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Technical Report

Universal Mobile Telecommunications System (UMTS); Network and Service Management Requirements for UMTS (UMTS 21.06, version 3.0.0)

Approved by SMG as SMG version only, not for publication

The logo for UMTS, consisting of the letters 'UMTS' in a bold, blue, sans-serif font. The background of the entire page features a large graphic of concentric, overlapping light blue arcs that resemble a signal or a stylized 'G' shape, with a grey rectangular area on the right side.

UMTS

Universal Mobile
Telecommunications System



Reference

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Contents

Intellectual Property Rights.....	4
Foreword.....	4
Introduction.....	4
1 Scope.....	5
2 References.....	5
3 Definitions and abbreviations.....	6
3.1 Definitions.....	6
3.2 Abbreviations.....	6
4 General.....	6
4.1 UMTS Phase 0.....	6
4.2 UMTS Phase 1 & beyond.....	6
4.3 Network Management.....	8
4.3.1 Requirements.....	9
4.3.2 Security Management.....	9
4.3.3 Performance Monitoring.....	10
4.3.4 System Configuration.....	10
4.3.5 Maintenance.....	11
4.3.5.1 Pro-active Maintenance.....	11
4.3.5.2 Detection/Localisation/Isolation of Failures.....	12
4.3.5.3 Reactive Maintenance.....	12
4.3.6 User Interface.....	12
4.4 Service Management.....	13
4.4.1 Requirements.....	13
4.4.1.1 Interoperability.....	13
4.4.1.2 Service Usage.....	15
4.4.2 Service management life cycle.....	16
4.4.3 Quality of Service Management.....	17
4.4.4 Service and Business Areas.....	18
4.4.4.1 Subscriber and User Administration.....	18
4.4.4.2 Charging and Billing.....	18
4.4.4.3 Inter-Operator Accounting.....	19
4.4.4.4 Terminal Administration.....	19
4.4.5 Requirements related to roaming.....	19
5 Future ETSI Standardisation for Network & Service Management.....	20
5.1 UMTS Management Standards.....	20
5.2 Target time scales for the work.....	21
Annex A: Optional NM Requirements.....	22
Annex B: Bibliography.....	23
History.....	24

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Foreword

This Technical Report (TR) has been produced by ETSI Special Mobile Group (SMG).

Introduction

The vision of UMTS is based on the evolution of GSM. Inevitably this means that the GSM network management system must evolve to UMTS network management.

From this we can deduce that there is not a need for new revolutionary services, and that both manufacturers and Network Operators are seeking cost-effective solutions to their short term needs. It may be said that the demand for mobile variable bit rate data services is not yet developed nor certain, but we should remember the success of GSM. GSM is an example of the success that may be achieved by developing the standards for new systems before the demand becomes too great. The standardisation of UMTS will bring new and different services that will make new demands on network management.

UMTS will be one of the IMT-2000 family members, the minimum service capabilities and features of which will be defined by the ITU. Accordingly the network & service management requirements defined in this document shall be aligned with those produced by the ITU. UMTS network and service management must not only support the relevant minimum functions to qualify as a family member of IMT-2000, but should also seek to be influential within ITU in the definition of those functions to enhance and improve those functions from a UMTS perspective.

1 Scope

The present document specifies the overall objectives and requirements for the definition of network and service management of both the Radio Access Network(s) and Core Network(s) for UMTS and focuses on functional aspects.

Detailed requirements for management systems, network elements and interfaces will be defined at a later stage. To this end this TR puts forward a proposal for ETSI to create the standards required for UMTS network and service management.

