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ETSI Standard

**Telecommunications Management Network (TMN);
Universal Mobile Telecommunications System (UMTS);
Management architecture framework;
Overview, processes and principles**



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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Telecommunications Management Network (TMN).

1 Scope

The present document establishes and defines the framework architecture for the management of UMTS.

Therefore, the present document identifies and/or defines:

- the reference model, showing the elements the UMTS Management System interacts with;
- the network operator processes needed to run, operate and maintain a UMTS network;
- the functional architecture of the UMTS Management System;
- the principles to be applied to UMTS Management Interfaces;
- the methodology to be followed in further steps of the UMTS Management Specifications.

The present document does not provide physical architectures of the UMTS Management System.

The present document is applicable to all further ETSI specifications regarding the Network Management of UMTS.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

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

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions apply:

UMTS Organization: A legal entity that is involved in the provisioning of UMTS.

Management Infrastructure: The collection of systems (computers and telecommunications) a UMTS Organization has in order to manage UMTS.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ATM	Advanced Testing Methods
CMIP	Common Management Information Protocol
CORBA IIOP	Common Object Request Broker Architecture Internet Inter-ORB Protocol
CPE	Customer Premises Equipment
DECT	Digital Enhanced Cordless Telecommunications
DSS1	Digital Signalling System number one
GSM	Groupe Spécial Mobile
HTML	HyperText Mark-up Language
IN	Intelligent Network
INAP	IN Application Protocol
IP	Internet Protocol
ISDN	Integrated Services Digital Network
LLA	Logical Layered Architecture
MAP	Management Access Protocol
MMI	Man-Machine Interface
NE	Network Entity
OP	Operation System
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RSVP	Reservation Protocol
SLA	Service Level Agreement
SNMP	Simple Network Management Protocol
TMN	Telecommunications Management Network
UMTS	Universal Mobile Telecommunications System
UTRA	Universal Telecommunications Radio Access
VHE	Virtual Home Environment

4 General

4.1 UMTS

4.1.1 UMTS Reference Model

A Universal Mobile Telecommunications System is made of the following components:

- 1 or more Access Networks, using different types of access techniques (GSM, UTRA, DECT, PSTN, ISDN, ...);
- 1 or more Core Networks, service specific or not, (GSM, UMTS, ISDN, IP, ATM ...);
- 1 or more Intelligent Node Networks, service logic and mobility management, (IN, GSM ...);
- 1 or more transmission networks (PDH, SDH etc) in various topologies (point-to-point, ring, point-to-multipoint...) and physical means (radio, fiber, copper ...).

The UMTS components have signalling mechanisms among them (V5, A, DSS1, INAP, MAP, #7, RSVP, ...).

From the service perspective, the UMTS is defined to offer:

- service support transparent to the location, access technique and core network, within the bearer capabilities available in one particular case;
- user to terminal and user to network interface (MMI) irrespective of the entities supporting the services required (VHE);
- multimedia capabilities.

4.1.2 UMTS Provisioning Entities

DTS/SMG-012201U (see Bibliography) identifies two major entities which cover the set of UMTS functionalities involved in the provision of the UMTS services to the user. These are:

- **Home Environment.** This entity holds the functionalities that enable a user to obtain UMTS services in a consistent manner regardless of the user's location or the terminal used.
- **Serving Network.** This entity provides the user with access to the services of the Home Environment.

4.1.3 UMTS Management Infrastructure

Every UMTS Organization has its own Management Infrastructure. Each Management Infrastructure will contain different functionality depending on the role played and the equipment used by that UMTS Entity.

However the core management architecture of the UMTS Organization is very similar. Every UMTS Organization:

- provides services to its customers;
- needs an infrastructure to fulfil them (advertise, ordering, creation, provisioning, ...);
- assures them (Operation, Quality of Service, Trouble Reporting and Fixing, ...);
- bills them (Rating, Discounting, ...).

