Technical Specification Group Services and System Aspects
Meeting #8, Düsseldorf, Germany, 26-28 June 2000

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Source: **SA5 (Telecom Management)**

Title: **32.102 CR, "Update ITU-T TMN related reference material in 32.102" (S5-000294)**

Document for: **Approval**

Agenda Item: **6.5.3**

Spec	CR	Phas	Subject	Ca	Versi	Versi	Doc-2nd-
32.102	004	R99	Update ITU-T TMN related reference material	F	3.1.1	3.2.0	S5-000294

3GPP TSG-SA5 (Telecom Management)
Meeting #12, Rome, Italy, 5 – 9 June 2000

S5-000294

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

32.102	CR	004	Current Version:	V.3.1.1

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	SA#8	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: SA5#12 **Date:** 9 June 2000

Subject: Update ITU-T TMN related reference material

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change:

This CR proposes to update reference material from ITU-T spec.

Considerable updates have been made on ITU-T TMN Standards 1999-2000. 3GPP TM architecture is largely based on TMN. The most important changes are identified and the proposal is to make changes in TS 32.102 according to this CR.

Clauses affected: 2.1 , 2.2 ; 4.2 ; 13 ; Annex A.1 ; A.2

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

An editorial modification proposal in the normative reference list is also included.

2 References

2.1 Normative references

[1] ITU-T Recommendation M.3010 (2000~~1996~~): "Principles for a telecommunications management network".

[2] 3G TS 32.101: "3G Telecom Management principles and high level requirements".

[3] ITU-T Recommendation Q.811 (1997~~3~~): "Lower layer protocol profiles for the Q3 interface".

[4] ITU-T Recommendation X.200 (1994): "Information technology – Open Systems Interconnection – Basic reference model: The basic model".

[5] CCITT Recommendation M.3400 (2000~~1992~~): "TMN management functions".

~~[6] TeleManagement Forum: "SMART TMN Technology Integration Map, GB909 (1998)".~~

2.2 Informative references

[20] TMF GB910. Smart TMN Telecom Operations Map (Release 1.1).

[21] TMF GB909. Smart TMN Technology Integration Map (Issue 1.1).

[22] ITU-T Recommendation M.3013-1999: “Considerations for a Telecommunications Management Network”.

4.2 TMN

TMN (Telecommunications Management Network), as defined in [1], provides:

- an architecture, made of OS (Operations Systems) and NEs (Network Elements), and the interfaces between them (Q~~3~~, within one Operator Domain and X, between different Operators);

13 Mediation/Integration

The increase in the need to incorporate a hybrid set of technologies, multiple protocols and heterogeneous resources requires the availability of open management interfaces between the management systems and the different network resources. These interfaces require an underlying mechanism to mediate - interpret, translate, and handle data – between the various data representations and protocols. A set of Technology Integration Points [21~~6~~] can be identified and will need to be supported.

Annex A (informative): Technology considerations

A.1 TMN ~~building~~ physical blocks

TMN functions can be implemented in a variety of physical configurations (M.3010 [1]). The relationship of the functional blocks to physical equipment is shown in Table A.1 which names the TMN ~~building~~ physical blocks according to the set of function blocks which each is allowed to contain. For each ~~building~~ physcical block there is a function block which is characteristic of it and is mandatory for it to contain. There also exist other functions, which are optional for the ~~building~~ physical blocks to contain. Table A.1 does not imply any restriction of possible implementations, but defines those identified within this Recommendation.

The subclauses below give the definitions for consideration in implementation schemes.

Table A.1: Relationship of TMN physical block names to TMN function blocks

(NOTES 2 and 3)	NEF	TF	OSF	WSF
NE	M	O	O	O (NOTE 3)
QA, XA, QM, XM		M		
OS		O	M	O
WS				M

M Mandatory
O Optional

NOTE 1 - Within this table, where more than one name is possible, the choice of the physical block name is determined by the predominant usage of the block.

