of references contained in Appendix B of [TMF513 v2.1] and Appendix B of [TMF608 v2.1].
 NOTE 4 – Refer to Notes 6 and 7 for an explanation of this exception.
- [TMF MTNM v3.0] TM Forum, *Multi-Technology Network Management (MTNM) Solution Suite Version 3.0* (2004) (consisting of [TMF513], [TMF608], [TMF814] and [TMF814A] and the MTNM Documentation Guide), except for the tables of references contained in Appendix B of [TMF513] and Appendix B of [TMF608].
 NOTE 5 – Refer to Notes 6 and 7 for an explanation of this exception.
- [TMF513] TM Forum TMF513 Version 3.0 (2004), *Multi-Technology Network Management (MTNM) NML-EML Interface: The Business Agreement*, except for the table of references contained in Appendix B.
 NOTE 6 – This table of references consists of the columns "reference", "description" and "brief use summary". Whilst the last column is meant to clearly indicate for each reference (i.e., row) whether the reference is needed for the implementation of the specification (a normative reference) or was used for the development of the specification (a non-normative reference), it turned out that this goal was not reached unambiguously in all cases. Therefore, this Recommendation does not reference this table. Instead, the truly normative references of [TMF513], namely [TMF608], [ITU-T G.805] and [ITU-T X.735], are added to this clause while the useful and available non-normative references are added to the bibliography (see [b-TMF044] and [b-TMF402]).
- [TMF608] TM Forum TMF608 Version 3.0 (2004), *Multi-Technology Network Management (MTNM) NML-EML Interface: Information Agreement*, Rational Rose™ (UML) version and generated HTML version, except for the table of references contained in Appendix B.

NOTE 7 – This Recommendation does not reference this table for the same reasons explained for TMF513 in Note 1. Instead, the truly normative references of [TMF608], namely [TMF513], [ITU-T G.805] and [ITU-T X.735], are added to this clause while the useful and available non-normative references are added to the bibliography (see [b-TMF044], [b-TMF045] and [b-TMF404]).

- [TMF814] TM Forum TMF814 Version 3.0 (2004), *Multi-Technology Network Management (MTNM) NML-EML Interface: CORBA IDL Solution Set*.
- [TMF814A] TM Forum TMF814A Version 3.0 (2004), *Multi-Technology Network Management (MTNM) NML-EML Interface: Implementation Statement Templates and Guidelines*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- 3.1.1 analysis phase:** [ITU-T M.3020].
- 3.1.2 design phase:** [ITU-T M.3020].
- 3.1.3 element management layer (EML):** [ITU-T M.3010].
- 3.1.4 interface:** [ITU-T M.3010].
- 3.1.5 network element layer (NEL):** [ITU-T M.3010].
- 3.1.6 network management layer (NML):** [ITU-T M.3010].
- 3.1.7 operations system (OS):** [ITU-T M.3010].
- 3.1.8 Q interface:** [ITU-T M.3010].
- 3.1.9 requirements phase:** [ITU-T M.3020].

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ATM	Asynchronous Transfer Mode
BA	Business Agreement
CLI	Command Line Interface
CORBA	Common Object Request Broker Architecture
CTP	Connection Termination Point
DSL	Digital Subscriber Line
DWDM	Dense Wavelength Division Multiplexing
EM	Element Management
EML	Element Management Layer
EMS	Element Management System
eTOM	enhanced Telecom Operations Map
FCAPS	Fault, Configuration, Accounting, Performance and Security
FRA	Functional Requirements and Architecture

FTP	Floating Termination Point
GCT	Graphical User Interface Cut-Through
GDMI	Guidelines for the Definition of Management Interface
GTP	Group Termination Point
GUI	Graphical User Interface
HTML	HyperText Markup Language
IA	Information Agreement
IDL	Interface Definition Language
IMA	Inverse Multiplexing for ATM
IPR	Intellectual Property Rights
IRP	Integration Reference Point
IS	Implementation Statement
IS	Information Service
MIB	Management Information Base
MISM	Management Interface Specification Methodology
MLSN	Multi-Layer SubNetwork
MOC	Managed Object Class
MTNM	Multi-Technology Network Management
NE	Network Element
NEF	Network Element Function block
NEL	Network Element Layer
NG	Next Generation
NGN	Next Generation Network
NGNM	Next Generation Network Management
NM	Network Management
NML	Network Management Layer
NMS	Network Management System
OMG	Object Management Group (see http://www.omg.org/index.htm)
OOAD	Object-Oriented Analysis and Design
ORB	Object Request Broker
OS	Operations System
OSF	Operations System Function block
OTH	Optical Transport Hierarchy
PDH	Plesiochronous Digital Hierarchy
PTP	Physical Termination Point

Q	type of interface applied at q reference points (i.e., between NEF and OSF, or OSF and OSF, or Q Adaptation Function block and OSF) (see [ITU-T M.3010], [ITU-T M.3013] and [ITU-T M.3060])
RAD	Requirements, Analysis and Design (and conformance)
SD	Supporting Document(ation)
SDH	Synchronous Digital Hierarchy
SM	Service Management
SNC	SubNetwork Connection
SNMP	Simple Network Management Protocol
SOA	Service-Oriented Approach/Architecture
SONET	Synchronous Optical Network
SS	Solution Set
TL1	Transaction Language 1
TM	Telecommunications Management
TM	TeleManagement
TMF	TeleManagement Forum (see http://www.tmforum.org/browse.aspx)
TMN	Telecommunications Management Network
TP	Termination Point
UML	Unified Modelling Language
VCAT	Virtual Concatenation

5 Conventions

This Recommendation does not use any particular notational or other conventions.