Not every UMTS Organization will implement the complete Management Architecture and related Processes. Some processes may be missing dependent on the role a particular UMTS Organization is embodying. Processes not implemented by a particular UMTS Organization are accessed via interconnections to other UMTS organizations which have implemented these processes (called X-interfaces in the TMN architecture).

The Management architecture itself does not distinguish between external and internal interfaces.

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 (Q3, within one Operator Domain and X, between different Operators);
- the methodology to define those interfaces;
- other architectural tools such as LLA (Logical Layered Architecture) that help to further refine and define the Management Architecture of a given management area;
- a number of generic and/or common management functions to be specialized/applied to various and specific TMN interfaces.

The UMTS Management Architecture is based on TMN, and will reuse those functions, methods and interfaces already defined (or being defined) that are suitable to the management needs of UMTS. However, the UMTS Management needs to explore the incorporation of other concepts (other management paradigms widely accepted and deployed) since:

- UMTS incorporates other technologies to which TMN is not applied fully;
- UMTS faces new challenges that TMN does not address today.

It has to be noted, that these concerns are applicable to other telecommunication areas as well as to UMTS, it is expected that the eventual evolution of TMN will cover this ground. Indeed, most of the above concepts are already being taken into account by TMN evolution (protocols and methodologies).

5 Architectural Framework

5.1 UMTS Management Reference Model

Figure 1 illustrates the UMTS Management Reference Model. It shows the UMTS Management System interfacing other systems.

The present document (and the rest of the ETSI UMTS Management detailed specifications) addresses the UMTS Management System (function and architecture wise) and the interfaces to the other systems (information and protocol wise).

The present document does not address the definition of any of the systems the UMTS Management System interfaces to. The rest of the ETSI specifications regarding UMTS Management will not cover them either.

It is not the approach (nor it is possible) to re-define the complete management of all the technologies that might be used in the provision of UMTS. However, it is the intention to identify and define what will be needed from the perspective of UMTS management.

