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## Foreword

This ETSI Technical Report (ETR) has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

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## 1 Scope

The purpose of this ETSI Technical Report (ETR) is to provide an overview of the Telecommunication Management Network (TMN) and related network management standards currently published. It does not attempt to provide an introduction to TMN, rather it is intended to be a reference document that can be used to identify all the relevant TMN standards. This issue of the overview covers European Telecommunication Standards (ETSS) and ETRs, ITU-T Recommendations, EWOS documents and ECMA Technical Reports (TRs). The review of core TMN documents is followed by a review of the various technology specific network management documents. This ETR is aimed at implementers of TMN systems within administrations, TMN system developers within vendor organisations and TMN standards developers within the international standards organisations.

A document of this kind in an evolving field can only ever be a "snapshot" of the current situation and will need to be frequently revised. This overview identifies "stable" documents, i.e. for ETSI this means Technical Committee approved documents and for ITU-T this means Study Group approved. However, if an existing stable document is currently being reviewed this is highlighted.

## 2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] ITU-T Recommendation X.700: "Management Framework for Open Systems Interconnection (OSI) for CCITT Applications".
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- [8] ISO/IEC ISP 11183-3: "Information technology - International Standardized Profiles AOM 1n OSI Management - Management Communications - Part 3: CMISE/ROSE for AOM11 - Basic Management Communications".
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- [109] ETS 300 612-2: "European digital cellular telecommunications system (Phase 2); Network Management (NM); Part 2: Common aspects of GSM/DCS 1800 Network Management (GSM 12.01)".
- [110] ETS 300 613: "European digital cellular telecommunications system (Phase 2); Subscriber, Mobile Equipment (ME) and services data administration (GSM 12.02)".
- [111] ETS 300 614: "European digital cellular telecommunications system (Phase 2); Security management (GSM 12.03)".
- [112] ETS 300 615: "European digital cellular telecommunications system (Phase 2); Performance data measurements (GSM 12.04)".
- [113] ETS 300 616: "European digital cellular telecommunications system (Phase 2); Subscriber related event and call data (GSM 12.05)".
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- [125] ITU-T Recommendation X.162: "Definition of management information for customer network management service for public data networks to be used with the CNMc interface".
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### 3 Definitions and abbreviations

#### 3.1 Definitions

For the purposes of this ETR, the following definitions apply:

**standards:** This generic term is used in this ETR to refer to ITU-T Recommendations, ETSs and ETRs, ECMA TRs, ISO/IEC standards and EWOS ISP.

**standards developer:** Person who actively participates in the standards development process, within international or regional standards organisations.

#### 3.2 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

ACSE	Association Control Service Element
AN	Access Network
AOM	Application OSI Management (A category for profiles in the ISO taxonomy)
AOW	Asia Oceania Workshop
ASN.1	Abstract Syntax Notation One
ATM	Asynchronous Transfer Mode
AUC	Authentication Centre
B-ISDN	Broadband-ISDN
BSC	Base Station Controller
BSS	Base Station System
BTS	Base Transceiver Station
CL	ConnectionLess
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
CNM	Customer Network Management
CO	Connection Oriented
CS-x	Capability Set x (where x takes the values 1, 2)
DECT	Digital European Cordless Telecommunications
DMI	Definition of Management Information
ECMA	European Computer Manufacturers Association
EDI	Electronic Data Interchange
EFD	Event Forwarding Discriminator
EG	Experts Group
EIR	Equipment Identity Register
ERMES	European Radio Message System
EURESCOM	European Research Organisation of PTTs and operators
EWOS	European Workshop for Open Systems
FRAN	Fixed Radio Access Network
FRU	Field Replaceable Unit
FTAM	File Transfer, Access and Management
FPLMTS	Future Public Land Mobile Telecommunications System
GDMO	Guidelines for the Definition of Managed Objects
GMI	Generic Management Information
GSM	Global System for Mobile communications (formerly Groupe Speciale Mobile)
HCS	High order Connection Supervision
HLR	Home Location Register
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity

IMT-2000	International Mobile Telecommunication - 2000
IN	Intelligent Network
ISDN	Integrated Services Digital Network
ISP	International Standardized ProfileLCS Low order Connection Supervision
LE	Local Exchange
MHS	Message Handling System
MIM	Management Information Model
MIS	Management Information Service
MO	Managed Object
MOCS	Managed Object Conformance Statement
MSC	Mobile Switching Service Centre
MTP	Message Transfer Part
NE	Network Element
NM	Network Management
NMF	Network Management Forum
OAM	Operation, Administration and Maintenance
OAN	Optical Access Network
OIW	OSE Implementers Workshop
OLT	Optical Line Terminal
OMC	Operations and Maintenance Centre
ONU	Optical Network Unit
OS	Operations System
OSE	Open Systems Environment
OSI	Open Systems Interconnection
PDH	Plesiochronous Digital Hierarchy
PICS	Protocol Implementation Conformance Statement
PLMN	Public Land Mobile Network
PON	Passive Optical Network
PTN	Private Telecommunication Network
PISN	Private Integrated Services Network
RACE	Research and Development for Advanced Communications in Europe
ROSE	Remote Operation Service Element
SAP	Service Access Point
SCCP	Signalling Connection Control Part
SCF	Service Control Function
SDF	Service Data Function
SDH	Synchronous Digital Hierarchy
SMF	Systems Management Function
SMI	Structure of Management Information
SNCP	Sub Network Connection Protection
SNMP	Simple Network Management Protocol
SRF	Specialised Resource Function
SS	Signalling System
SSF	Service Switching Function
TETRA	Trans European Trunked Radio System
TFTS	Terrestrial Flight Telephone System
TMN	Telecommunications Management Network
TR	Technical Report
UMTS	Universal Mobile Telecommunications System
UPT	Universal Personal Telecommunications
VLR	Visitor Location Register

## 4 OSI Management

The top-level standards and recommendations for OSI systems management<sup>1</sup>, form the basis for TMN standards. The conceptual and functional framework of OSI management is given in ITU-T Recommendation **X.700 [1]**. This Recommendation categorises management functionality into the following areas:

- fault management;
- configuration management;
- accounting management;
- performance management;
- security management.

The remaining OSI management standards can be separated into the following groups:

- overview;
- communication services and protocols;
- Structure of Management Information (SMI);
- Systems Management Functions (SMFs).

There is also continuous work on the development of International Standardized Profiles (ISPs) for the OSI systems management communications and management functions in the following organizations:

- the European Workshop for Open Systems (EWOS);
- the Asia Oceania Workshop (AOW); and
- the Open Systems Environment (OSE) implementers Workshop (OIW).

### 4.1 Overview

The CCITT Recommendation **X.701 [2]** provides an overview of the X.700 series of ITU-T Recommendations and how they relate to each other. It also defines the basic concepts of manager and agent, management operations on managed objects, protocol support and systems management functions.

### 4.2 Communications

The CCITT Recommendation **X.710 [3]** defines the Common Management Information Services (CMIS) to be used for the exchange of management operations and informations, while the CCITT Recommendations **X.711 [4]** and **X.712 [5]** specify respectively the Common Management Information Protocol (CMIP) and the Protocol Implementation Conformance Statement (PICS) proforma for CMIP which are used to vehicle the management operations.

The OSI network management communications profiles are defined in:

- ISO/IEC ISP **11183-1 [6]**, which specifies the Association Control Service Element (ACSE), presentation and session layer for use by Remote Operation Service Element (ROSE) and Common Management Services Element (CMISE);
- ISO/IEC ISP **11183-2 [7]**, which specifies the enhanced management communications; and
- ISO/IEC ISP **11183-3 [8]**, which specifies the basic management communications.