NOTE 2 - TMN physical blocks may contain additional functionality which allows them to be managed.

NOTE 3 - For the WSF to be present the OSF must also be present. This means that the WSF must address an OSF. The local man-machine access is not considered part of the TMN.

A.1.1 Operations System (OS)

The OS is the system, which performs OFS. The OS may optionally provide ~~MFs,~~ QAFs and WSFs.

A.1.2 ~~Mediation Device (MD)~~Transformation

~~The MD is the device, which performs MFs. The MD may also optionally provide OFS, QAFs and WSFs.~~

~~MDs can be implemented as hierarchies of cascaded devices.~~Transformation provides conversion between different protocols and data formats for information interchange between physical blocks. There are two types of transformation: adaption and mediation that can apply at q or x reference points.

A.1.2.1 Adaptation device

An adaptation device (AD), or adaptor, provides transformation between a non-TMN physical entity to a NE to OS within a TMN. A Q-adaptor (QA) is a physical block used to connect NE-like or OS-like physical blocks with non-TMN compatible interfaces (at m reference points) to Q interfaces. An X-adaptor (XA) is a physical block used to connect non-TMN physical entities having a non-TMN communication mechanism in a non-TMN environment to an OS at the edge of a TMN.

A.1.2.2 Mediation device

A mediation device (MD) provides transformation between TMN physical blocks that incorporate incompatible communication mechanisms. A Q-mediation device (QMD) is a physical block that supports connections within one TMN. An X-mediation device (XMD) is a physical block that supports connections of OSs in different TMNs.

A.1.3 Network Element (NE)

The NE is comprised of telecommunication equipment (or groups/parts of telecommunication equipment) and support equipment or any item or groups of items considered belonging to the telecommunications environment that performs NEFs. The NE may optionally contain any of the other TMN function blocks according to its implementation requirements. The NE has one or more standard Q-type interfaces and may optionally have F and X interfaces.

Existing NE-like equipment that does not possess a TMN standard interface will gain access to the TMN via a Q Adaptor Function, which will provide the necessary functionality to convert between a non-standard and standard management interface.

NEs may be distributed or centralized. Various parts of a NE are not geographically constrained to one physical location. For example, the parts may be distributed along a transmission system. An example of a distributed NE is illustrated in Figure A.1 (M.3013 [22]).

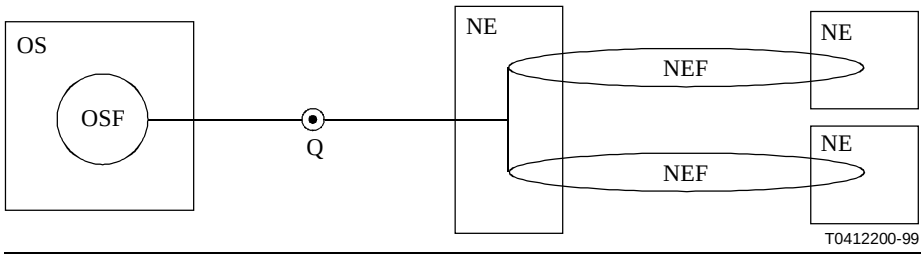


Figure A.1: Distributed network element

A.1.4 Workstation (WS)

The WS is the system which performs WSFs. The workstation functions translate information at the f reference point to a displayable format at the g reference point, and vice versa.

If equipment incorporates other TMN functionality as well as the WSF, then it is named by one of the other names in Table A.1

A.1.5 Data Communication Network (DCN)

A DCN supporting a TMN has traditionally conformed to the network service of the OSI reference model for ITU-T applications as specified in Recommendation X.200. ITU-T Recommendation X.25 has been a commonly used packet protocol. However, the evolution of telecommunication services is merging circuit-switched and packet-switched modes with advancing technologies of ISDN, ATM, SDH, and the Internet. A variety of telecommunications services can be employed as long as integrity of information transfer can be preserved.