6 MTNM overview

This clause introduces the four MTNM views according to the popular RAD paradigm and relates them to the MTNM deliverables, provides an overview of the file structure of these deliverables including the numerous supporting documents and CORBA IDL files, and summarizes the business objectives that initiated the multi-company effort to develop the MTNM specifications.

6.1 MTNM deliverables

MTNM specifies an NML-EML interface according to [ITU-T M.3010] for the FCAPS management of multi-technology fixed networks. The specifications use TM Forum templates and MTNM-specific templates. Methodology and templates follow the widespread requirements, analysis and design (RAD) paradigm and comply with [ITU-T M.3020] and the template-based guidelines for the definition of management interface (GDMI) that are progressed in the [ITU-T M.3020.x].

Object-oriented analysis and design (OOAD) principles, but also service-oriented design principles, and an iterative three-phase process, namely the RAD methodology, have been applied to develop and progress the MTNM specifications, which provide four views of the NML-EML interface:

- Requirements – the *business view*;
- Analysis – the *system view*;
- Design and conformance – the *implementation view* and the *deployment view*.

6.1.1 Deliverables of the MTNM Solution Suite v3.0

The companion ITU-T Recs M.3170.1, M.3170.2 and M.3170.3 introduce the corresponding MTNM deliverables each of which consists of a set of files:

- The MTNM business view is specified through requirements and use cases in the *Business Agreement* (BA) [TMF513], which is introduced by ITU-T Rec. M.3170.1.
- The MTNM system view is specified in UML in the *Information Agreement* (IA) [TMF608], which is introduced by ITU-T Rec. M.3170.2.
- From the beginning, the MTNM project has chosen CORBA as the interface language and communication technology for implementing and deploying the system view; the CORBA-based implementation and deployment views of MTNM are specified in the HTML-documented *Solution Set* (SS) [TMF814] and associated *Implementation Statement* (IS) *Templates and Guidelines* [TMF814A], which are introduced by ITU-T Rec. M.3170.3.
- The MTNM *Supporting Documentation* (SD) [TMF MTNM v3.0] not only guides and lightens the practical work with the MTNM views but also includes normative parts of the interface such as name/value pairs; it is introduced in this Recommendation and referred to from the rest of the M.3170-series of ITU-T Recommendations.

6.1.2 File structure of the MTNM Solution Suite v3.0

The entire MTNM Solution Suite v3.0 [TMF MTNM v3.0] consists of the following files:

- Documentation Guide:
 - (6 pages) MTNM_v3.0_DocumentationGuide.pdf (90 kbit/s).
- Business Agreement:
 - (565 pages) TMF513\TMF513_V3.0.pdf (5260 kbit/s).
 - (310 pages) 14 supporting documents (see clause 6.3).
- Information Agreement – Rational Rose™ (UML) version:
 - (26 pages) TMF608-MDL\TMF608v3.0-MDL_2004_04.pdf (85 kbit/s).
 - (389 pages) 24 supporting documents (see clause 6.3).
 - UML model TMF608-MDL\TMF608v3.0-2004_04.mdl (2899 kbit/s).
- Information Agreement – HTML version:
 - (26 pages) TMF608-HTML\TMF608v3.0-HTML_2004_04.pdf (85 kbit/s).
 - (389 pages) 24 supporting documents (see clause 6.3).
 - HTML documentation folder (generated by Rational Rose™)
TMF608-HTML\TMF608v3.0-html\ (2694 files).

- CORBA Solution Set:
 - (1 page) TMF814_Version_3.0\INSTALL_ReadMe.txt (1 kbit/s).
 - (1 page) TMF814_Version_3.0\ReadMe.txt (1 kbit/s).
 - (17 pages) TMF814_Version_3.0\TMF814InterfaceVersion3.0.pdf (76 kbit/s).
 - (564 pages) 37 supporting documents (see clause 6.3).
 - (234 pages) 26 TMF CORBA IDL files (see clause 6.4).
 - (61 pages) 13 OMG CORBA IDL files (see clause 6.4).
 - HTML documentation folder (generated by DoxygenTM)
TMF814_Version_3.0\TMF814_Documentation\html\ (1587 files).
- Implementation Statement for CORBA:
 - (103 pages) TMF814A\TMF814A-Version3.doc (1450 kbit/s).
 - (30 pages) 2 supporting documents (see clause 6.3).

These files are not part of the M.3170-series of ITU-T Recommendations but are available from the TM Forum. It should be noted that the TM Forum may change this file structure in subsequent releases of MTNM.

6.2 MTNM business objectives

The composition of today's telecommunication networks has contributed to the complexity of managing these networks. The networks are commonly composed of network elements (NEs) provided by various equipment vendors. The task of interoperation extends beyond the network element layer up to the TMN management layers, to include interoperability between multi-vendor element and network (and service) management systems provided by the equipment vendors or third party companies.