### 4.3 Management information

The Structure of Management Information (SMI) standards consists of standards that contain definitions of managed object classes and standards that support the definition of managed object classes

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<sup>1</sup> The OSI management standards were developed jointly by ITU-T and ISO/IEC. Only the ITU-T recommendation number is given in the body of this ETR.



ITU-T Recommendation **X.720 [9]** contains the Management Information Model (MIM) which sets out the fundamental concepts of managed objects, and is therefore the basis for all the other standards in the SMI series. All managed object definitions should comply with it.

CCITT Recommendation **X.721 [10]** known as The Definition of Management Information (DMI) document, was intended to collect together all the DMIs needed by the systems management standards into a single document, which could then serve as a reference point for managed object developers. CCITT Recommendation X.721 [10] was approved in 1991, and contains definition of management information for the first seven systems management functions standards (from ITU-T Recommendations X.730 to X.736). Since, it is found impractical to update DMIs continually, the management information definitions for subsequent functions have been published as annexes to the function standards themselves.

ITU-T Recommendation **X.722 [11]** provides a specification technique for managed objects, attributes, notifications, etc. To be sure of completeness and compatibility with the rest of systems management, all definitions of management information should comply with Guidelines for the Definition of Managed Objects (GDMO).

NOTE: Compliance with ITU-T Recommendation X.722 [11] does not necessarily ensure compliance with all aspects of the ITU-T Recommendation X.720 [9]. Managed objects developers should refer to both standards: CCITT Recommendation X.721 [10] and ITU-T Recommendation X.722 [11].

ITU-T Recommendation **X.723 [12]** which contains the generic management information, specifies management information that is applicable to more than one open systems resource by documenting those common structures as generic definitions. These generic definitions may be used in the specification of managed objects for technology specific use such as OSI layers.

ITU-T Recommendation **X.724 [13]** provides guidance for the production of conformance statements for management information including managed objects.

#### **4.4 Systems management functions**

ITU-T Recommendation **X.730 [14]** defines services for the object management function. Essentially, it provides a service whereby a Management Information Service (MIS) user can create and delete managed objects, examine and modify managed object attribute(s) values and is made aware of changes in the configuration of managed objects.

ITU-T Recommendation **X.731 [15]** defines services for the state management function. It defines a service whereby a MIS user can examine, modify and be notified of changes in the management state of managed object. ITU-T Recommendation **X.732 [16]** defines services for the relationship change reporting. It provides definitions for the various relationship types and relationship specific attributes.

ITU-T Recommendations **X.733 [17]** and **X.733/Amend. 1 [18]** define services for the reporting of alarms, errors and related information. They do not include mechanisms for correlating alarms.

ITU-T Recommendations **X.734 [19]** and **X.734/Amend. 1 [20]** define services for the event reporting function. This function includes both remote event reporting and local processing of potential event reports.

ITU-T Recommendation **X.735 [21]** defines a log control function. This function allows the creation, retrieval and deletion of logs, it also allows the criteria for logging an event to be modified.

ITU-T Recommendation **X.736 [22]** defines a security alarm reporting function that enables the security management user to be alerted whenever an event indicating an attack or potential attack on system security has been detected.

ITU-T Recommendation **X.738 [23]** specifies methods to observe and report on attribute values for performance related purposes. Attributes may be of the same or different types. Results of observations may be provided through notifications as they are collected or "buffered" and provided en bloc.

ITU-T Recommendation **X.739 [24]** specifies performance tools to observe characteristics of resources either directly within managed objects or through the use of metric objects. These tools also include provision of statistics, such as mean and percentage calculations and thresholds to generate notifications.

ITU-T Recommendation **X.740 [25]** defines services for logging of security related events so that the security of the system can be audited. A security audit may be used to help assess the effectiveness of a security policy.

ITU-T Recommendation **X.741 [26]** specifies an access control security model and the management information necessary for creating and administering access control associated with OSI systems management. This specification is of generic application and is applicable to the security management of many types of application. It is expected to be adopted for TMN use.

ITU-T Recommendation **X.742 [27]** specifies models, protocols and managed objects for controlling, notifying and recording data on resource usage.

ITU-T Recommendation **X.745 [28]** defines a function which allows system tests to be carried out. It includes the ability to set up a test environment, control and monitor the test and reinstate the previous environment. Scheduling of tests is also allowed.

ITU-T Recommendation **X.746 [29]** specifies the scheduling function to be used for systems management. It generalises the scheduling facilities associated with the event forwarding discriminator and the log.

#### **4.5 Management function profiles**

ISO/IEC DISP 12060 is a multipart set of profiles for management functions. These profiles are used to specify the requirements for the implementation of a set of management functions. These sets are selected according to industry requirements.

ISO/IEC DISP **12060-1 [30]** is a General Management Capability which is based on object management, state management, attributes for representing relationships and alarms, implementing fault reporting and configuration management capabilities. These capabilities include the ability to create and delete managed objects, to retrieve and modify managed object attributes, reporting of changes in state, relationship or other attribute values of managed objects and reporting of alarms. An agent system conforming to this profile has the ability to provide the general management of any managed object.

ISO/IEC DISP **12060-2 [31]** is a subset of ISO/IEC DISP 12060-1 [30], it is defined for systems that require alarm reporting and state management.

ISO/IEC DISP **12060-3 [32]** is a subset of ISO/IEC DISP 12060-1 [30], it is defined for systems that only require alarm reporting. This profile only requires the support of alarm notifications, hence it is most suitable for manager systems that are restricted to limited management functionality.

ISO/IEC DISP **12060-4 [33]** is based on the event report management function. The profile specifies the implementation requirements for Event Forwarding Discriminator (EFD) managed objects. The profile specifies the ability to select which notifications are sent by a resource and where they are sent to. An agent system conforming to this profile needs to implement at least one instance of the EFD object class and the ability to manage it. A manager system should be able to send and receive the required messages to manage the EFD.

ISO/IEC DISP **12060-5 [34]** is based on the log control management function. It specifies the ability to select which notifications generated both locally and remotely are logged within the system. The criteria for selection is specified as part of the log managed object. An agent system conforming to this profile needs to demonstrate the logging of notifications and the management of log and log record managed objects. A manager system should be able to send and receive the required messages to manage the log managed object and retrieve log records.

## 5 Core TMN

### 5.1 Overview

ITU-T Recommendation **M.3000 [35]** describes TMN related recommendations that have been developed within the ITU-T. It is similar to this ETR, however, it only addresses ITU-T recommendations.

### 5.2 TMN principles

ITU-T Recommendation **M.3010 [36]** and **ETR 037 [37]** describe the TMN Principles and are very similar. The differences between these two documents are editorial in nature. ETR 037 was published because of delay to the publication of ITU-T Recommendation M.3010 caused by the ITU-T four year publication cycle. ITU-T Recommendation M.3010 is currently being revised.

These documents recognise that there is a requirement to manage telecommunications networks in order to carry out such tasks as operations, administration, planning, provisioning, installation and maintenance of telecommunications networks and services. They introduce the concept of a TMN. The TMN architecture is separated into the following three components; Functional architecture, Information architecture and Physical architecture. These TMN principles underpin all other TMN standards. The TMN standards make use of OSI principles where appropriate. The basic OSI reference model is defined in ITU-T Recommendation **X.200 [38]**.