Within a TMN, the necessary physical connection, such as circuit-switched or packet-switched, may be offered by communication paths constructed with various network components, including dedicated lines, X.25 packet-switched data network, ISDN, common channel signalling network, public-switched telephone network, local area networks, terminal controllers, etc. The facilities can be either dedicated to a DCN or shared resources (for example, using SS No. 7 or an existing X.25 or IP-based packet-switched network).

Equipment supporting an OSF must provide for two modes of data communication. These are spontaneous transmission of messages (e.g. for the NEF to the OSF) and a two-way dialogue (e.g. as the OSF obtains supporting information from the NEF and sends commands to the NEF or transfer messages to or from another OSF). In addition, an OSF is responsible for assuring the integrity of the data channels through a DCN. Physical connectivity in a local environment may be provided by a variety of subnetwork configurations including point-to-point, star, bus or ring.

The DCN may consist of a number of individual subnetworks of different types, interconnected together. The DCN may be a local path or a wide-area connection among distributed physical blocks. The DCN is technology independent and may employ any single or combination of transmission technologies.

A.1.6 TMN logical layered architecture within the TMN physical architecture

Four specializations of the OS physical block are defined to support a physical realization of function blocks in logical layers. The four specialized OS physical blocks are the Business (B-OS), the Service (S-OS), the Network (N-OS) and the Element (E-OS) Operations Systems. These physical blocks are named according to the predominant function block they contain. Specifically, B-OS, S-OS, N-OS and E-OS predominantly contain B-OSF, S-OSF, N-OSF and E-OSF respectively. When physical blocks contain more than one kind of specialized OS function block that provide substantial functionality to the physical block, thus spanning more than one logical layer, the physical block is named according to the highest hierarchically layered function block. For example, a physical block containing both N-OSF and E-OSF, providing substantial network functionality is called an N-OS.

The exchange of management information between logical layers employs the managing roles and managed roles of the TMN interaction model. This allows management activities to be clustered into layers and to be decoupled. The managed roles will be associated with a set of information elements from information model(s) exposing a view at the layer's level of abstraction (e.g. equipment, element, network, service). Generally, managing and managed roles may be placed in logical layers without restriction. A managed role may be associated with a set of information elements from any layer. Managed roles may be placed in any layer and invoke operations associated with any other managed roles.

A.1.7 Interoperable interface concept

In order for two or more TMN physical blocks to exchange management information they must be connected by a communications path and each element must support the same interface onto that communications path.

It is useful to use the concept of an interoperable interface to simplify the communications problems arising from a multivendor, multicapability network.

The interoperable interface defines the protocol suite and the messages carried by the protocol. Transaction-oriented interoperable interfaces are based upon an object-oriented view of the communication and therefore, all the messages carried deal with object manipulations. It is the formally defined set of protocols, procedures, message formats and semantics used for the management communications.

The message component of the interoperable interface provides a generalized mechanism for managing the objects defined for the information model. As part of the definition of each object there is a list of management operations types which are valid for the object. In addition, there are generic messages that are used identically for many classes of managed objects.

In the architecture, what predominantly distinguishes one interface from another is the scope of the management activity that the communication at the interface must support. This common understanding of the scope of operation is termed Shared Management Knowledge. Shared Management Knowledge includes an understanding of the information model of the managed network (object classes supported, functions supported, etc.), management support objects, options, application context supported, etc. The Shared Management Knowledge ensures that each end of the interface understands the exact meaning of a message sent by the other end.

A.1.3 Q Adaptor (QA)

The QA is a device, which connects NE-like or OS-like with non-TMN compatible interfaces (at m reference points) to Q_x or Q_3 interfaces.

A.1.4 Data Communication Network (DCN)

The DCN is a communication network within a TMN, which supports the DCF. The DCN represents an implementation of the OSI layers 1 to 3, which include any relevant ITU-T (formerly CCITT) or ISO standards for layers 1 to 3. The DCN provides no functionality at layers 4 to 7.