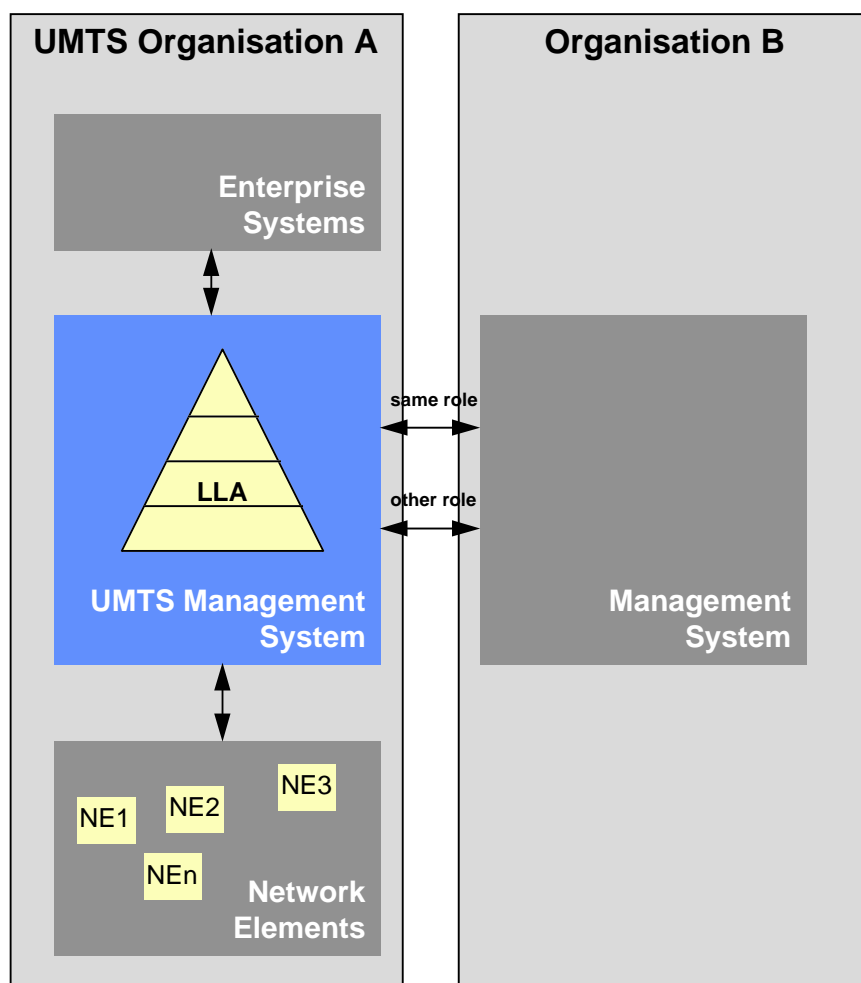


Figure 1: UMTS Management System Interactions

5.2 Interfaces to Enterprise Systems

It is the approach to define a UMTS Management that fully fits into the enterprise processes needs of the UMTS Organizations. One of the essential issues of today's way of running telecommunications businesses is integral operation (e.g.: customer care, from service subscription to billing, from order fulfilment to complaint management).

Enterprise System are those Information Systems that are used in the telecommunication organizations but are not directly or essentially related to the telecommunications aspects (Call Centers, Fraud Detection and Prevention Systems, Invoicing etc.).

Standardizing Enterprise Systems is out of the scope of ETSI work, since it involves many operator choices (organizational, etc) and even regulatory. More over, they are many times a competitive tool. However, it is essential that the requirements of such systems are taken into account and interfaces to the UMTS Management Systems are defined, to allow for easy interconnection and functional support.

5.3 Interfaces to NEs

In some cases, the management interfaces to NEs have been defined bottom-up, trying to standardize the complete O&M functionality of the various NEs.

For UMTS management, a top-down approach will be followed to streamline the requirements from the perspective of top priority management processes within a UMTS operator.

It is assumed that this will not fully cover the OAM functionality of all NE types in UMTS at once, therefore a part of the functionality will be phased for further work and consideration, and some proprietary solutions (local and/or remote) will be needed in the interim. The rationale of that approach is not only lack of resources, but also to follow a pragmatic step-wise approach that takes into account the market forces (manufacturers and operators capabilities), defining clear and easy to consensuate steps that allow to have Management functionality implemented on the same time frame than the telecom functionality in the network (i.e. synchronize the management and network releases).

It is the approach to Management Interfaces to NEs to concentrate on information models, allowing the mapping to several protocol suites. The rationale is:

- the blurring of Information and Telecommunication technologies in UMTS, it is required to work on a more open approach (acknowledging the market status and foreseen evolutions);
- the life-cycle of information flows is 10 to 20 years, while the protocols is 5 to 10 years;
- the developments on automatic conversion allows for a more pragmatic and open approach.

However, it is the intention to at least recommend one mapping for each interface.

5.4 Interfaces to other Management Systems

UMTS Management considers integrally the interaction between the management systems of other legal entities for the purpose of providing UMTS services.

There are two major types of interfaces to other management systems:

- to other UMTS Management Systems (i.e. other from other UMTS operators);
- to other Management Systems (i.e. to non UMTS operators).

The first type deals with co-operation to provide UMTS services across a number of UMTS networks (e.g. roaming related interactions).

The second type deals with client-server relationship to other operators (e.g. to leased lines providers, to added value service providers etc).

The approach that will be followed is to identify and define integral processes, not taking into account at first step, how many operator/management systems might be involved, just concentrating on the interactions among them (i.e. assuming a UMTS operator encompasses all functionalities). A further step will consider and define extra requirements (security, confidentiality etc.) when part of the process involves interactions with other operator/management system.