### 5.3 TMN interface specification

ITU-T Recommendation **M.3020 [39]** provides a description of the process to be used for describing functional and protocol specifications for TMN interfaces. These specifications are based on user requirements in the form of TMN management services, components of TMN management services and TMN management functions. TMN standards developers should use this methodology when specifying TMN interfaces to enable maximum reuse of the specifications. ITU-T Recommendation M.3020 is currently being revised by ITU-T. **ETR 078 [40]** simply notes that ITU-T Recommendation M.3020 incorporates the contents of ETR 078.

### 5.4 TMN modelling

The purpose of **ETR 046 [41]** is to provide guidance on the information modelling tasks contained in ITU-T Recommendation M.3020. ETSI is currently working on the second issue of these modelling guidelines. ETR 046 describes the use of ITU-T X.700 series of Recommendations for the development of Management Information Models. In addition, it clarifies the options available in the X.700 series and provides additional guidelines for ETSI definers of managed objects.

ITU-T Recommendation **M.3100 [42]** contains the definition of a generic network information model, i.e. it defines technology independent TMN object classes that can be used to manage a TMN network. In most cases these classes were developed for use with the Q interface to manage Network Elements (NEs). ITU-T Recommendation M.3100 is currently being revised. **I-ETS 300 293 [43]** is an extended version of ITU-T Recommendation M.3100. Essentially, it consists of M.3100 plus additional name bindings for equipment and network. Although this is a generic model, concepts from ITU-T Recommendation **G.803 [44]** were taken as a basis for this work (this is why entities such as "trails" and "connections" are used to describe a network).

ITU-T Recommendation **M.3180 [45]** is a catalogue of TMN management information involved in communications across the TMN interfaces defined in ITU-T Recommendation M.3010. It identifies the Managed Object (MO) classes by name and provides a reference to the Recommendation that contains its definition. It is intended that future issues of this Recommendation will include attributes, name bindings, conditional packages, actions, notifications and behaviours.

**I-ETS 300 653 [46]** contains a class library of objects for modelling the network level view. It is intended that this class library should be specialised<sup>2</sup> by technology groups using the NMF ensemble technique described in **Forum 025 [47]** to produce a specific interface. The ETSI modelling guidelines given in ETR 046 [41] should be used when carrying out this specialisation.

For some management applications, the scheduling function relationships between managed objects are dependant on the time of day and the type of day. **ETR 088 [48]** models the support function at the NE/Operations System (OS) interface, related to the time/type of day dependant scheduling function.

GDMO and Abstract Syntax Notation One (ASN.1) are used to define the information model in **I-ETS 300 291 [82]**, ITU-T Recommendation M.3100 [42] and the technology specific information models described later. There are two versions of ASN.1 currently in use, the older version is specified in CCITT Recommendation **X.209 [49]** and the most recent version is specified in ITU-T Recommendation **X.680 [50]**.

## 5.5 Management requirements

ITU-T Recommendation **M.3200 [51]** introduces a set of recommendations containing descriptions of TMN management services. A TMN management service provides support for an aspect of the Operation, Administration and Maintenance (OAM) of the network being managed. The objective of this Recommendation is the analysis of each management service with a view to defining the objects referenced by it, it is not a detailed specification of services, i.e. it provides an overview and refers the reader to other documents where there is a more detailed specification of the service. The more detailed specifications are described later in this overview in subclause 8.1. ITU-T Recommendation M.3200 is currently being revised.

**ETR 047 [52]** contains the same information as ITU-T Recommendation M.3200 [51]. It was published before the ITU-T Recommendation and can be considered to be superseded by it. However, it should not be assumed that future revisions of this ETR will necessarily be superseded by subsequent versions of ITU-T Recommendation M.3200. **ETR 048 [53]** contains a more extensive description of the management services.

ITU-T Recommendation **M.3400 [54]** describes important management functions in terms of the OSI management functional areas (fault management, configuration management, accounting management, performance management and security management). A TMN management function is the smallest part of the TMN management service as perceived by the user of the service. In reality, it will usually consist of a sequence of actions on a defined managed object or objects. ITU-T Recommendation M.3400 [54] was derived from ITU-T Recommendation M.3200 [51]. ITU-T Recommendation M.3400 is currently being revised.

## 5.6 F interface

ITU-T Recommendation **M.3300 [55]** considers the management of the telecommunications network from the perspective of the user work station, i.e. the F interface. This document identifies the TMN management capabilities presented for human information and intervention. It does not consider how this information is to be displayed. The ITU-T Z series of recommendations describes this human-machine function. ITU-T Recommendation M.3300 is currently being revised.

## 5.7 TMN terminology

ITU-T Recommendation **M.60 [56]** collects definitions for the ITU-T M series of recommendations, the TMN specific definitions are in clause 2 of ITU-T Recommendation M.60.

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<sup>2</sup> From ITU-T recommendation X.720:1992  
Specialization: The technique of deriving a new managed object class from one or more existing managed object classes by inheritance and by the addition of new characteristics.

## 5.8 Q3 interface

ITU-T Recommendation **Q.811 [57]** defines the requirements that shall be met at the OSI layer 3 to layer 4 boundary (i.e. the boundary between the upper and lower layer profiles) for the Q3 interface and defines a number of lower layer profiles that meet these requirements.

ITU-T Recommendation **Q.812 [58]** defines the protocol profiles for OSI layers 4 to 7 for the Q3 interface.

ITU-T Recommendation **Q.821 [59]** defines an information model for Alarm Surveillance.

ITU-T Recommendation **Q.822 [60]** defines an information model for performance management. It focuses on collection and storage of parameters and thresholding aspects of performance management.

## 6 Transmission network management

### 6.1 General transmission network management

ITU-T Recommendation **G.773 [61]** contains protocol suites for Q interfaces for management of transmission systems. It defines layer services, layer protocols, application service elements and protocols, and conformance requirements to be met by an implementation of these interfaces. It specifies two types of protocol suites: a full 7 layer OSI stack, as defined in ITU-T Recommendation X.200 [38], to be used for complex NEs such as Synchronous Digital Hierarchy (SDH) equipment, and a short OSI stack (i.e. layers 1 to 3 and layer 7) to be used for existing equipment such as Plesiochronous Digital Hierarchy (PDH) equipment. **ETS 300 150 [62]** is similar to ITU-T Recommendation G.773. ETSI is currently working on a revision of ETS 300 150.

### 6.2 Synchronous Digital Hierarchy (SDH)

#### 6.2.1 General SDH management

General SDH management aspects are addressed in ITU-T Recommendation **G.784 [63]**.

ITU-T Recommendation **G.831 [64]** describes the management requirements of the layered and partitioned SDH transmission networks defined in ITU-T Recommendation G.803 [44]. These include the path management processes and the interfacing requirements for interworking across administrative domain boundaries. The technical details to implement these requirements will be specified in other recommendations.

#### 6.2.2 Network Element (NE) management

**ETS 300 304 [65]** defines the information model to be used at the interface between NEs and management systems. ETSI is currently working on an enhancement to ETS 300 304.

ITU-T Recommendation **G.774 [66]** also defines an information model to be used at the interface between NEs and management systems. ITU-T Recommendation G.774 is currently being revised. Extensions to this Recommendation have been developed and are described below.

ITU-T Recommendation **G.774.01 [67]**, defines an information model for the management of the performance monitoring function for SDH NEs. SDH performance monitoring functions are used to monitor and report to its management system on specified performance events and quality of service alarms. **ETS 300 411 [68]** imports definitions from ITU-T Recommendation G.774.01.