Service providers have also taken advantage of technological advancements in transport network equipment. It is not uncommon for service providers to deploy next generation, multi-technology, high-density network elements, or "hybrid NEs" also known as "multi-service provisioning platforms", as these network elements provide new services and optimal equipment and network resource utilization. However, network management (NM) solutions very often apply only to a single, specific network technology and are based on technology-specific (or even vendor-specific) SNMP MIBs, CLI interfaces or TL1 interfaces.

While equipment vendors become able to deliver more and more powerful multi-service networks, the management tasks have become much more complex due to the volatile service portfolio and personalization that they need to support. The lack of a common management framework results in high operational and development cost to the service providers due to the intensive manual customizations required per customer and per network technology, and the system integration tax to develop interoperable point-to-point solutions among vendor products.

Service providers have become concerned that the increase in network capabilities will also increase the complexity, unnecessary variety and duplication of the network management systems and underlying NM models, in particular in multi-vendor environments. This would result in an integration tax – a cost that must be paid but that returns little in business value and that may still result in data islands. As a consequence, there is a very strong industry demand for a full-featured but lightweight, commercially available, scaleable and non-proprietary element and network management interface implementation standard that allows multi-vendor, multi-technology and multi-domain management systems to interoperate easily and seamlessly in an open architecture environment, thereby distinctly reducing the integration tax and overall operational expenses.

The objective of the TM Forum's *MTNM project* is, in the first place, to create an UML-based interface between the TMN network management layer (NML) and element management layer

(EML), which provides the protocol-neutral foundation of such a "commercial out of the box integration" element and network management solution, and, secondly, to develop the UML model of the system view into a CORBA-based implementation view that is very efficient, very easy-to-use and highly interoperable, and therefore allows for low cost integration of MTNM systems.

The MTNM interface model supports the FCAPS and eTOM [ITU-T M.3050.x] management of multi-technology fixed networks with wireline and wireless physical layers. [TMF MTNM v3.0] includes PDH, SONET/SDH, ATM, frame relay, DWDM/OTH, DSL and point-to-point Ethernet. MTNM progression aims to gradually cover the unified management of all proven or emerging, fixed circuit-switched or packet-switched transport, access and aggregation network technologies (e.g., Ethernet bridging, control plane management) but is not concerned with mobile network management.

The MTNM NML-EML interface supports a wide variety of element and network management business scenarios from the configuration of ports and provisioning of connections to the retrieval of alarm, equipment inventory and NE and network performance information. Key areas of the business scenarios that are supported by MTNM include, but are not limited to:

- inventory discovery;
- fault management;
- port configuration (with profile mechanisms);
- connectivity provisioning (with protection and restoration capabilities);
- equipment provisioning (NEs, equipment holders, equipment units);
- performance management;
- maintenance management;
- security management.

Service providers will benefit from the common multi-technology network management interface that is able to translate the service definitions made in service management (SM) systems into technology-specific implementations in a uniform way. Such benefits include, for example:

- Rapid service delivery by decreasing service creation and activation time.
- Fast introduction of new technologies in the network without causing major changes to the interfaces at the network management level.
- Increased operating efficiency through automation and smart integration of element and network management systems and solutions.
- Enabling smooth and standardized multi-vendor interoperability that affords service providers the option of choosing various vendor products according to competitive differentiation.
- Allowing equipment and software vendors to offer vendor-specific extensions and diversifications in an interoperable and easy-to-implement way.

Refer to [b-Siemens AG] and the companion ITU-T Rec. M.3170.3 for technical details on the CORBA-based MTNM NML-EML interface that support these business objectives.

6.3 MTNM supporting documentation (SD)

As shown in clause 6.1.2 the four main MTNM deliverables are packaged together with a number of so-called supporting documents. Such supporting documents provide normative and/or informative information on the MTNM interface in support of the main deliverables. Examples of normative information are interface parameters in the form of name/value pairs and details on managed object attributes, examples of informative documents are tutorial and background material on specific technologies such as DSL or IMA or the SDH and SONET multiplexing hierarchies.

Table 6-1 provides an overview of MTNM v3.0's SD with short descriptions and with indications of which SDs are bundled together with the individual deliverables of clause 6.1.2.

The files listed in Table 6-1 are not part of the M.3170-series of ITU-T Recommendations but are available from the TM Forum together with the MTNM deliverables listed in clause 6.1.2. It should be noted that the TM Forum may change structure and contents of the MTNM SD in subsequent releases of MTNM.

NOTE – Some SD descriptions in Table 6-1 refer to companion documents thereby indicating that there are relationships between some SDs. Refer to the companion ITU-T Recs M.3170.1, M.3170.2 and M.3170.3 for an overview of the dependencies between supporting documents.