The proposal identifies :

- functionalities for future UMTS network and service management standardisation activity;
- the relevant committees to carry out the work;

See clause 6

2 References

References may be made to:

- a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
- b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or
- c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or
- d) publications without mention of a specific version, in which case 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] | TG32 UMTS - Radio Requirements |
| [2] | UMTS 22.25 Quality of Service and network performance |
| [3] | UMTS 22.05 Service capabilities |
| [4] | UMTS 33.20 Security Principles for UMTS |
| [5] | UMTS 22.15 Security and Charging |
| [6] | UMTS 22.24 New charging & Accounting Mechanisms |
| [7] | UMTS 22.70 Virtual Home Environment |
| [8] | UMTS 22.71 Automatic Establishment of Roaming agreements |
| [9] | UMTS 23.05 Network Principles |
| [10] | TG24 Requirements for Charging, Billing, Accounting, Tariffing |
| [11] | UMTS 22.20 Service Management |
| [12] | UMTS 22.25 Quality of Service and Network Performance |
| [13] | ITU-T G.805-1995 Generic Functional Architecture of Transport Networks |
| [14] | GSM 12.00 |

3 Definitions and abbreviations

3.1 Definitions

Management Service: An area of management activity which provides for the support of operations, maintenance or administration of the network being managed, described from the user perception of the OAM requirements.

Management Function: The smallest part of the management service as perceived by the user of the service. A management function is a co-operative interaction between application processes in managing and managed systems for the management resources (physical and logical).

Service A set of functions offered to a user by an organisation

3.2 Abbreviations

2G	Second Generation
3G	Third Generation
AN	Access Network
CN	Core Network
IN	Intelligent Network
IP	Internet Protocol
ISDN	Integrated Services Digital Network
NM	Network Management
QoS	Quality of Service
SLA	Service Level Agreement
SM	Service Management

4 General

It is an accepted premise that a third generation system should offer superior services and capabilities to its users compared to second generation systems. This premise applies equally to UMTS management. The primary requirement of UMTS management is thus to provide superior management services and capabilities for network operators/service providers, and in particular, where deficiencies that exist in the GSM system have been identified they shall not be imported into UMTS network management.

4.1 UMTS Phase 0

It is expected that phase 0 of UMTS, (the enhancement of 2G systems by some UMTS functionality, e.g. by introducing GPRS), will be managed with existing and emerging (in the case of GPRS) 12 series appropriately extended. This TR addresses UMTS phase 1 and beyond.

4.2 UMTS Phase1 & beyond

UMTS management will allow Network Operators and Service Providers to plan, provision, install, maintain, operate, and administer all equipment embraced within a UMTS network to develop, offer, provide, assure and bill UMTS services

A UMTS network is in general a very heterogeneous, complex network whose entities are grouped into a layered structure by several different drivers, mainly regulatory and operational. This layered structure (as outlined in fig. 1) is an extension of the layered networks architecture principles developed in ITU-T G.805. However this document is focusing on the client layer in terms of ITU-T G.805 and leaves the details of a transport network supporting a UMTS network out of scope.

NOTE: Within this TR Figure 1 is intended to outline the business environment only where UMTS management has to fit in.

As in any telecommunication network the transport network is the basis for a UMTS network. This UMTS transport network is besides the architectural concepts of ITU-T G.805, layered (horizontally structured) and partitioned (vertically structured).

The reasons for the additional layering within the UMTS transport network are business and/or regulatory reasons. In case the UMTS transport network operator is not able to fulfil a transport requirement from its application network caused by either missing technical means or missing legal permissions than additional transport capacity has to be contracted. This is illustrated in figure 1 as transport network and transport subnetwork.

The additional partitioning within the UMTS transport network is driven by the specific requirements of a wireless network applying the transport network capabilities or being the application network on top of the transport network. A wireless network such as UMTS contains two transport network clients :

- 1) UMTS radio access network (RAN) requiring transport capabilities for unswitched traffic; and
- 2) UMTS core network (CN) requiring transport capabilities for switched traffic.

This results in a corresponding partitioning within the transport network.

The layering between the application network (UMTS RAN and CN) and the Value Added Services networks are a result of regulatory requirements (separation between Network Operator and Service Provider). Therefore application networks will not have direct interface with retail customers. Application networks have only wholesale customers in the form of Service Providers. In addition to the retail of UMTS services provided by the application network Service Providers have the possibility to extend these services or to provide new services.

A detailed architecture of a UMTS network extending and filling up the principles illustrated in Fig. 1 are subject to separate UMTS network architecture specifications and therefore out of the scope of this document.