ITU-T Recommendation **G.774.02 [69]** defines an information model for the management of payload configuration of SDH NEs. **ETS 300 412 [70]** imports definitions from ITU-T Recommendation G.774.02.

ITU-T Recommendation **G.774.03 [71]** defines an information model for the management of protection with particular application to multiplex section protection of SDH NEs. This Recommendation applies to SDH NEs which support the multiplex section protection switching function as defined in ITU-T Recommendation **G.783 [72]**. **ETS 300 413 [73]** imports definitions from ITU-T Recommendation G.774.03.

ITU-T Recommendation **G.774.05 [74]** defines an information model for the management of SDH NEs which use the connection supervision function (HCS/LCS). The connection supervision function is optional, consequently the following ETS only applies to SDH NEs which support connection supervision. **ETS 300 484 [75]** imports definitions from ITU-T Recommendation G.774.05.

ITU-T Recommendation **G.774.04 [76]** provides an information model for the management of low order and high order subnetwork connection protection for SDH subnetworks. **ETS 300 493 [77]** imports definitions from ITU-T Recommendation G.774.04.

### **6.2.3 Network level management**

Both ETSI and the ITU-T are working on information modelling of the network level view. Currently, there are no stable documents.

### **6.3 Plesiochronous Digital Hierarchy (PDH)**

**ETS 300 371 [78]** defines the information model for network elements using PDH multiplexing, including PDH interfaces of SDH network elements. ETSI is currently revising this in order to maintain and enhance the information model for the management of PDH interfaces.

### **6.4 Optical Access Network (OAN)**

**ETR 240 [79]** considers the management of OANs with Optical Line Terminal/Optical Network Unit (OLT/ONU) type of topology limited to Passive Optical Network (PON) technology. It contains management requirements for OANs, identifies the reference points applicable for the management of OANs and contains a functional model to cover management aspects of OANs. Information model fragments to support this functional model are currently being developed by ETSI, these fragments will be published as supplementary documents.

## **7 Intelligent Network (IN)/TMN integration**

### **7.1 Integration of IN and TMN**

There are two aspects to the integration of IN and TMN. The first is how IN should be managed by TMN, the second is the possible use of IN techniques in TMN.

ETSI has been working on the integration of IN and TMN since 1990. The first document they produced was a baseline document on the integration of IN and TMN and has been published as **ETR 062 [80]**. This ETR provides an introduction to TMN and IN and compares their architectural concepts. It also proposes enhancements to the IN and TMN concepts that would make the integration of IN and TMN possible. It concludes that using the current methodology TMN can be used to model the operation and maintenance of IN. Using TMN for rapid deployment of new services in IN would require more significant changes. A number of recommendations for changes to the IN and TMN methodologies are listed.

Both ETSI and ITU-T have accepted this document as a starting point for further addressing the special requirements of IN with respect to management (i.e., rapid deployment and provisioning of new services and corresponding management functionality). The work on further alignment of IN and TMN terminology and concepts is an ongoing activity, since both IN and TMN concepts are expected to evolve towards the definition of open and distributed platform oriented environments. The objective is to harmonise and integrate IN and TMN platforms to the greatest possible extent.

## 7.2 Intra domain management

ETR 224 [81] provides a set of requirements on IN Intra domain management in the scope of IN Capability Set 2 (CS-2). The identified set should however not be seen as exhaustive. The high level requirements identified in this ETR should merely be seen as the basis for (more detailed) specifications of IN management capabilities.

The document considers the full IN service life cycle, as defined by Network Aspects Technical Committee, i.e. the phases needs analysis, service creation, acceptance testing, service deployment, service provisioning and operation, and service removal. For this full cycle, the following types of management requirements (relationships) are addressed:

- requirements on the IN functional entities (Service Switching Function (SSF), Specialised Resource Function (SRF), Service Control Function (SCF) and Service Data Function (SDF));
- relationship requirements between management entities within one TMN administrative domain;
- service user / subscriber relationships to the TMN.

On the basis of these requirements, the standardisation of the corresponding management interfaces (Q and X) will be initiated.

## 7.3 Inter domain management

Whereas the ETR 224 [81] covers the intra domain management aspects, the requirement for global IN services and the liberalization of the European telecommunications arena necessitates a harmonised development of inter operator relationships (X interfaces). Currently, most of the activities in this area are performed in RACE and EURESCOM. No stable ETSI or ITU-T documents on X interfaces for IN are currently available.

## 7.4 Management of IN services

There will be some differences in the way different IN services are managed, although a great deal will be common. IN services such as Universal Personal Telecommunications (UPT) and Universal Mobile Telecommunications Service (UMTS) are discussed in clauses 11 and 12, respectively.

# 8. Switching and signalling management

## 8.1 Functional specifications on the OS/NE interface

The following specifications focus on the information model at the Q3 interface between the NE and the OS.

**I-ETS 300 291 [82]** is a functional specification of customer administration on the Operations System/Network Element (OS/NE) interface and is concerned with the function of managing customer service provisioning information on a switch.

**I-ETS 300 292 [83]** is a functional specification of call routing information management on the Operations System/Network Element (OS/NE) interface and is concerned with the management aspects of the "routing and digit analysis" function in an exchange. ETSI is currently working on a revised version to this I-ETS.

**I-ETS 300 637 [84]** is a functional specification of traffic management on the Operations System/Network Element (OS/NE) interface. It assumes that we want to enable as many calls as possible to be successfully completed. Hence this document attempts to; maximise the use of resources, monitor performance, and control the flow of traffic. ITU-T is working on a similar Recommendation.

## 8.2 Management of V5 interface

V5 interfaces are access interfaces, that operate between an Access Network (AN) and a Local Exchange (LE) to support various narrowband, ISDN and PSTN services. They are specified in **ETS 300 324-1 [85]** and **ETS 300 347-1 [86]**.

**ETS 300 376-1 [87]** specifies the Q3 interface between an AN and the TMN for the support of configuration management functions for V5 interfaces and their associated user ports. This ETS details the requirements for this interface and specifies the object classes, (however it does not actually specify an object class for an AN). **ETS 300 376-2 [88]** provides the Managed Object Conformance Statements (MOCS) proforma for ETS 300 376-1 [87]. It identifies the mandatory, conditional and optional elements of the information model specified in ETS 300 376-1.

**ETS 300 377-1 [89]** specifies the Q3 interface between an LE and the TMN for the support of configuration management functions for V5 interfaces and their associated customer profiles. The provision of services to customers follows the principles defined in I-ETS 300 291 [82] The functional specification of customer administration on the OS/NE interface. Hence the information model defined in ETS 300 377-1 [89] uses some of the object classes defined in I-ETS 300 291. **ETS 300 377-2 [90]** provides the MOCS proforma for ETS 300 377-1.

**ETS 300 378-1 [91]** specifies the Q3 interface between an AN and TMN for the support of fault and performance management functions for V5 interfaces and their associated user ports. It includes the scheduled testing of the lines and line circuits at the user ports associated with the V5 interface, and the logging of faults and related functions. **ETS 300 378-2 [92]** provides the MOCS proforma for ETS 300 378-1 [91]. It identifies the mandatory, conditional and optional elements of the information model specified in ETS 300 378-1.

**ETS 300 379-1 [93]** specifies the Q3 interface between an LE and TMN for the support of fault and performance management functions for V5 interfaces and their associated customer profiles.

ITU-T is also working on V5 management, however no stable documents exist at present.