Table 6-1 – Overview of supporting documentation of MTNM v3.0

File name of supporting document	TMF513	TMF608	TMF814	TMF814A	Description of supporting document
additionalInfoUsage.pdf			X		A mechanism is provided to apply additional information (name/value pairs) to operations and responses from the managed resources. Any additional information is optional: the EMS need not make available this information and the NMS need not interpret it. When the EMS wants to implement a feature that is predefined by additional info parameters, it SHALL use the predefined names and values to achieve multi-vendor interoperability, and when the EMS implements vendor-specific additional info parameters subject to bilateral agreements with NMS vendors, the NMSs SHOULD interpret these parameters.
AVC_SC_Notifications.pdf			X		Provides a list of the attribute value and state change notifications along with the data that should be conveyed over the interface.
BundledSNC.pdf		X	X		The MTNM interface supports simultaneous operations on SNCs grouped in bundles. This SD explains the concept and usage of bundled SNCs.
Changes_to_Version 2-1.pdf		X			This SD summarizes the changes that were applied to migrate the UML model of MTNM v2.1 to the UML model of MTNM v3.0.
conformanceDefinitions.pdf	X	X	X		Provides ATM service category and conformance definitions.
ContainedTPs.pdf		X	X		This supporting document provides specific naming details for a number of cases of TP containment using the layered model and is a companion SD to the supporting documents objectNaming.pdf and layers.pdf.
DSLOverview.pdf			X		Provides an overview of DSL technology as a companion SD to layers.pdf.
encodingX731M3100.pdf		X	X		Explains how to provide ITU-T Rec. X.731 and [ITU-T M.3100] state and status information in the event fields defined in the MTNM interface.
encodingX733.pdf			X		Explains how to provide ITU-T Rec. X.733 alarm information in the event fields defined in the MTNM interface.
EquipmentModel.pdf		X	X		Specifies the MTNM equipment model and states, and provides examples.
featuresMatrix.xls • sheet v2.1 • sheet v3.0				X	Provides feature lists for MTNM v2.1 and MTNM v3.0, relates the features to the CORBA IDL operations and managed object classes (i.e., the MTNM interface capabilities) and makes a number of comments.
FeatureSummaryVersion3.pdf	X	X	X	X	Provides an overview of the features of the MTNM interface release 3.0 that are additional to those of the MTNM interface release 2.1.
guiCutThrough.pdf			X		Explains the NMS to EMS GUI cut-through.
IMOverview.pdf			X		Provides an overview of inverse multiplexing technologies (VCAT, IMA, etc.) and their use with the MTNM interface.

Table 6-1 – Overview of supporting documentation of MTNM v3.0

File name of supporting document	TMF513	TMF608	TMF814	TMF814A	Description of supporting document
iterators.pdf			X		Iterators are used extensively. This SD explains their usage.
LayeredParameters.pdf	X	X	X		The MTNM interface is built around a layered transmission model (see SD layers.pdf). This supporting document provides a normative specification and explanation of the parameters (name/value pairs) that may be reported and configured in the context of the layered TP model.
LayerRates.pdf	X	X	X		Provides a normative list of supported transport layers (e.g., PDH, SDH /SONET, DSL, ATM) along with their naming and proposes a method for adding new layers where they are currently not supported.
layers.pdf	X	X	X		The MTNM interface extends the layered model identified by [ITU-T G.805] and [ITU-T G.852.2]. This document explains the MTNM layered model, the extensions to ITU-T and their usage, from both a nodal and a network perspective and includes many examples. It provides guidelines for modelling the traffic capabilities of network elements.
LocationIdentification.pdf		X	X		Provides location and direction identification for PM parameters, probable causes and layered parameters, and includes examples.
maintenanceCommands.pdf		X	X		Maintenance operations are supported by the MTNM interface for certain technologies. This document summarizes and explains these maintenance commands and the corresponding signal flows.
MappingIASS.pdf			X		Provides a mechanism to relate the details of the implementation in the CORBA Solution Set [TMF814] to the UML model provided in the Implementation Agreement [TMF608].
modelDiagramComponents.ppt			X		This SD is a companion to the SD layers.pdf that provides the diagram model components used in the layers document to aid in the production of compatible layers-like diagrams that represent a specific solution.
modesOfOperation.pdf		X	X		There are several ways that an NMS may choose to use the SNC concept. This document explains these various modes of operation.
NativeEMSName.pdf	X				This document contains the rules to be used for determining the values for the native EMS name and user label attributes.
objectNaming.pdf	X	X	X		Provides an overview and specification of the managed object naming used across the MTNM interface.
OMGservicesUsage.pdf			X		The MTNM interface makes use of both the notification service and the telecom log service from the OMG. This normative document explains their usage in detail and defines the notification types of MTNM v3.0.
overview_NML-EML_Interface.pdf			X		This supporting document provides an overview of the TMF814 CORBA Solution Set of the TM Forum's MTNM NML-EML interface version 3.0, which has been constructed as a result of collaboration between equipment and OS vendors and service providers.
PerformanceParameters.pdf	X	X	X		Provides a specification and explanation of the performance parameters.
PGPPParameters.pdf		X	X		Specifies and explains the protection group parameters.
PMExample.txt	X	X	X		This is a companion supporting document to PMFileFormat.pdf that provides an example of a performance monitoring and measurement (PM) file in both plain text and Excel formats.
PMExample.xls	X	X	X		
PMFileFormat.pdf	X	X	X		The interface supports the reporting of bulk PM data. This document provides a normative definition of the PM file format.