6 UMTS Management Processes

UMTS Management will be approached from the point of view of the management processes involved in the running of the UMTS telecommunication systems.

This clause identifies and describes those major processes, following and considering a telecommunication enterprise model that expands from the relationship to the customers to the operation of the network elements, both inclusive (see figure 2).

NOTE 1: Processes such as Roaming Agreement Management or Fraud Management are covered by and included within these major processes.

NOTE 2: Q-Adapter needs to be interpreted here in a wider sense than in [1], since UMTS will consider other application protocols different to CMIP.

This clause is based on NMF GB910 (see Bibliography).

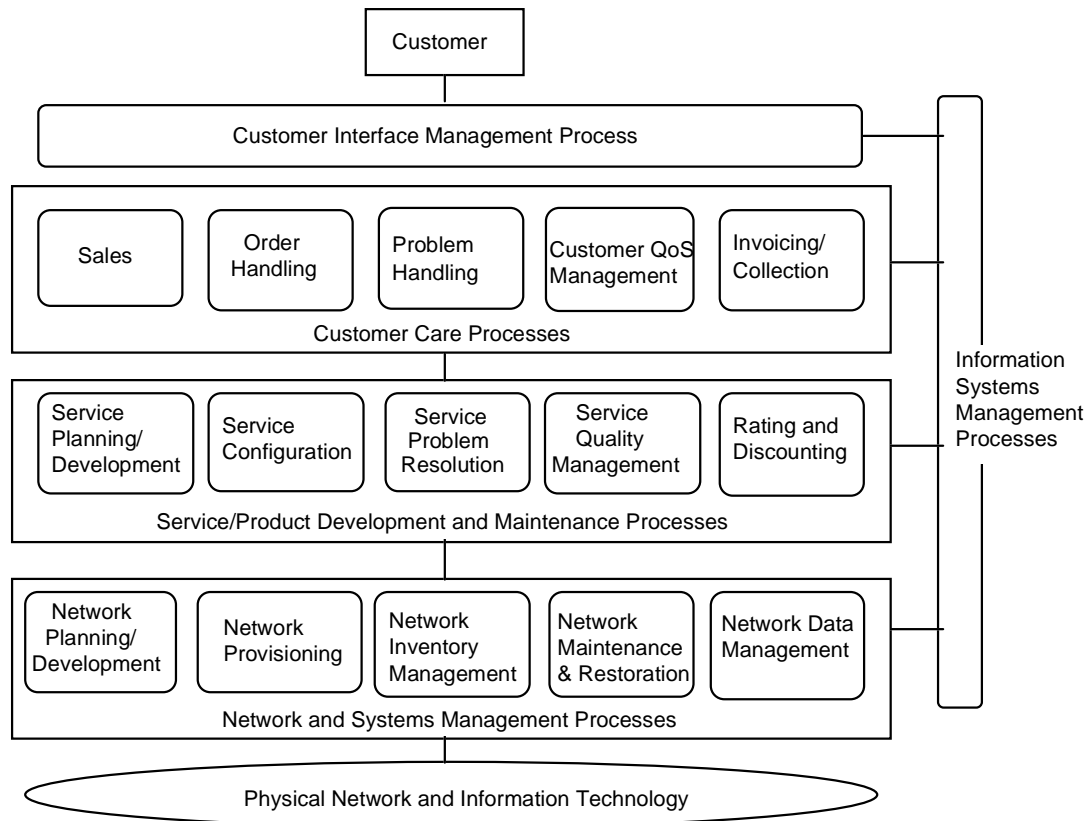


Figure 2: Telecommunications Operation Map (Source NMF GB910 (see Bibliography))

6.1 Customer Interface Processes

This process encompasses all those aspects that involve direct interaction with the customers of a UMTS Organization.

It basically consist in translating customer requests or interactions into requests to other processes (provisioning, billing etc.).

All effective interactions with the customers will be logged and tagged for further tracking and/or post-processing.