### **8.3 Signalling System No. 7 (SS7) management**

#### **8.3.1 General management**

ITU-T Recommendation **Q.750 [94]** provides an introduction to the SS7 management series of recommendations, it also includes an architecture which is based on the OSI management model.

ITU-T Recommendation **Q.751 [95]** contains the managed object definitions for SS7 management.

ITU-T Recommendation **Q.752 [96]** considers the monitoring and measurements of SS7 networks to measure the present and estimate the future performance, utilisation and availability of the network. This is to enable the effective management of the network.

ITU-T Recommendation **Q.753 [97]** contains descriptions of the SS7 management functions; Message Transfer Part (MTP) routing management, Signalling Connection Control Part (SCCP) management and circuit management.

ITU-T Recommendation **Q.754 [98]** derives SS7 application service elements from those defined in CMIP.

ITU-T Recommendation **Q.755 [99]** contains protocol tests to be used for testing the SS7 management functions.



### 8.3.2 SS7 maintenance

ITU-T Recommendation **M.4100 [100]** considers the general administration of common channel SS7. It defines the administrative control and sub-control, their respective functions and responsibilities, contact point information and monitoring requirements for maintenance purposes. This Recommendation is currently being revised to take into account TMN principles. ITU-T Recommendation **M.4110 [101]** provides the various technical aspects that need to be considered when undertaking inter-administration agreements to establish SS7. This Recommendation is also currently being revised to take into account TMN principles.

### 8.4 Exchange Information of OAM

ITU-T Recommendation **Q.513 [102]** provides a brief overview of TMN interfaces relevant to switching and signalling.

## 9 Broadband Management

### 9.1 Management of ATM cross connects

**ETS 300 469 [103]** specifies the Q3 interface between an ATM cross connect and the TMN for all management services and functions required to manage an ATM cross connect.

ITU-T Recommendation **I.751 [104]** also specifies the Q3 interface between an ATM cross connect and the TMN. ETS 300 469 [103] was used as one of the inputs to ITU-T Recommendation I.751.

### 9.2 Management of ATM switches

ETSI is currently working on management of ATM switches, however no stable documents exist.

## 10 ISDN Management

General aspects of the ISDN user-network interface protocol for management are described in CCITT Recommendation **Q.940 [105]** which specifies the management architecture and provides an overview of the management services and functions. The management services are considered from the subscriber perspective.

ITU-T Recommendation **Q.941 [106]** contains ISDN user-network interface profile for management. It specifies the application protocol and the use of the layer 1-3 protocols at the ISDN user-network interface in providing management capabilities.

## 11 Universal Personal Telecommunication (UPT) management

UPT is a telecommunications service by which other telecommunications services, routing and charging can be related to a personal identity/subscription which can be moved freely between terminals and networks. UPT is an example of an IN service.

**ETR 179 [107]** describes UPT management aspects in terms of UPT Management Functional Areas, UPT Management Functional Components, UPT Management Function Sets and UPT specific Management Functions based on the OSI Functional areas. It also includes a description of a UPT management model and definitions of UPT specific Managed Objects (MOs).

## 12 Universal Mobile Telecommunication System (UMTS) management

ETSI is currently working on UMTS (Universal Mobile Telecommunications System) a third generation mobile telecommunications system. UMTS is an example of an Intelligent Network (IN) service. They are working on a TMN Framework to provide requirements and guidelines for the production of standards on management aspects relating to UMTS. UMTS management will allow operators to plan, provision, install, maintain, operate and administer UMTS. This framework will then be used by ETSI to produce a set of ETSS on UMTS management.

ITU-R is working on a similar system - FPLMTS (Future Public Land Mobile Telecommunication Systems) also referred to as IMT-2000 (International Mobile Telecommunications - 2000).

## **13 Global System for Mobile (GSM) management**

The management functions for a Public Land Mobile Network (PLMN) are described using ETSI and ITU-T principles. The GSM 12-series is divided between network management and maintenance requirements. It is important to note that both logical functions and physical requirements are described and that many maintenance activities utilise operational functions.

The following descriptions are taken from the GSM Phase 2 versions of the documents. Each document is identified by its 12-series number as well as its assigned ETS number.

### **13.1 General specifications**

**ETS 300 612-1 [108]** is the fundamental specification that sets the framework for all the other 12 series specifications. It contains the overview of the objectives for the definition of the management environment. It also contains object definitions which are common to more than one application described in the 12-series.

**ETS 300 612-2 [109]** covers the common concepts and strategic aspects of PLMN Management which are specifically applicable to the PLMN, including example implementations.

A very important item of this specification is the definition of the protocols and profiles to be used on the management interfaces. It defines the System Management Functions (SMF) used and it also specifies the basic communication services on which the network management functions rely (CMIS, ACSE, ROSE, FTAM, etc.) and details of their use. This specification provides a common reference and background for the GSM 12 series in this area.

### **13.2 Subscriber, mobile equipment and services data administration**

**ETS 300 613 [110]** gives a description of the functions associated with the administration of data related to subscribers, mobile equipment's and services, from a network management point of view.

This data known as the "Subscriber Profile" is used for the provision of services for a particular user of a PLMN, or for the user's equipment represented by the International Mobile Subscriber Identity (IMSI) and the International Mobile Equipment Identity (IMEI) respectively. The functions include the administrative procedures for both the subscriber (for example "provision of service"), and the equipment identified by the IMEI. Also included is the management of subscriber data necessary for network management.

The managed functional entities involved are the Home Location Register (HLR), Visitor Location Register (VLR), Mobile Switching Service Centre (MSC), Equipment Identity Register (EIR), Authentication Centre (AUC). The administration of subscriber data in all these entities is part of this specification, which includes the means for a PLMN operator to create, update and delete information concerning a particular subscriber in order to allow (or bar) the use of the network.

### **13.3 Security management**

**ETS 300 614 [111]** describes the management of security aspects of GSM. Specifically the air interface in the GSM PLMN. It includes an overview of security features together with a description of the relevant management procedures and associated object model.

### **13.4 Performance management**

**ETS 300 615 [112]** gives a description of the requirements for the management of performance measurements and the collection of performance measurement data across a PLMN. It defines the administration of measurement schedules, the generation of measurement results in the NEs and the transfer of these results to the OS. It also describes how the various requirements can be modelled as part of the generic PLMN information model. A set of measurements available for collection by NEs are described.

### 13.5 Subscriber related call and event data

**ETS 300 616 [113]** is concerned with the administration of subscriber related call and event data. This includes both the collection of call data from, and the distribution of tariff to, the network elements.

The subscriber (IMSI) and mobile equipment (IMEI) related call and event data collected is employed by a number of management activities including billing and accounting, statistical analysis and customer care.

The tariff data in the network elements is required to support the supplementary service "Advice of Charge".

The aim of this specification is to describe both the network management functions required and the data involved.

### 13.6 Network configuration management

**ETS 300 617 [114]** describes the configuration management aspects for those network elements which comprise the GSM PLMN, with initial emphasis on the management of the Base Station System (BSS). This is described from a high level management perspective and decomposed into constituent functionalities, which in turn will allow the construction of a management information model using the object oriented paradigm to support open systems management.

This specification defines a set of controls to be employed to effect set-up and changes to a PLMN, in such a way that operational capability, network integrity and interworking co-operation are ensured. In this way, the interface behaviour for the management of the network elements of a PLMN is defined in the context of the described management environment. The standardisation of specific controls is outside the scope of this specification.

### 13.7 Subscriber and equipment trace

**ETS 300 627 [115]** specifies the trace facility for GSM where it refers to:

- subscriber tracing (tracing of IMSI);
- equipment tracing (tracing of IMEI).