Table 6-1 – Overview of supporting documentation of MTNM v3.0

File name of supporting document	TMF513	TMF608	TMF814	TMF814A	Description of supporting document
ProbableCauses.pdf	X	X	X		Provides a specification of the standard probable causes that shall be used when reporting an alarm.
protectionSwitch.pdf			X		Provides an overview of the protection switching model and operations for trail protection and applies it to a number of example scenarios.
SNCStateDiagram.pdf			X		Provides an explanation and specification of the various states of an SNC.
SNCtypes.pdf	X	X	X		The SNC is a fundamental component in the provision of connectivity across the network. This document defines the SNC types and provides examples of their usage.
TCAs.pdf	X	X	X		Provides a graphical representation of the threshold crossing alert types and corresponding trigger and clear values.
TPPoolRelationship.pdf		X	X		Explains the relationship between TP pools and their associated TPs.
trafficParameters.pdf		X	X		Provides a specification and explanation of ATM traffic parameters.
versioning.pdf			X		Provides details and examples on how to operate new and old versions of the MTNM interface.
40 supporting documents	14	24	37	2	

6.4 MTNM CORBA IDL files

Tables 2 and 3 present an overview of the IDL files provided with the CORBA Solution Set TMF814 of [TMF MTNM v3.0]. There are two types of IDL files: *TMF files* and *OMG files*. The TMF files were developed as part of the MTNM project (see clause 6.2) whilst the OMG files are publicly available IDL specifications of the Object Management Group. The IDL files of [TMF MTNM v3.0] are fully backward compatible extensions of the IDL files of [TMF MTNM v2.1]. As a rule, each IDL file consists of a single CORBA module whose name equals the file name.

Table 6-2 – Overview of TMF CORBA IDL files of MTNM v3.0

File name of CORBA IDL file	Description of CORBA IDL file
aSAP.idl	The CORBA module aSAP contains the definition of the alarm severity assignment profiles of the MTNM interface.
common.idl	The CORBA module common contains the definition of the Common_I interface of the MTNM interface.
CosNotifyComm.idl	The CORBA module CosNotifyComm is a copy from OMGidl\CosNotifyComm.idl (see Table 6-3) where EventType has been replaced by _EventType.
emsMgr.idl	The CORBA module emsMgr contains the definitions of the EMS_T managed object class and the EMS Manager interface EMSMgr_I of the MTNM interface.
emsSession.idl	The CORBA module emsSession contains the definitions of the EmsSession_I interface and the potentially supported manager names of the MTNM interface.

Table 6-2 – Overview of TMF CORBA IDL files of MTNM v3.0

File name of CORBA IDL file	Description of CORBA IDL file
emsSessionFactory.idl	The module <code>emsSessionFactory</code> contains the definition of the <code>EmsSessionFactory_I</code> interface of the MTNM interface.
equipment.idl	The CORBA module <code>equipment</code> contains the definitions of the equipment and equipment holder managed object classes and the Equipment Manager interface <code>EquipmentInventoryMgr_I</code> .
globaldefs.idl	The CORBA module <code>globaldefs</code> defines common types used by other CORBA modules of the MTNM interface. It is intended as a common repository for definitions that need to be exported across modules.
guiCutThrough.idl	The CORBA module <code>guiCutThrough</code> contains the definition of the GUI Cut-Through Manager interface <code>GuiCutThroughMgr_I</code> of the MTNM interface, with related IDL types.
maintenanceOps.idl	The CORBA module <code>maintenanceOps</code> contains the definition of the Maintenance Manager interface <code>MaintenanceMgr_I</code> of the MTNM interface, with related IDL type and interface definitions.
managedElement.idl	The CORBA module <code>managedElement</code> contains the definition of the managed element managed object class <code>ManagedElement_T</code> of the MTNM interface, which is an SO management abstraction of an NE.
managedElementManager.idl	The CORBA module <code>managedElementManager</code> contains the definition of the Managed Element Manager interface <code>ManagedElementMgr_I</code> of the MTNM interface.
mtnmVersion.idl	The CORBA module <code>mtnmVersion</code> contains the definition of the version interface <code>Version_I</code> of the MTNM interface.
multiLayerSubnetwork.idl	The CORBA module <code>multiLayerSubnetwork</code> contains the definitions of the MLSN MOC <code>MultiLayerSubnetwork_T</code> with related IDL types and interfaces, and the MLSN Manager interface <code>MultiLayerSubnetworkMgr_I</code> .
nmsSession.idl	The CORBA module <code>nmsSession</code> contains the definition of the <code>NmsSession_I</code> interface of the MTNM interface.
notifications.idl	The CORBA module <code>notifications</code> contains the definitions of the notification portions of the MTNM interface that are to be used in structured event push notifications and on-demand pull notifications.
performance.idl	The CORBA module <code>performance</code> contains the definitions of the performance management types, structures and MOCs of the MTNM interface. It also contains the definition of the Performance Management Manager interface <code>PerformanceManagementMgr_I</code> of the MTNM interface, which is used to gain access to operations dealing with performance monitoring and measurement (PM).
protection.idl	The CORBA module <code>protection</code> contains the definitions of the protection and equipment protection management structures, with related IDL types and interfaces, and the Protection Manager interface <code>ProtectionMgr_I</code> of the MTNM interface.