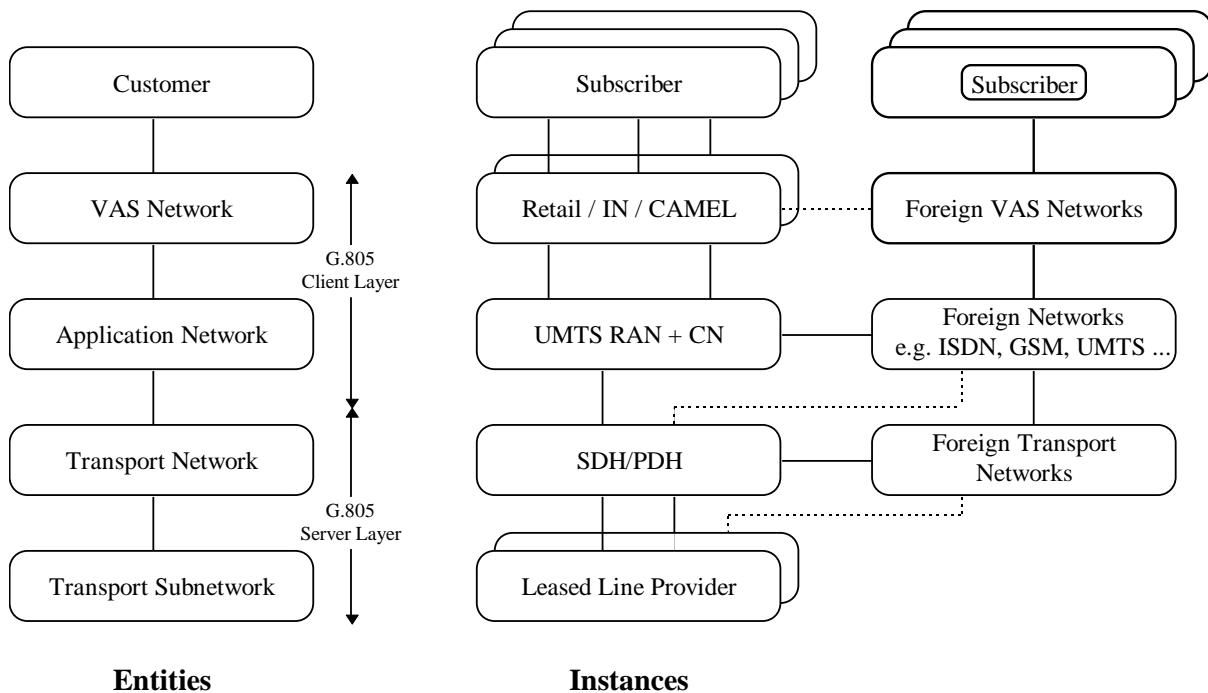


Figure 1: Layered structure of an UMTS network

Based on a UMTS network architecture, specification management processes and functions will be identified, information flows will be described and interface specifications will be derived from the requirements to support the described information flows. Within this scope it is a major objective to reuse and to utilise as much work already done as possible. Examples might be Transport Network Management and UMTS Service Profile Management (see Ref 11).

It is recognised that some requirements, whilst desirable, are not essential. For this reason UMTS management requirements have been subdivided into two categories :

Essential requirements

These requirements are mandatory and identify the minimum set of UMTS management requirements needed to be supported by a system in order to qualify as a UMTS system. Essential UMTS management requirements are specified in this clause.

Non essential requirements

These requirements are not mandatory but identify additional UMTS management requirements which are desirable in a UMTS system. These optional requirements permit UMTS systems to provide a higher level of standardised UMTS management. Optional requirements are specified in Annex A.

[The minimum set is currently not defined.]

UMTS management focuses on two layers of the TMN pyramid :Network Management

Service Management

These are shown in Fig 2 below along with Element management, and Business management. Element management is the set of functions that provide network element specific information to the network management layer and vice versa. For the purposes of this document element management is considered to be part of network management.

NOTE: Element management systems usually provide the means to manage all network elements of at least a certain type from at least one vendor all together. This level of subnetwork management capabilities differs from element manager to element manager. Nevertheless these management systems provide a grouping of Networks Elements into Subnetworks (by technology and/or by vendor) and therefore are partly located within the network layer.