It does not cover types of trace which relate more to network elements than to individual subscribers, e.g. tracing events within a BSS, and so on.

### 13.8 Maintenance of the base station system

**ETS 300 619 [122]** addresses fault management as applied to the GSM Base Station System (BSS) network element. It defines requirements, management services, management service components and service component functions associated with GSM fault management for the BSS. It also defines an information model to support this fault management capability for the BSS by an operations systems over a Q3 interface.

### 13.9 Network management procedures

**ETS 300 622 [116]** provides the management information model for the BSS Network Element as seen on the Q3 interface between the OS, for example the Operations and Maintenance Centre (OMC) and the BSS. The management information defined in this document is primarily related to what is termed configuration management within CCITT Recommendation X.701 [2] definition of Systems Management Functional Areas. In addition to formal GDMO definitions, information is included to aid in understanding the model and its elements. Summary descriptions, containment and inheritance diagrams and entity relationship diagrams are provided for this purpose.

**ETS 300 623 [117]** addresses the network management messages and procedures across the A-bis interface which is defined as Qx in GSM. The information model included here defines the objects and how they are addresses for purposes of operation and maintenance activities.

There is a requirement for the A-bis interface to be open to allow interoperation between Base Transceiver Stations (BTSs) of different manufacturers working to the same Base Station Controller (BSC). This specification addresses this requirement from the operation and maintenance point of view, which allows this interworking to take place. It shows the split of network management functions between BSC and BTS. The procedures and coding of the messages are specified in detail.

**ETS 300 624 [118]** ensures management of different manufacturers' BTS from the OMC through the BSC in a standardised way, BSC interworking is needed to link the ETS 300 622 [116] on the OMC-BSC interface and the ETS 300 623 [117] on the A-bis interface.

On the OMC-BSC interface the description of BTS and its components follows an object-oriented approach. On the A-bis interface the addressing of managed objects is a compromise between an object oriented and a functional approach. This standard specifies the mapping of two different information models: information model in the OMC-BSC interface and in the A-bis interface.

The scope of this Recommendation is to cover the interworking specification related to the BSC

### **13.10 Object identifier registration**

**ETR 128 [119]** describes the structure to be used for the registration of the managed object classes and associated descriptions within the ETSI identifier tree.

## **14 Radio systems management**

### **14.1 European Radio Message System (ERMES)**

The ERMES paging system is described in ETS 300 133. This is a multipart ETS and the operations and maintenance aspects are described in **ETS 300 133-7/A1 [120]**. It defines the architecture of the TMN and the network management functions. TMN entities and the functional interfaces between these entities and the network elements are defined and described.

### **14.2 Terrestrial Flight Telephone System (TFTS)**

TFTS is a public telecommunications system for aircraft to provide voice services using a cellular direct air-ground radio transmission system. TFTS specific network management standards have not been identified.

### **14.3 Trans European Trunked Radio System (TETRA)**

TETRA provides advanced, flexible, wide-area digital voice and data communications (up to 28.8 kb/s) to meet the requirements of professional radio users such as the emergency services, utilities and transport industries. TETRA specific network management standards are currently being developed.

### **14.4 Digital European Cordless Telecommunications (DECT)**

DECT is a general radio access technology for short range wireless telecommunications. No DECT specific network management standards have been specified.

## **15 Private networks**

Much of the work on managing Private Integrated Services Network (PISN) is based on the work on managing public networks. ECMA TC32 and Business TeleCommunications (BTC) Technical Committees produce standards for private networks at the European level. They use the TMN work of Network Aspects Technical Committee as a basis for managing private networks. However, Simple Network Management Protocol (SNMP) is also being considered.

### **15.1 Management framework**

**ECMA TR/54 [121]** considers the management of a PISN environment, and the interworking of PISN network management with public network management and other PISN network management. This document provides a reference model for PISN network management.

## 15.2 Management services

ETR 245 [122] provides PISN management service definitions and relates them to the management functions in ITU-T Recommendation M.3400. These service definitions are based on the TMN service definition defined by ETSI and the ITU-T.

## 16 Customer Network Management (CNM)

CNM provides (business) customers with access to management information in the public network management system used by this kind of users. This management information relates to services provided to the customer by the service provider. In some cases the customer may be able to modify information, for example entering fault reports. CNM may be provided within a TMN environment although this is not a requirement. If CNM is provided with a TMN, CNM information is passed via the X interface.

### 16.1 CNM service

ITU-T Recommendation **X.160 [123]** defines the architecture for CNM. ITU-T Recommendation **X.161 [124]** defines the management services for CNM.

### 16.2 Definition of management information for CNM

ITU-T Recommendation **X.162 [125]** defines the management information for CNM using CMIP. ITU-T Recommendation **X.163 [126]** defines the management information for CNM using Electronic Data Interchange (EDI) with X.400 Message Handling Systems (MHS).

**Annex A (informative): Ordered table of TMN documents**

Doc Id	Title	Source
X.200	Information technology - Open Systems Interconnection: Basic reference model: The basic model	ITU-T SG7
X.209	Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1)	ITU-T SG7
X.680	Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation	ITU-T SG7

Doc Id	Title	Source
X.700   ISO/IEC 7498-4:1989	Management Framework for Open Systems Interconnection (OSI) for CCITT Applications	ITU-T SG7 & ISO/IEC
X.701   ISO/IEC 10040	Information technology - Open Systems Interconnection - Systems management overview	ITU-T SG7 & ISO/IEC
X.710   ISO/IEC 9595	Common Management Information Service (CMIS) Definition	ITU-T SG7 & ISO/IEC
X.711   ISO/IEC 9596-1	Common Management Information Protocol (CMIP) Specification	ITU-T SG7 & ISO/IEC
X.720   ISO/IEC 10165-1	Information technology - Open Systems Interconnection - Structure of management information: Management information model	ITU-T SG7 & ISO/IEC
X.721   ISO/IEC 10165-2	Information technology - Open Systems Interconnection - Structure of management information: Definition of management information	ITU-T SG7 & ISO/IEC
X.722   ISO/IEC 10165-4	Information technology - Open Systems Interconnection - Structure of Management Information: Guidelines for the definition of managed objects	ITU-T SG7 & ISO/IEC
X.723   ISO/IEC 10165-5	Information technology - Open Systems Interconnection - Structure of management information: Generic management information	ITU-T SG7 & ISO/IEC
X.724   ISO/IEC 10165-6	Information technology - Open Systems Interconnection - Structure of management information: Requirements and guidelines for implementation conformance statement proformas associated with OSI management	ITU-T SG7 & ISO/IEC
X.730   ISO/IEC 10164-1	Information technology - Open Systems Interconnection - Systems Management: Object management function	ITU-T SG7 & ISO/IEC
X.731   ISO/IEC 10164-2	Information technology - Open Systems Interconnection - Systems Management: State management function	ITU-T SG7 & ISO/IEC
X.732   ISO/IEC 10164-3	Information technology - Open Systems Interconnection - Systems Management: Attributes for representing relationships	ITU-T SG7 & ISO/IEC