Taking into account current trends, it is very likely that the interaction with the customer is not through an operator but computer based. The process definition, functionally speaking, is transparent to this fact. It is assumed that it is only a presentation and access rights issue. An operator is to be seen as a mediator between the customer and the management system, the operator will have access (maybe depending on the operator type) to more data than the customer. Therefore, security and flexible access rights is a key factor to this process group.

ETSI Standards on this respect will not define presentation aspects (HTML, dialling based systems, etc) but the information exchanges between the customer and the UMTS Management system.

Functionality for this process includes:

- Sales Inquiries;
- Subscription requests;
- Subscription Profile Management (tariff plan, service configuration, QoS, payment data ...);
- Complaints (faults, performance, billing ...);
- Billing Inquiries.

6.2 Sales Process

The Sales Process deals basically with sales inquiries from the customers. The Sales Process aim is two fold:

- to learn about the customer expectations;
- to find the current offering that better matches those expectations.

This process needs information on current/planned offering (from Service Planning/Development Process and QoS Management).

Information obtained during this process might be used for market surveys, forecasting service demand (volume and/or new services), advertising etc.

6.3 Ordering Process

The Ordering Process includes all the functions of accepting a customer's order for service, tracking the progress of the order, co-ordinating actions to other processes to implement the order and notifying the customer when the order is complete.

Orders are to be understood in a broad sense, i.e. including also changes and cancellations of previous orders.

Order Handling involves several of the following functions:

- determine the feasibility and price estimate of the request;
- develop an order plan;
- perform credit check and/or require deposit;
- initiate the service installation (to Service Configuration);
- establish QoS and SLA terms (for Problem Handling);
- establish rating/discounting terms;
- track order status;
- initiate the service and the billing process.

To support these functions, the Ordering Process relies in information provided by the Service Planning/Development Process and needs to be supported by Service Configuration and Credit Processes. In some cases, it may need direct support of other UMTS Organizations.

6.4 Problem Handling Process

The Problem Handling Process takes responsibility of the reception and resolution of customer complaints. Additionally, operator's problems affecting the service shall be communicated to Problem Handling and they might be notified to the customer (depending on the problem type and instance). Therefore it involves some of the following functionalities:

- determine cause of the problem;
- forward complaint to relevant processes;
- track the progress of resolution (if resolution is delegated to other internal processes and/or other UMTS Organizations);
- take corrective actions:
 - reconfiguration;
 - pay-back/discount ...

6.5 Quality of Service Monitoring Process

The Quality of Service (QoS) Monitoring Process takes responsibility of reporting information in relationship to the SLA QoS (end-to-end). Therefore it involves:

- reception of performance data;
- elaboration of QoS parameters;
- elaboration of scheduled customer reports;
- determination of SLA/QoS violations (either triggered by a customer complaint or an internal service problem).

6.6 Invoicing and Collection Process

The Invoicing and Collection Process basically deals with invoices. Typically it covers the following functions:

- processing of the billing records into invoices;
- invoice on behalf of third party providers (Other UMTS Organizations);
- sending of invoices;
- collect payments;
- debt management;
- respond invoicing related inquiries from the customer.

6.7 Service Planning and Development Process

The Service Planning and Development Process basically consists in designing the technical capabilities to meet the service needs of a specified market at the desired cost. It ensures that the new services being planned can be properly installed, monitored, controlled and billed. It also ensures that the capacity/dimensioning would be appropriate in relationship with the expected sales. The output of this process triggers the actions to implement the services:

- modifications to the underlying network and information systems;
- agreements with other providers;
- service documentation;
- pre-operational testing.

6.8 Service Configuration Process

The Service Configuration Process basically deals with the installation and/or configuration of available services for specific customers, including the configuration/installation of the CPE, at contracting time as well as at subsequent customer modification requests. Therefore, it involves:

- design solution;
- assign capacity;
- configure network and CPE;
- update customer information;
- initiate orders (to its own organization and/or other providers).