Table 6-2 – Overview of TMF CORBA IDL files of MTNM v3.0

File name of CORBA IDL file	Description of CORBA IDL file
session.idl	The CORBA module session contains the definition of the Session_I interface of the MTNM interface.
softwareAndDataManager.idl	The CORBA module softwareAndDataManager contains the definition of the Software and Data Manager interface SoftwareAndDataMgr_I and associated IDL types and interfaces.
subnetworkConnection.idl	The CORBA module subnetworkConnection contains the definition of the SNC managed object class SubnetworkConnection_T of the MTNM interface and associated IDL types and interfaces.
terminationPoint.idl	The CORBA module terminationPoint contains the definition of the TP and GTP managed object classes TerminationPoint_T and GTP_T of the MTNM interface and associated IDL types and interfaces.
topologicalLink.idl	The CORBA module topologicalLink contains the definition of the topological link managed object class TopologicalLink_T of the MTNM interface and associated IDL types and interfaces.
trafficDescriptor.idl	The CORBA module trafficDescriptor contains the definitions of the traffic descriptor managed object class with related types and interfaces and the Traffic Descriptor Manager interface TrafficDescriptorMgr_I of the MTNM interface.
transmissionDescriptor.idl	The CORBA module transmissionDescriptor contains the definitions of the transmission descriptor managed object class with related types and interfaces, and the Transmission Descriptor Manager interface TransmissionDescriptorMgr_I of the MTNM interface.
transmissionParameters.idl	The CORBA module transmissionParameters contains various definitions common to PTPs, CTPs, FTPs, GTPs, SNCs and MLSNs of the MTNM interface (e.g., layered parameters).
26 TMF CORBA IDL files	

Table 6-3 – Overview of OMG CORBA IDL files of MTNM v3.0

File name of CORBA IDL file	Description of CORBA IDL file
OMGidl\CosEventChannelAdmin.idl	The OMG module CosEventChannelAdmin defines the proxy and admin interfaces that inherit from the CosEventComm interfaces, and the EventChannel interface of the event service.
OMGidl\CosEventComm.idl	The OMG module CosEventComm defines the interfaces PushConsumer, PushSupplier, PullSupplier and PullConsumer that support the event service communication styles.
OMGidl\CosNaming.idl	The OMG module CosNaming defines the interfaces and associated IDL types of the naming service.

Table 6-3 – Overview of OMG CORBA IDL files of MTNM v3.0

File name of CORBA IDL file	Description of CORBA IDL file
OMGidl\CosNotification.idl	The OMG module <code>CosNotification</code> defines the <code>QoSAdmin</code> and <code>AdminPropertiesAdmin</code> interfaces and the basic types of the notification service such as <code>StructuredEvent</code> and the standard QoS and admin properties.
OMGidl\CosNotifyChannelAdmin.idl	The OMG module <code>CosNotifyChannelAdmin</code> defines the proxy and admin interfaces that inherit from the <code>CosNotifyComm</code> interfaces and the <code>EventChannel</code> and <code>EventChannelFactory</code> interfaces of the notification service.
OMGidl\CosNotifyComm.idl	The OMG module <code>CosNotifyComm</code> extends the <code>CosEventComm</code> interfaces to define the interfaces <code>PushConsumer</code> , <code>PushSupplier</code> , <code>PullSupplier</code> and <code>PullConsumer</code> that support the corresponding notification service communication styles. It also defines the interfaces for the structured and event batch communication styles.
OMGidl\CosNotifyFilter.idl	The OMG module <code>CosNotifyFilter</code> defines the interfaces supported by the filter (and mapping filter) objects used by the notification service.
OMGidl\CosTrading.idl	The OMG module <code>CosTrading</code> defines the interfaces and associated IDL types of the trading service.
OMGidl\DsEventLogAdmin.idl	The OMG module <code>DsEventLogAdmin</code> defines the <code>EventLog</code> and <code>EventLogFactory</code> interfaces.
OMGidl\DsLogAdmin.idl	The OMG module <code>DsLogAdmin</code> defines the <code>Log</code> and <code>LogMgr</code> interfaces and associated IDL types.
OMGidl\DsNotifyLogAdmin.idl	The OMG module <code>DsNotifyLogAdmin</code> defines the <code>NotifyLog</code> and <code>NotifyLogFactory</code> interfaces.
OMGidl\orb.idl	This file contains the dummy ORB module CORBA needed for generating the HTML documentation.
OMGidl\TimeBase.idl	The OMG module <code>TimeBase</code> of the time service defines IDL types used by the telecom log service.
13 OMG CORBA IDL files	

The files listed in Tables 6-2 and 6-3 are not part of the M.3170-series of ITU-T Recommendations but are available from the TM Forum together with [TMF814] and [TMF MTNM v3.0] (see also clause 6.1.2). It should be noted that the TM Forum may change structure and contents of the IDL files in subsequent releases of MTNM.