X.733   ISO/IEC 10164-4	Information technology - Open Systems Interconnection - Systems Management: Alarm reporting function	ITU-T SG7 & ISO/IEC
X.733/Amend. 1	Information technology - Open Systems Interconnection - Systems Management: Alarm reporting function Amendment 1: Implementation conformance statement proformas	ITU-T SG7 & ISO/IEC
X.734   ISO/IEC 10164-5	Information technology - Open Systems Interconnection - Systems Management: Event report management function	ITU-T SG7 & ISO/IEC
X.734/Amend. 1	Information technology - Open Systems Interconnection - Systems management: Event report management function - Amendment 1: Implementation conformance statement proformas	ITU-T SG7 & ISO/IEC
X.735   ISO/IEC 10164-6	Information technology - Open Systems Interconnection - Systems Management: Log control function	ITU-T SG7 & ISO/IEC
X.736   ISO/IEC 10164-7	Information technology - Open Systems Interconnection - Systems Management: Security alarm reporting function	ITU-T SG7 & ISO/IEC
X.738   ISO/IEC 10164-13	Information technology - Open Systems Interconnection - Systems Management: Summarization function	ITU-T SG7 & ISO/IEC
X.739   ISO/IEC 10164-11	Information technology - Open Systems Interconnection - Systems Management: Metric objects and attributes	ITU-T SG7 & ISO/IEC
X.740   ISO/IEC 10164-8	Information technology - Open Systems Interconnection - Systems Management: Security audit trail function	ITU-T SG7 & ISO/IEC
X.741   ISO/IEC 10164-9	Information technology - Open Systems Interconnection - Systems Management: Objects and attributes for access control	ITU-T SG7 & ISO/IEC
X.742   ISO/IEC 10164-10	Information technology - Open Systems Interconnection - Systems Management: Usage metering function for accounting purposes	ITU-T SG7 & ISO/IEC
X.745   ISO/IEC 10164-12	Information technology - Open Systems Interconnection - Systems Management: Test Management function	ITU-T SG7 & ISO/IEC
X.746   ISO/IEC 10164-15	Information technology - Open Systems Interconnection - Systems Management: Scheduling function	ITU-T SG7 & ISO/IEC

Doc Id	Title	Source
ISO/IEC ISP 11183-1	Information technology - International Standardized Profiles AOM 1n OSI Management - Management Communications - Part 1: Specification of ACSE, presentation and session for the use by ROSE and CMISE".	ISO/IEC
ISO/IEC ISP 11183-2	Information technology - International Standardized Profiles AOM 1n OSI Management - Management Communications - Part 2: CMISE/ROSE for AOM12 - Enhanced Management Communications	ISO/IEC
ISO/IEC ISP 11183-3	Information technology - International Standardized Profiles AOM 1n OSI Management - Management Communications - Part 3: CMISE/ROSE for AOM11 - Basic Management Communications	ISO/IEC

ISO/IEC DISP 12060-1	Information technology - International Standardized Profiles - OSI Management - Management functions - Part 1: AOM211 - General management capability	ISO/IEC
ISO/IEC DISP 12060-2	Information technology - International Standardized Profiles - OSI Management - Management functions - Part 2: AOM212 - Alarm reporting and state management capabilities	ISO/IEC
ISO/IEC DISP 12060-3	Information technology - International Standardized Profiles - OSI Management - Management functions - Part 3: AOM213 - Alarm reporting capabilities	ISO/IEC
ISO/IEC DISP 12060-4	Information technology - International Standardized Profiles - OSI Management - Management functions - Part 4: AOM221 - General event report management	ISO/IEC
ISO/IEC DISP 12060-5	Information technology - International Standardized Profiles - OSI Management - Management functions - Part 5: AOM231 - General log control	ISO/IEC

Doc Id	Title	Source
M.60 (1994)	Maintenance terminology and definitions	ITU-T SG4

Doc Id	Title	Source
M.3000	Overview of TMN Recommendations	ITU-T SG4
M.3010 (1993)	Principles for a telecommunications management network	ITU-T SG4
M.3020 (1993)	TMN interface specification methodology	ITU-T SG4
M.3100 (1992)	Generic network information model	ITU-T SG4
M.3180 (1993)	Catalogue of TMN management information	ITU-T SG4
M.3200	TMN management services: overview	ITU-T SG4
M.3300	TMN management facilities presented at the F interface	ITU-T SG4
M.3400	TMN management functions	ITU-T SG4

Doc Id	Title	Source
ETR 037	Network Aspects (NA); Telecommunications Management Network (TMN); Objectives, principles, concepts and reference configurations	ETSI NA4
ETR 078	Maintenance: Telecommunications management network TMN interface specification methodology [CCITT Recommendation M.3020 (1992)]	ETSI NA4



ETR 046	Network Aspects (NA); Telecommunications management networks modelling guidelines	ETSI NA4
I-ETS 300 293	Telecommunications Management Network (TMN); Generic managed objects	ETSI NA4
I-ETS 300 653	Telecommunications Management Network (TMN); Generic managed object class library for the network level view	ETSI NA4
ETR 088	Network Aspects (NA); Time/type of day dependant scheduling function support object classes	ETSI NA4
ETR 047 (1992)	Network Aspects (NA); Telecommunications Management Network (TMN) Management services	ETSI NA4
ETR 048 (1992)	Network Aspects (NA); Telecommunications Management Network (TMN) Management services prose descriptions	ETSI NA4

Doc Id	Title	Source
Q.811	Lower layer protocol profiles for the Q3 interface	ITU-T SG11
Q.812	Upper layer protocol profiles for the Q3 interface	ITU-T SG11
Q.821	Stage 2 and stage 3 description for the Q3 interface - Alarm surveillance	ITU-T SG11
Q.822	Stage 1, stage 2 and stage 3 description for the Q3 interface - Performance management	ITU-T SG11

Doc Id	Title	Source
G.773	Protocol suites for Q interfaces for management of transmission systems	ITU-T SG15
G.774	Synchronous digital hierarchy (SDH) management information model for the network element view	ITU-T SG15
G.774.01	Synchronous digital hierarchy (SDH) performance monitoring for the network element view	ITU-T SG15
G.774.02	Synchronous digital hierarchy (SDH) configuration of the payload structure for the network element view	ITU-T SG15
G.774.03	Synchronous digital hierarchy (SDH) management of multiplex section protection for the network element view	ITU-T SG15
G.774.04	Synchronous Digital Hierarchy (SDH) Management of the Subnetwork Connection Protection for the Network Element View	ITU-T SG15
G.774.05	Synchronous digital hierarchy (SDH) management of connection supervision functionality (HCS/LCS) for the network element view	ITU-T SG15
G.783	Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks	ITU-T SG15

G.784	Synchronous digital hierarchy (SDH) management	ITU-T SG15
G.803	Architectures of transport networks based on the synchronous digital hierarchy (SDH)	ITU-T SG15
G.831	Management capabilities of transport networks based on the synchronous digital hierarchy (SDH)	ITU-T SG15

Doc Id	Title	Source
ETS 300 150	Transmission and Multiplexing (TM); Protocol suites for Q interfaces for management of transmission systems	ETSI TM2
ETS 300 304	Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH) information model for the Network Element (NE) view	ETSI TM2
ETS 300 411	Transmission and Multiplexing (TM); Performance monitoring information model for the Network Element (NE) view	ETSI TM2
ETS 300 412	Transmission and Multiplexing (TM); Payload configuration information model for the Network Element (NE) view	ETSI TM2
ETS 300 413	Transmission and Multiplexing (TM); Multiplex section protection information model for the Network Element (NE) view	ETSI TM2
ETS 300 484	Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH) information model; Connection supervision function (HCS / LCS) for the Network Element (NE) view	ETSI TM2
ETS 300 493	Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH) information model of the Sub Network Connection Protection (SNCP) for the Network Element (NE) view	ETSI TM2
ETS 300 371	Transmission and Multiplexing (TM); Plesiochronous Digital Hierachcy (PDH) information model for the Network Element (NE) view	ETSI TM2
ETR 240	Operation and Maintenance of Optical Access Networks	ETSI TM2