The DCN may consist of a number of individual subnetwork(s) of differing types, interconnected together. For example, the DCN may have a backbone subnetwork(s) that provides TMN-wide connectivity between a variety of subnetwork(s) providing local access to the DCN. The various types of sub-networks may include technology specific subnetwork(s) such as the SDH DCC.

A.1.5 Network Element (NE)

The NE is comprised of telecommunication equipment (or groups/parts of telecommunication equipment) and support equipment or any item or groups of items considered belonging to the telecommunications environment that performs NEFs. The NE may optionally contain any of the other TMN function blocks according to its implementation requirements. The NE has one or more standard Q type interfaces and may optionally have F and X interfaces.

Existing NE-like equipment that does not possess a TMN standard interface will gain access to the TMN via a Q Adaptor Function, which will provide the necessary functionality to convert between a non-standard and standard management interface.

A.1.6 Workstation (WS)

The WS is the system, which performs WSFs. The workstation functions translate information at the f reference point to a displayable format at the g reference point, and vice versa.

If equipment incorporates other TMN functionality as well as the WSF, then it is named by one of the other names in Table A.1.

Table A.1: Relationship of TMN building block names to TMN function blocks

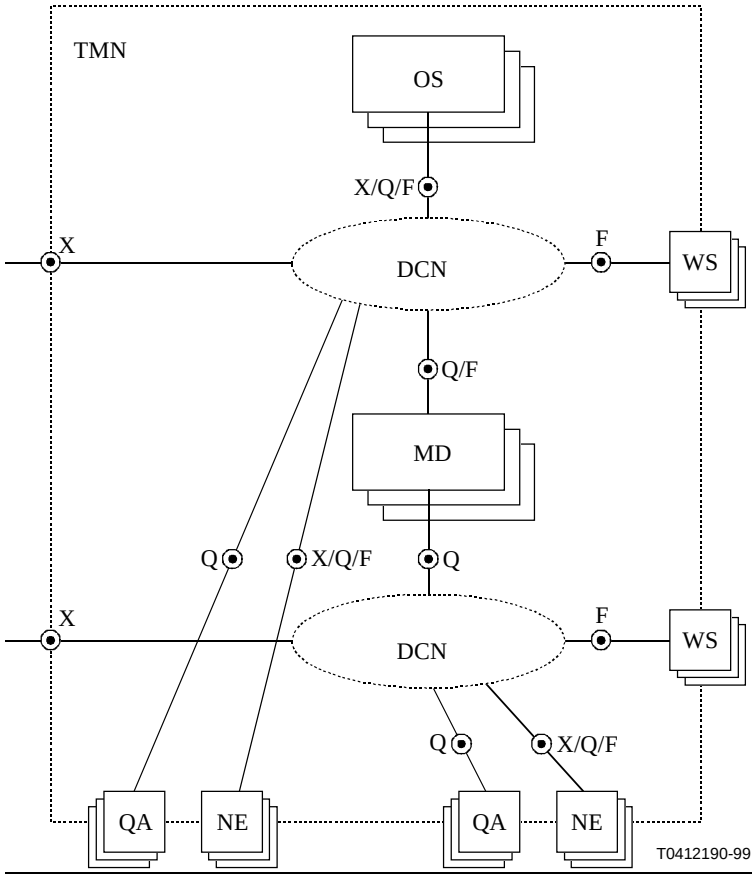
(Notes 2 & 3)	**NEF**	**MF**	**QAF**	**OSF**	**WSF**
NE	M	O	O	O	O (Note 3)
MD		M	O	O	O
QA			M		
OS		O	O	M	O
WS					M

M Mandatory
O Optional

NOTE 1: Within this table, where more than one name is possible, the choice on the building block name is determined by the predominant usage of the block.
NOTE 2: TMN building blocks may contain additional functionality, which allows them to be managed.
NOTE 3: For the WSF to be present either the MF or OSF shall also be present. This means that the WSF shall address an OSF or a MF. The local man-machine access is not considered part of the TMN.