Network management has the difficult task to process the requirements imposed by the Service Management in order to provide the customer an appropriate service onto the capabilities provided by the technology of its subnetworks. Then it has to integrate, correlate and in many cases summarise the information coming from its subnetworks, in order to pass on the relevant information to Service Management Systems.

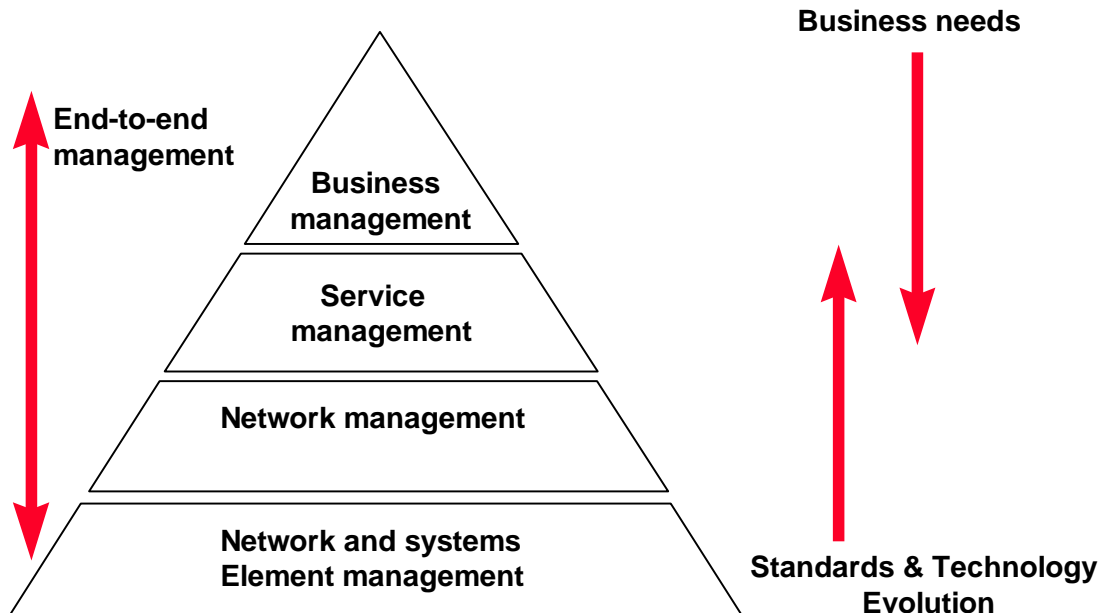


Figure 2: UMTS Management Pyramid

4.3 Network Management

Network management will provide a variety of management services required to support the planning of operations, administration, maintenance and provisioning of networks and services for a UMTS telecommunications system and includes management of the RAN and CN.

4.3.1 Requirements

The requirements and decomposition of Network Management for UMTS do not differ radically from that of 2G systems. The following requirements have been identified :

- 1) To be capable of managing equipment supplied by different vendors including the management systems themselves.
- 2) To minimise the complexity of UMTS management.
- 3) To build UMTS Network Management according to the principles of the TMN framework.
- 4) To provide the communication between UMTS Network Elements and UMTS Management Systems or between UMTS Management Systems themselves via standardised interfaces (e.g. Q3, CORBA, SNMP, etc.) as appropriate and necessary.
- 5) To minimise the costs of managing a UMTS network such that it is a small component of the overall operating cost.
- 6) To provide UMTS configuration capabilities that are flexible enough to allow rapid deployment of services.
- 7) To report events and reactions in a common way in order to allow remote control.
- 8) To simplify maintenance interventions by supporting remote maintenance operations.
- 9) To allow interoperability between Network Operators/Service Providers for the exchange of management/charging information. This includes interoperability with other networks and services (e.g. ISDN/B-ISDN, PSTN, UPT) as well as other UMTS networks.
- 10) To enable the support and control of a growing number of resources. This would allow the system to start from a small and simple configuration and grow as needed, both in size and complexity.
- 11) To re-use existing relevant standards (eg GSM, IN, ISDN/B-ISDN etc.) where necessary
- 12) To support and control the management of the security aspects in UMTS (e.g. key management, access control management, operation and administration of security mechanisms).
- 13) To provide and support a flexible billing and accounting administration, to support charging across UMTS and non-UMTS systems.
- 14) To address the management and assessment of system performance and operation through the use of common measurements, etc. This would enable a Network Operator/Service Provider to assess actual performance against planned targets.
- 15) To expose any information only once.
(Example: In case an OSS operator would like to change the frequency of one carrier in a cell: Then all occurrences of this frequency in this OSS, e.g. transceiver frequency, hand-over relationships, performance measurements, frequency hopping control, etc., should be changed by one action only.)
- 16) To support the restoration of a UMTS Management System (e.g. Back-up/Restore, Undo, Transaction log, etc.).