7 Referencing the TM Forum MTNM document set in ITU-T Recommendations

The M.3170-series of ITU-T Recommendations normatively reference TM Forum approved documents and point to further in-force ITU-T Recommendations in order to relate the TM Forum documents to ITU-T's key management and functional frameworks and architectures, specifically:

- M.3170.0 references the MTNM Solution Suite [TMF MTNM v3.0];
- M.3170.1 references the MTNM Business Agreement (BA) [TMF513];
- M.3170.2 references the MTNM Information Agreement (IA) [TMF608];

- M.3170.3 references the MTNM CORBA Solution Set (SS) [TMF814] and the MTNM Implementation Statement (IS) for CORBA [TMF814A].

The referenced MTNM v3.0 deliverables have been described in detail in clause 6. Figure 7-1 provides a graphical overview of the M.3170-series of ITU-T Recommendations and the MTNM v3.0 deliverables.

That way the MTNM interface and the MTNM document set can be shown to be:

- TMN interface protocol conformant;
- Level B TMN interface information conformant; and
- TMN compliant;

according to [ITU-T M.3010] and so they get hooked into the ITU-T TMN frameworks and architectures without changing the original TM Forum deliverables.

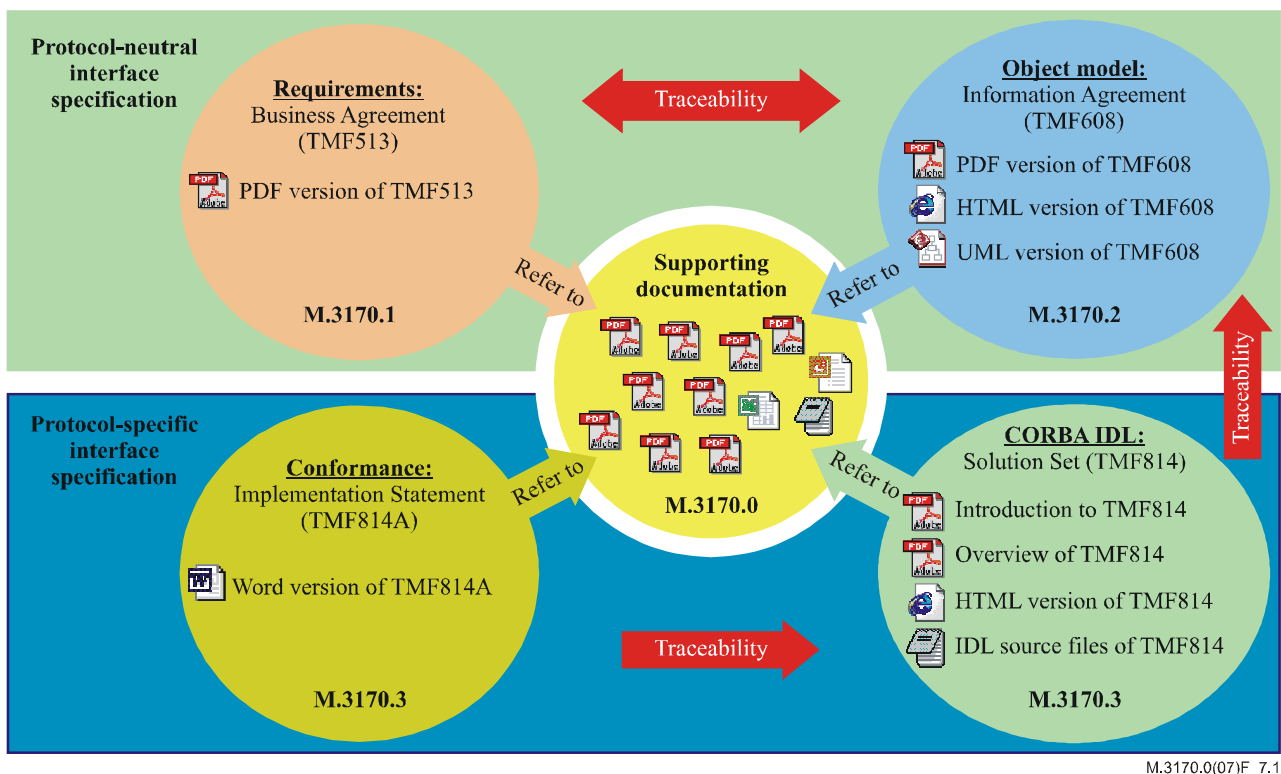


Figure 7-1 – Overview of M.3170-series and MTNM v3.0 deliverables

The certifications of the TMN interface protocol and information conformances depend on the *TMN guidelines for defining CORBA managed objects* specified by [ITU-T X.780.x], [ITU-T X.781] and [ITU-T Q.816.x], in particular on the novel concepts of *service-oriented CORBA* managed objects, façade objects and TMN support services, which were developed by ITU-T's former MTNM Focus Group [b-MTNMFG]. The ITU-T NGN Management Focus Group (NGNMFG), a group sponsored by ITU-T Study Group 4, identified the MTNM specifications as relevant to NGN management in the context of its specification architecture (see [ITU-T Roadmap]).

Figure 7-2 shows how this Recommendation points to the MTNM Solution Suite and to the related ITU-T Recommendations on TMN and functional architectures.