A.2 TMN standard interfaces

Figure A.2 shows an example of a physical architecture. It represents each of the functions as physical blocks and illustrates how a number of interfaces might share communication paths within a given TMN physical architecture.



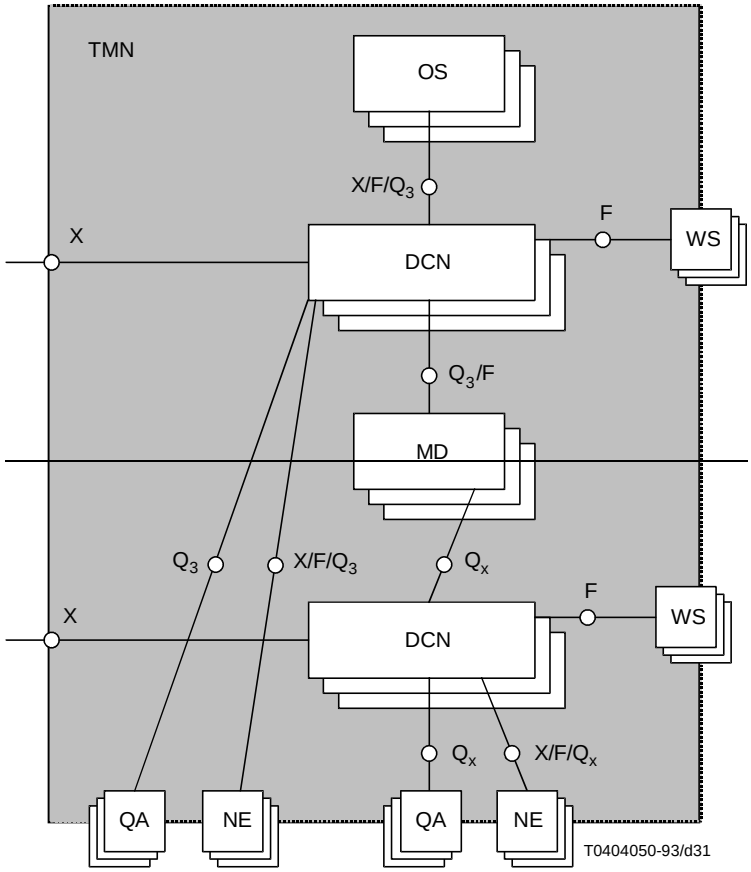


Figure A.2~~1~~: Examples of interfaces for the TMN physical architecture M.3010 [1]

Figure A.2~~1~~ shows the interconnection of the various TMN physical~~building~~ blocks by a set of standard interoperable interfaces. The allowable interconnections of these standard interfaces within a given TMN may be controlled by both the actual interfaces provided and/or by security and routing restrictions provided within the various physical~~building~~ block entities (e.g. passwords, log-ons, DCN routing assignment, etc.).

TMN standard interfaces are defined corresponding to the reference points. They are applied at these reference points when external physical connections to them are required.

There is a family of protocol suites for each of the TMN interfaces; Q_3~~, Q_x,~~ X and F. The choice of the protocol is dependent on the implementation requirements of the physical configuration.

A.2.1 Q interface

The Q interface is applied at q reference points.

To provide flexibility of implementation, the class of Q interfaces is made up of the following subclasses:

- the interface Q_3 is applied at the q_3 reference point;
- ~~the interface Q_x is applied at the q_x reference point.~~ the Q interface is characterized by that portion of the information model shared between the OS and those TMN elements to which it directly interfaces.