It is acknowledged that the introduction of new architecture to support new services or the introduction of new services themselves may impact the detailed requirements of some or all of the above.

[NOTE: Additional requirements may become identified when the radio interface for UMTS is finalised]

4.3.2 Security Management

Security management is concerned with the management functions allowing Network Operators/Service Providers to perform administration of the security features of the network (e.g. handling of security alarms).

Security requirements can be found in Ref 4.

4.3.3 Performance Monitoring

This subclause describes the requirements for the following aspects:

- performance data generation and collection (e.g. for QoS analysis);

NOTE: This requires plausibility checks, estimation algorithms and the possibility of calculating parameters.

- traffic measurements;
- subscriber activity tracing.

Network management shall support the use of measurements from e.g. handover, user registration, location updating and paging, for performance management, maintenance and planning purposes.

The measurement data produced by the network may be used for:

- traffic measurements (e.g. successful/unsuccessful handovers per Base Station Group per hour);
- evaluation of current network configuration (e.g. ratio of handover attempts and successful handovers per cell); the measurement results can be further processed in the network planning and reconfiguration part of TMN;
- evaluation of possible fault situations around the UMTS network (e.g. number of successful and failed handovers per source/target cell).

4.3.4 System Configuration

This subclause describes the requirements for the following aspects:

- spectrum management,
- system extension (e.g. introduction of a new network element or function),
- system reduction (e.g. removal of a network element or function),
- system modification (e.g. change of an existing network element or function),
- interworking with other systems.

Network management shall support:

- the ability to manage a wide range of cell types (eg uncoordinated installation/removal of base stations, no frequency planning, etc.);
- the reconfiguration of assigned frequency blocks (spectrum management) in response to changing traffic, service requirements or spectrum allocation, allowing efficient and economical use of the radio spectrum;
- provision of access to UMTS dependent on e.g. the mobile terminal type or location;
- reconfiguration of the system with minimal disruption of the normal provision of services;
- the management of the relevant configuration information used by UMTS specific radio interface protocols, e.g. cell identities;
- control of the handover function by allowing the selection of the handover algorithm, the selection of the candidate cells for handover for each cell individually, the configuration of the handover function, and the management of handover mechanisms characteristics;
- the Network Operators' ability to force handovers or to disconnect calls, in order to initiate maintenance activities;
- all UMTS Network Elements and UMTS Management Systems shall support auto-discovery

Auto-discovery is a function of a Management System allowing the automatic discovery of previously not known Network Elements and Management Systems within the complete network or parts of it. During auto-discovery it should be possible to retrieve the following information:

- inventory information (hardware, software, firmware);
- status information (operational, administrative and usage status);
- interconnection information (links to neighbour network elements).

The selection of specific items should be possible to avoid the transmission of the complete information in case it is not necessary.

- “plug-and-play” for the introduction of new network elements

4.3.5 Maintenance

Network Operators need to maintain equipment in a state where the quality of offered services to the subscriber is acceptable. Maintenance includes techniques that aim to minimise the loss of service caused by a failure.

This subclause describes the network management requirements for the following aspects:

- pro-active maintenance (e.g. routine maintenance activities, transmission of relevant failure information to manufacturers),
- detection/localisation/isolation of failures (e.g. monitoring, analysis of operating trends, analysis of customer complaints),
- reactive maintenance (i.e. repair and restore the network functions).