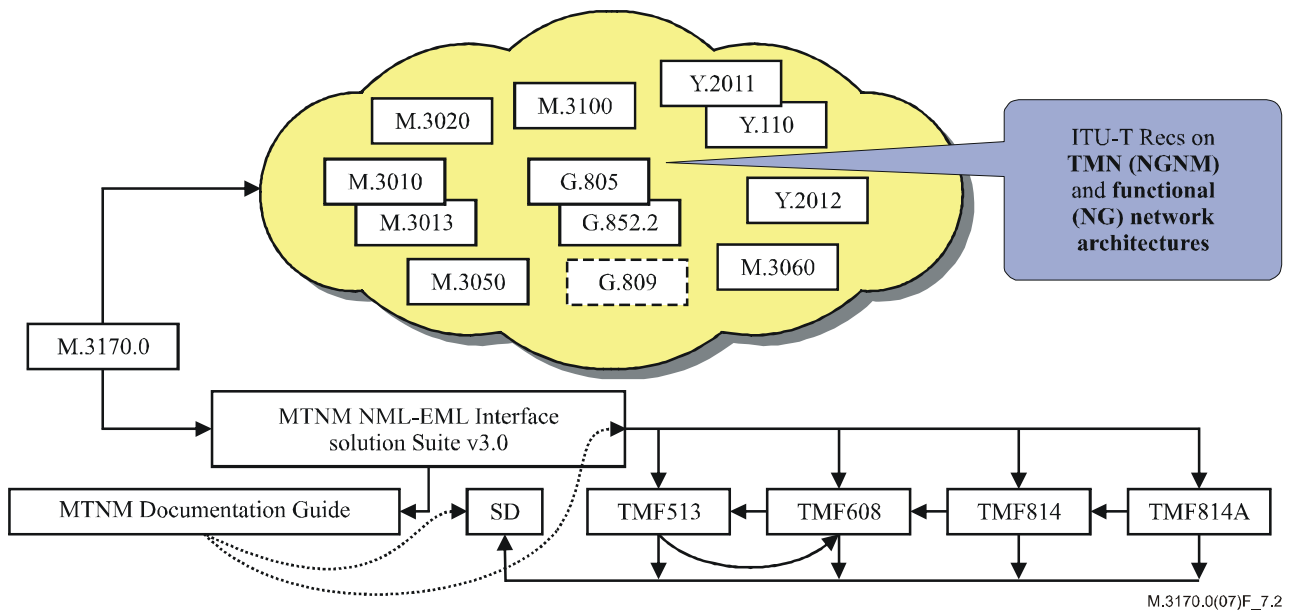


Figure 7-2 – ITU-T and TM Forum documents linked by M.3170.0

The TM Forum documents are depicted in a network view with dependency links while the ITU-T Recommendations are depicted in a non-linked NE view ("ITU-T Recommendation cloud") since it is considered within the responsibility of the referencing Recommendations to explain dependencies between TM Forum documents but not considered within their responsibility to point out dependencies between ITU-T documents. Each of the companion Recommendations of the M.3170-series of ITU-T Recommendations includes a similar diagrammatic presentation of the referencing role of the respective Recommendation, namely:

- M.3170.1 references the *MTNM BA*; at the TM Forum side it explains the BA structure and contents, looks inside the SD box (BA-relevant supporting documents) and relates the BA to other key TM Forum documents; at the ITU-T side it depicts an ITU-T Recommendation cloud with the BA-relevant ITU-T Recommendations.
- M.3170.2 references the *MTNM IA*; at the TM Forum side it explains the IA structure and contents, looks inside the SD box (IA-relevant supporting documents) and relates the IA to other key TM Forum documents; at the ITU-T side it depicts an ITU-T Recommendation cloud with the IA-relevant ITU-T Recommendations.
- M.3170.3 references the *MTNM CORBA SS* and the *MTNM IS for CORBA*; at the TM Forum side it explains the SS and IS structures and contents, looks inside the SD box (SS- and IS-relevant supporting documents according to Table 6-1), and relates the SS and IS to other key TM Forum documents; at the ITU-T side it depicts an ITU-T Recommendation cloud with the SS- and IS-relevant ITU-T Recommendations, which encompasses the ITU T framework for CORBA-based TMN interfaces [ITU-T X.780.x], [ITU-T X.781] and [ITU-T Q.816].

The M.3170-series of ITU-T Recommendations are considered to be light documents. They do not provide a full tutorial on MTNM but may well be considered a sort of crash course on MTNM. A more detailed *TM Forum/ITU-T documentation model* is for further study. Its essential parts would be first an "equivalence document", that mediates between the MTNM TMN framework fragments and details of the ITU-T TMN framework thereby making more MTNM details more easily readable, and secondly a version-specific (delta) "interface document" that instructs in

MTNM interface usage from an ITU-T point of view, thereby providing a course on new MTNM details. The referencing of MTNM from the M.3170-series of ITU-T Recommendations as well as the design guidelines of the service-oriented CORBA framework for TMN interfaces [ITU-T X.780.x] and [ITU-T X.781] are first steps in this direction. As a consequence of the TM Forum/ITU-T documentation model, it will not be necessary to develop very detailed mappings between TMN items of the TM Forum MTNM specifications and related ITU-T Recommendations.

Bibliography

The following references contain information that was used in the development of the M.3170-series of ITU-T Recommendations.

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