~~The Q_3 interface is characterized by that portion of the information model shared between the OS and those TMN elements to which it directly interfaces.~~

~~The q_x reference point represents the requirements derived from the interaction between MF-MAF and other applicable MAFs. The difference in these requirements from those which a q_3 reference point represents will be clarified using TMN management functions (as defined in Recommendation M.3400 [5]) as well as some definite interface characteristics. The difference between Q_x and Q_3 interfaces are for further study. The Q_x interface is characterized by that portion of the information model that is shared between the MD and those NEs and QAs it supports.~~

~~The information models for both types of interfaces can potentially be the same but it can normally be expected that the less functionality there is, that the protocol supports, the less generic the information model will be. Hence, the MF is needed to provide conversion between the information models.~~

~~Qx support non-standardised protocols.~~

A.2.2 F interface

The F interface is applied at f reference points. The F interfaces connecting workstations to the TMN physical~~building~~ blocks containing OFS or MFs through a data communication network are included in this Recommendation. Connections of implementation specific, WS-like entities to OSs or NEs, are not subject of this Recommendation.

A.2.3 X interface

The X interface is applied at the x reference point. It will be used to interconnect two TMNs or to interconnect a TMN with other network or systems which accommodates a TMN-like interface. As such, this interface may require increased security over the level, which is required by a Q-type interface. It will therefore be necessary that aspects of security are addressed at the time of agreement between associations, e.g. passwords and access capabilities.

The information model at the X interface will set the limits on the access available from outside the TMN. The set of capabilities made available at the X interface for access to the TMN will be referred to as TMN Access.

Additional protocol requirements may be required to introduce the level of security, non-repudiation, etc. which is required.

A.2.4 Relationship of TMN interfaces to TMN physical~~building~~ blocks

Table A.1~~2~~ defines the possible interfaces, which each named TMN physical~~building~~ block can support. It is based upon the function blocks which Table A.1 associates with each physical~~building~~ block and the reference points between function blocks.

~~Table A.2: Relationship of TMN interfaces to TMN building blocks~~

	~~Q_x~~	~~Q_3~~	~~X~~	~~F~~
~~NE~~	~~(Note 1)~~ ~~O~~	~~O~~	~~O~~	~~O~~
~~OS~~	~~(Note 1)~~ ~~O~~	~~O~~	~~O~~	~~O~~
~~MD~~	~~(Note 1)~~ ~~O~~	~~O~~	~~O~~	~~O~~
~~QA~~	~~(Note 1)~~ ~~O~~	~~O~~		
~~WS~~				~~(Note 2)~~ ~~M~~

~~M Mandatory~~
~~O Optional~~

~~NOTE 1: At least one of the interfaces inside the box shall be present.~~
~~NOTE 2: This mandatory relationship only to workstations.~~

Table A.3: Differences between TMN interfaces [1]

Differentiating factors	X interface	F interface	Q_3 interface
Function blocks	OSF- OSF	OSF – WSF MF – WSF	OSF – NEF/ OSF – MF/ OSF – OSF/ OSF – QAF
Service type	interactive (object oriented)/store-and-forward file transfer/	interactive (object oriented)	interactive (object oriented)/file transfer
Syntax	machine/machine ASN.1	machine/machine human/machine characters	machine/machine ASN.1
Access control requirement on an activity basis	Mandatory	optional	optional
Other security aspects (e.g. data integrity/ encryption)	Yes	yes	For further study
NOTE: Q_x interface is for further study.			

The application layer (layer 7) of each family is common, and is the basis for ensuring interoperability. Some functionality of layer 7 may not always be required (e.g. file transfer). In certain interfaces, some or all of the other layers may have reduced functionality.

The requirement of the lower layers is to support the upper layers. Several network types have been identified as suitable for the transport of TMN messages such as those detailed in Recommendation Q.811 [3]. Any one or a mixture of networks could be used so long as suitable interworking is made available.

For network equipment that does not have an interoperable interface, there is a need to convert the protocols and messages into an interoperable interface format. This conversion is performed by Message Communications Functions plus Q-Adaptor Functions, which can reside in Q-Adaptors, Network Elements, Mediation Devices or Operations Systems.