Reactive maintenance is the use of management functions to detect a fault and restore all or part of the network element following a failure. Pro-active maintenance is the use of management functions and manual routine maintenance activities to prevent, as far as possible, the occurrence of a failure. The management functions may be used either as part of pro-active or reactive maintenance.

UMTS NM shall standardise the access to the mechanisms specified in the following sub-clauses..

NOTE: It could be expected that most faults in terminals have no impact to the network, meaning they do not disturb the network. In this case fault detection and repair is not a concern of the network operator. On the other hand there may be faults in terminals which do disturb the network. In this case it is necessary for the network operator to have the possibility of dealing with these problems. This subject is for further study.

4.3.5.1 Pro-active Maintenance

The main purpose of pro-active maintenance is to minimise failure occurrences. It is not proposed to standardise specific requirements for pro-active maintenance. This subclause is only an example of the mechanisms that could be used,

The following mechanisms could be used :

- self tests; the self test may be used to ensure correct functioning prior to operation;
- test loops, may be used to ensure correct communication prior to operation;
- a maintenance friendly design of the equipment, so that normal maintenance activities can easily be performed by the maintenance staff;
- provision of redundant units of equipment, (these units may be on hot or cold standby, depending on requirements); such units could be provided for all important units necessary to maintain the operation;
- arrangement of equipment of the network in such a way, that in case of a failure the active part of the network can be switched to an equivalent circuit.

- the establishment a database of fault history for forecasting purposes.

4.3.5.2 Detection/Localisation/Isolation of Failures

Detection and localisation mechanisms are necessary to recover from system failures. Isolation mechanisms are necessary to minimise the impact of these failures.

If a failure occurs this can have different effects on services depending where the fault occurs. Understanding the severity of the fault is necessary to determine the required speed of repair. For example, the following mechanisms may be used for detection, localisation and isolation:

- failures have to be able to be reported in alarm messages, with information facilitating the localisation and severity assessment;
- generation of alarms if UMTS performance, e.g. handover performance, is below a pre-defined threshold;
- detection and evaluation of discrepancies between two hot standby units;
- recording and evaluation of call characteristics, (e.g. statistical surveys of calls to avoid or to detect faults);
- analysis of user complaints;
- the ability to perform regular and automatic testing, and test functions or facilities which can be activated on site;
- facilities to check status information of all units;
- analysis of operating trends to detect or describe failures using history databases;
- analysis of historical fault data for faster fault localisation;
- performance of alarm correlation, e.g. using an expert system.

4.3.5.3 Reactive Maintenance

Once the detection, localisation and isolation of the failure has been accomplished, the faulty unit (software or hardware) must be repaired or replaced.

Network management should provide information, so that it can quickly be ascertained what are e.g. equipment/system status, load levels, trouble conditions, activated network management controls. When existing, the redundant units must overtake the operation.

In order to verify the repair, it is useful for the maintenance staff to have access to the management network to initiate tests.

In case of replacement, the consistency between software and hardware versions must be verifiable.

4.3.6 User Interface

All functions of a UMTS Management System should be equally accessible:

- locally interactively (e.g. by a GUI);
- locally non-interactively (e.g. by a command line interface);
- remotely interactively (e.g. by a redirected GUI); and

remotely non-interactively (e.g. by a management interface).

4.4 Service Management

Service management applies management principles to the services supported by UMTS. Although UMTS services are realised by the operation of managed entities, they do not map directly onto identifiable network elements, so their management is distinguishable from network management.

One of the goals for UMTS is the provision of global coverage and the ability for seamless roaming between networks. Users' applications will need to negotiate to establish communications paths having the required characteristics of bandwidth, delay and quality, (see also subclause 4.4.3 Quality of Service Management). The need to provide for non-standardised services which can be created independently in a competitive, multi-operator environment, will place radically new requirements on the radio interface where elements (eg channel coder, modulator, transcoder etc.), will not have fixed parameters as in 2G systems but will be in the form of a "toolbox" whereby the key parameters of bandwidth, transmission quality and delay can be selected, negotiated, mixed and matched by requirements of the required service according to capabilities of the radio channel(s), and which needs to be managed by service management. Likewise the user will be allowed access to service creation/modification functionalities possibly also extending to the creation of new personalised services so that individual requirements can be met, (see Ref 11). Service management takes as its input, data from, (amongst others), network management.