6.9 Service Problem Resolution Process

The Service Problem Resolution Process basically consists in identifying the root cause of service failures and initiating actions to solve them. This process is triggered both by customer complaints and/or the network events (only service affecting events). This process does not correlate network events into service affecting events. Additionally it involves:

- identification of chronic failures;
- recommendation of re-design or re-configuration of the service (depending on the severity and cause of the problem);
- initiation of test to validate problems/solutions.

6.10 Service Quality Management Process

The Service Quality Management Process is responsible of determining whether or not the service levels are being met consistently, in terms of performance, problems and penetration forecasts/goals. It is also responsible of initiating the appropriate actions to correct deviations (excess as well as defect) from those forecasts/goals.

6.11 Rating and Discounting Process

The Rating and Discounting Process basically consists in applying the correct rating rules to the usage information on a customer-by-customer basis and applying any discount/rebate that is pertinent (either agreed in the ordering process or as a consequence of an SLA violation).

6.12 Network Planning and Development Process

The Network Planning and Development Process basically deals with translating service and capacity requests into implementation plans. Typically it covers the following functions:

- validate and implement new service descriptions against network capabilities (if current network can not meet the request but upgrade and/or additional equipment can make it feasible, it might be possible to initiate the ordering process to the suppliers);
- allocate more capacity based on service planning/configuration and/or network information (performance etc.).

It ensures that the requests can be properly installed, monitored, controlled and billed in the network.

It also ensures that the capacity is enough to meet the estimations.

In implementing the requests, this process might sub-contract capacity and/or capability of other network operators.

6.13 Network Provisioning Process

The Network Provisioning Process basically deals with the network configuration, ensuring that the capacity and functionality is ready for provisioning planned services. Typically it covers the following functions:

- (re-)configuration of the network, including the topology and connectivity based on service and network planning requests;
- re-configuration of the network based on network maintenance plans and/or network events (faults, performance etc.);
- (re-)configuration of network terminations to satisfy service instances of specific customers;
- start the testing and monitoring (usage/performance) processes in the network that are needed and relevant to its function.

6.14 Network Inventory Management Process

The Network Inventory Management Process is responsible of all administrative and operational information of all network elements in the network, including spare parts and software versions. Typically it covers the following functions:

- installation and validation of all NEs and associated equipment of the physical network;
- administration of all NEs and associated equipment of the physical network;
- repairing and upgrading of all the NEs and associated equipment of the physical network;
- guarantee the alignment of the inventory repository with the actual NEs and associated equipment of the physical network.

6.15 Network Maintenance and Restoration Process

The Network Maintenance and Restoration Process its responsible for maintaining the operational quality of the network, in accordance with required network performance goals. Typically it covers the following functions:

- planning and triggering of preventive actions (e.g. scheduled routine tests);
- responding to fault/performance degradation conditions by taking the appropriate corrective actions;
- determine the cause and impact of the problems found.

6.16 Network Data Management Process

The Network Data Management Process basically deals with collecting, registration and pre-processing of data and events of the network. This information might be used for performance evaluation, traffic analysis and billing. Typically it covers the following functions:

- provisioning of sufficient and relevant information for the evaluation of SLA violations;
- provisioning of sufficient and relevant information to properly bill the customers and/or other providers;
- ensure that the network performance goals are tracked and that the appropriate notification is provided when any of these goals is compromised or violated;
- suggest changes to the network configuration (re-configuration or capacity requests) in case traffic conditions required it so.

7 UMTS Management Interfaces

All management interfaces in UMTS, namely:

- between the NEs and the Management System of a single UMTS Organization;
- between Management Systems of different UMTS Organizations;
- within the Management System of a single UMTS Organization;
- between the Management System and the Enterprise Systems of a single UMTS Organization,

can be studied from four different perspectives or levels:

- logical (information model and flows used in the relationship manager-agent, or equivalent);
- application protocol (end to end, upper layers protocol running between manager-agent, or equivalent);
- networking protocol (lower layer protocols carrying the information in/out the manager and agent, or equivalents);
- physical (mapping of the manager and agent, or equivalents, roles into physical entities).