Doc Id	Title	Source
ETR 062	Network Aspects (NA); Baseline document on the integration of Intelligent Network (IN) and Telecommunication Management Network (TMN)	ETSI NA6/NA4
ETR 224	Intelligent Network (IN); Capability Set 2 (CS2); IN intra domain management requirements for CS2	ETSI NA6/NA4

Doc Id	Title	Source
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I-ETS 300 291	Network Aspects (NA); Functional specification of Customer Administration (CA) on the Operations System/Network Element (OS/NE) interface	ETSI NA4
I-ETS 300 292	Network Aspects (NA); Functional specification of call routing information management on the Operations System/Network Element (OS/NE) interface	ETSI NA4
I-ETS 300 637	Network Aspects (NA); Functional specification of traffic management on the Operations System/Network Element (OS/NE) interface	ETSI NA4

Doc Id	Title	Source
ETS 300 324-1	V5.1 Interface for the support of Access Network	ETSI SPS3
ETS 300 347-1	V5.2 Interface for the support of Access Network	ETSI SPS3

Doc Id	Title	Source
ETS 300 376-1	Signalling Protocols and Switching (SPS); Q3 interface at the Access Network (AN) for configuration management of V5 interfaces and associated user ports; Part 1: Q3 interface specification	ETSI SPS3
ETS 300 376-2	Signalling Protocols and Switching (SPS); Q3 interface at the Access Network (AN) for configuration management of V5 interfaces and associated user ports; Part 2: Managed Object Conformance Statement (MOCS) proforma specification	ETSI SPS3
ETS 300 377-1	Signalling Protocols and Switching (SPS); Q3 interface at the Local Exchange (LE) for configuration management of V5 interfaces and associated customer profiles; Part 1: Q3 interface specification	ETSI SPS3
ETS 300 377-2	Signalling Protocols and Switching (SPS); Q3 interface at the Local Exchange (LE) for configuration management of V5 interfaces and associated customer profiles; Part 2: Managed Objects Conformance Statement (MOCS) proforma specification	ETSI SPS3
ETS 300 378-1	Signalling Protocols and Switching (SPS); Q3 interface at the Access Network (AN) for fault and performance management of V5 interfaces and associated user ports; Part 1: Q3 interface specification	ETSI SPS3
ETS 300 378-2	Signalling Protocols and Switching (SPS); Q3 interface at the Access Network (AN) for fault and performance management of V5 interfaces and associated user ports Part 2: Managed Objects Conformance Statement (MOCS) proforma	ETSI SPS3
ETS 300 379-1	Signalling Protocols and Switching (SPS); Q3 interface at the Local Exchange (LE) for fault and performance management of V5 interfaces and associated customer profiles; Part 1: Q3 interface specification	ETSI SPS3

Doc Id	Title	Source
Q.750	Overview of Signalling System No. 7 management	ITU-T SG11
Q.751	Signalling System No. 7 managed objects	ITU-T SG11
Q.752	Monitoring and measurements for Signalling System No. 7 networks	ITU-T SG11
Q.753	Signalling System No. 7 management functions MRVT, SRVT and cVT and definition of the OMASE-user	ITU-T SG11
Q.754	Signalling System No. 7 management application service element (ASE) definitions	ITU-T SG11
Q.755	Signalling System No. 7 management protocol tests	ITU-T SG11
M.4100 (1993)	Maintenance of common channel Signalling System No. 7	ITU-T SG4
M.4110 (1993)	Inter-Administration agreements on common channel Signalling System No. 7	ITU-T SG4
Q.513	Digital exchange interfaces for operations, administration and maintenance	ITU-T SG11

Doc Id	Title	Source
ETS 300 469	Broadband Integrated Services Digital Network (B-ISDN); Asynchronous Transfer Mode (ATM); B-ISDN management architecture and management information model for the ATM crossconnect	ETSI NA5

Doc Id	Title	Source
I.751	Asynchronous Transfer Mode (ATM) management of the network element view	ITU-T SG15

Doc Id	Title	Source
ETS 300 612-1	European digital cellular telecommunications system (Phase 2); Network Management (NM); Part 1: Objectives and structure of Network Management (GSM 12.00)	ETSI SMG6
ETS 300 612-2	European digital cellular telecommunications system (Phase 2); Network Management (NM); Part 2: Common aspects of GSM/DCS 1800 Network Management (GSM 12.01)	ETSI SMG6
ETS 300 613	European digital cellular telecommunications system (Phase 2); Subscriber, Mobile Equipment (ME) and services data administration (GSM 12.02)	ETSI SMG6
ETS 300 614	European digital cellular telecommunications system (Phase 2); Security management (GSM 12.03)	ETSI SMG6
ETS 300 615	European digital cellular telecommunications system (Phase 2); Performance data measurements (GSM 12.04)	ETSI SMG6
ETS 300 616	European digital cellular telecommunications system (Phase 2); Subscriber related event and call data (GSM 12.05)	ETSI SMG6
ETS 300 617	European digital cellular telecommunications system (Phase 2); GSM Network configuration management (GSM 12.06)	ETSI SMG6
ETS 300 627	European digital cellular telecommunication system (Phase 2); Operation and Maintenance (O&M) aspects on tracing	ETSI SMG6
ETS 300 622	European digital cellular telecommunications system (Phase 2); Base Station System (BSS) Management Information (GSM 12.20)	ETSI SMG6
ETS 300 623	European digital cellular telecommunications system (Phase 2); Network Management (NM) procedures and message on the A-bis interface (GSM 12.21)	ETSI SMG6
ETS 300 624	European digital cellular telecommunications system (Phase 2); Interworking of GSM Network Management (NM) procedures and messages at the Base Station Controller (BSC) (GSM 12.22)	ETSI SMG6
ETR 128	European digital cellular telecommunications system (Phase 2); ETSI Object Identifier tree; Common domain; Mobile domain; Operation and Maintenance (O&M), managed object registration definition (GSM 12.30)	ETSI SMG6

Doc Id	Title	Source
ETR 179	Universal Personal Telecommunication (UPT); UPT management aspects	ETSI NA7

Doc Id	Title	Source
Q.940	ISDN user-network interface protocol for management - General aspects	ITU-T
Q.941	Digital subscriber Signalling System No. 1 (DSS 1) - ISDN user-network interface protocol profile for management	ITU-T

Doc Id	Title	Source
ETS 300 133-7/A1 (1994)	Paging Systems (PS); European Radio Message System (ERMES) Part 7: Operations and maintenance aspects	ETSI RES

Doc Id	Title	Source
X.160	Architecture for customer network management service for public data networks	ITU-T SG7
X.161	Definition of customer network management services for public data networks	ITU-T SG7
X.162	Definition of management information for customer network management service for public data networks to be used with the CNMc interface	ITU-T SG7
X.163	ITU-T Recommendation X.163: "Definition of management information for customer network management service for public data networks to be used with the CNMe interface"	ITU-T SG7

Doc Id	Title	Source
Forum 025	Network Management Forum: The "Ensemble" concepts and Format - Issue 1.0, August 1992	NMF

Doc Id	Title	Source
ECMA TR/54	A Management Framework for Private Telecommunications Networks	ECMA
ETR 245	Private Integrated Services Network (PISN) Management; Compendium of PISN management services	ECMA

## History

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