4.4.1 Requirements

Some requirements for service management are identical to those for network management. For clarity they have been included in the list below.

The following requirements have been identified :

- 1) To minimise the costs of managing a UMTS network such that it is a small component of the overall operating cost.
- 2) To minimise operating costs of UMTS.
- 3) To support introduction and removal of new services
- 4) To control access to UMTS services (eg by mobile type or location)
- 5) To allow management of services over shared infrastructure.
- 6) To allow interoperability between Network Operators/Service Providers for the management of services in order to offer services in the most cost-effective way. See below subclause 4.4.1.1 Interoperability.
- 7) To provide Quality of Service management. Since some services require specific levels of quality of service or charge according to the quality of service some means of managing the QoS is required.
- 8) Standardisation of service management should not prevent competition between manufacturers nor between operators. Eg service providers/operators and/or manufacturers should have the capability of creating service provider/operator specific services without necessarily having the service standardised.

4.4.1.1 Interoperability

This includes interoperability with other networks (e.g. ISDN/B-ISDN, PSTN, UPT) as well as other UMTS networks and UMTS service providers. Where multiple Network Operators/Service Providers are involved in providing a service the hierarchical management levels will need to be correlated with the horizontal management of all the resources across the different networks.

UMTS service management shall include co-operative management capabilities complementing the traditional hierarchical (vertical) interworking of management systems by peer-to-peer (horizontal) interworking of management systems. These management systems may be part of the same administrative domain or parts of different administrative domains (similar to the TMN X-interface).

Therefore service management shall support the following functions over an interworking interface:

- retrieval of supported management functions;

- configuration of Service Level Agreements (SLA);
- request for supported management functions within a SLA;
- transparency whether the request comes from a human operator or another management system;

Example:

Suppose a RAN operator has a SLA with a transport network operator allowing the use of a certain transport capacity on request. Then UMTS management systems should support the allocation of transport capacity by the RAN management system from the transport network management system within the agreed SLA. This does not exclude the possibility for the transport network management system to reject the allocation request. However this depends on the SLA. The allocation may result from a human interaction as well as from a traffic management (forecast) system.

[The requirements for network authentication have an impact here]

4.4.1.2 Service Usage

Service management shall support the monitoring of services usage by subscribers, and permit the collection of service access data for analysis and monitoring of services usage by subscribers. In an evolving world of UMTS networks, there will be a diversity of services and functionalities at the subscribers' disposal depending on the maturity of the home UMTS network, visited UMTS network and the varying service capabilities of multi-mode terminals. In rapidly evolving UMTS networks, differentiation of services offered by the UMTS networks will be the norm.

Roaming UMTS subscribers may be visiting the network from a home UMTS network which offers a richer set of UMTS services which are as yet not available in the visited UMTS network. These roaming subscribers are a valued revenue source to network operators, and their service access requests require to be identified. Additionally, the evolution of terminals will result in subscribers in the home UMTS network possessing equipment which is capable of supporting services that a visited network has yet to introduce.

The collection of services data will enable the network operators to identify the volume of services accessed, the type of services requested, and the growth trend of the services usage. Subsequent analysis of the collected data will permit network operators to grow and plan the services offered within their UMTS network in a manner which is not dissimilar to the way in which network resources are monitored for usage and expansion with Performance Measurements.

The collection of service access data shall support the following:-

- service capability of MS' (e.g. service classmark);
- services requested by subscribers, and which are supported by the network, taking into account requirements necessary to support VHE;
- services requested by subscribers, which are not supported by the network;
- frequency and level of service usage, broken down into service types;

4.4.2 Service management life cycle

The service management life cycle is shown in Figure 3 below.