7.1 Logical Level

This level covers the mutual and conceptual knowledge of entities being connected by a given interface.

Interactions at this level are fully standardized by ETSI in terms of Information Models (static information definition, in a language as protocol neutral as possible) and Information Flows (dynamic aspects).

7.2 Application Protocol Level

This level covers the set of primitives used to pass information across a given interface and the means to establish associations between the application entities (including the related addressing aspects) across a given interface.

The Application Protocol Suite used for the interaction between entities across a given interface is optional within the valid UMTS Management Application Protocol Suites (see Annex A for a list of UMTS Management Protocol Suites). In some cases, one of those protocol suites will be recommended as preferred protocol suite.

7.3 Networking Protocol Level

Whatever standardized protocol suite at the networking level that is capable of meeting the functional and operational requirements (including the network addressing aspects) of the Logical and Application Protocol levels of a given UMTS management interface, is a valid Networking Protocol for that interface. No further standardization will be defined within ETSI, in order to allow market to influence on this point.

7.4 Physical Level

Though the interaction at the logical level takes place between the UMTS Management System and the UMTS NEs, it is left to the implementor choice the possibility to use the Q-Adaptor concept of TMN Architecture as physical implementation (as defined in [1]).

NOTE: Q-Adapter needs to be interpreted here in a wider sense than in [1], since UMTS will consider other application protocols different to CMIP.

The present document does not preclude the usage of Q-Adaptors at other interfaces of the UMTS Management.

7.5 Compliance Conditions

For a UMTS entity (Management System or NE) to be compliant to a given UMTS Management Interface, all the following conditions shall be satisfied:

- 1) it implements the management functionality following the Information Model and flows specified by the relevant ETSI UMTS Management Interface Specifications applicable to that interface;
- 2) it provides at least one of the valid Application Protocols specified by ETSI UMTS Application Protocols for that interface;
- 3) it provides at least one standard networking protocol;
- 4) in case the entity does not offer the management interface on its own, a Q-Adaptor shall be provided. This Q-Adaptor shall be provided independently of any other UMTS NE and/or UMTS Management System.

8 Methodology

8.1 Documentation

The Methodology followed for the specification of UMTS Management is structured in the following levels and steps:

8.1.1 UMTS Management Overall Architecture, Functionality/Processes and Principles specification

Defined by the present document.

8.1.2 Description of UMTS Management Processes

One Technical Report will be produced per UMTS Management Process. The intention is not to standardize the Processes themselves, but the interactions between them. This type of document will capture the functional and operational aspects of the process that are needed for the production of the various interfaces.

8.1.3 UMTS Management Interface Specifications

One ETSI Standard will be produced per UMTS Management Interface. Interface Specifications will be multi-part Work Items:

- Part 1: Information Model and Flow;
- Part 2: Recommended Protocol Suite (if applicable).

8.1.4 Other General Applicability Specifications

Another level of documentation will be defined either to:

- capture together aspects common or relevant to a number of processes;
- further progress general aspects in terms of architecture, principles etc.

8.2 Tools and Methods

The tool and method to be used for documenting Interface Specifications will be UML.

Annex A (normative): UMTS Management Application Protocols

The valid Management Application Protocols for UMTS are:

- CMIP;
- SNMP;
- CORBA IIOP.

Further developments on the Application Protocols applicable to management will be monitored and eventually accepted.

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

DTS/SMG-012201U: "Universal Mobile Telecommunications System (UMTS); UMTS service aspects; Service principles (UMTS 22.01)".

NMF GB910: "NMF Telecom Operations Map (Draft 0.2)".

History

Document history		
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