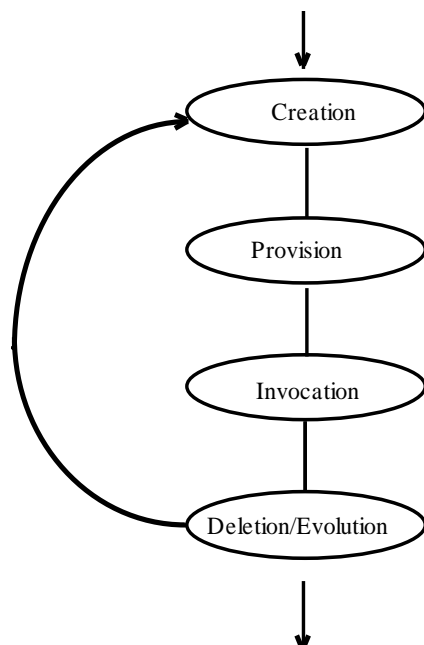


Figure 3 Service Management Life Cycle

Service management functional requirements can be associated with each stage in the life cycle. These functional requirements are elaborated below by means of examples.

Service Management Functional Requirements

Usage Monitoring

Statistical information shall be gathered and maintained concerning the usage of services.

At the *service creation* stage this information might relate to the service creation function as a whole, and/or to specific individual services or service sub-sets.

At *service provision*, usage monitoring information might be concerned with demographic or calendar-related distributions

Service invocation usage statistics might be concerned with time-of-day distribution of service invocations

During *service operation*, usage monitoring might be concerned with the usage characteristics of the specific service concerned

Service deletion usage monitoring information might relate to service deletions as a whole, or to specific services or service sub-sets

Performance monitoring

Statistical information shall be gathered and maintained concerning system performance throughout the service life cycle.

At *service creation*, this information might relate to the performance of the service creation process as a whole (for example average response times) or to response times or success rates in the creation of specific new services

Performance data collected during *service provision* might be concerned with measuring response times and/or success rates on the provision of individual services

Service invocation performance statistics might be concerned with invocation success rates and breakdowns of causes of invocation failure

During *service operation* performance data might be required by interoperating service providers in support of the operation of SLAs, or for charging purposes

At the *service deletion* stage, performance data might relate to average times taken to respond to deletion requests, deletion success rates, failure causes, etc.

Status Monitoring

UMTS services are expected to be implemented through the inter-operation of sub-services from multiple operators. In order to present status information for subscriber-facing interaction, status information relating to these sub-services needs to be exchanged.

At *service creation*, requirements for status monitoring information need to be defined and agreed. It is possible that different levels of service status detail may be requested by a service requesting organisation, and different levels of information may be available from service providers.

At *service provision* the level of status monitoring information required to be provided to the end user or subscriber need to be agreed.

At *service invocation* actual status monitoring levels have to be negotiated. these may vary from those agreed at service creation or service provision, to take account of prevailing network constraints.

During *service operation* status information relating to the service shall be exchanged between the service operators involved, as required by the status monitoring levels negotiated during the earlier stages of the life cycle.

At *service deletion* status information exchange would be required to ensure the service is able to be deleted.

Control

Delivery of a reliable user-configurable service depends on the exchange, across operator boundaries, of service control functions. Such functions would control and manage service invocation, service usage, deal with testability, resilience and load control mechanisms.

4.4.3 Quality of Service Management

Some services will require/provide specific levels of quality of service upon which charging may depend, (eg variable bit rate services, multimedia services etc.), where QoS describes the communication and processing requirements of information which have to be mapped onto the characteristics and capabilities of end-systems and networks. Network Operators/Service Providers should also be able to select criteria for the evaluation, differentiation and renegotiation of Quality of Service. Such renegotiation and differentiation may be :

- mobility related, (required QoS in source cell not available in target cell at handover);
- periodic, (cell capacity varies over time resulting in QoS for high bandwidth user causing blocking in the cell);
- spasmodic, (sudden demand for services causing blocking in the cell);
- connection oriented (mobile to mobile connection controlled by the mobile with the lowest QoS availability).

The following requirements for QoS management, from an operator's perspective, have been identified:

- to recognise the kind of service and the related Quality of this Service,
- to monitor the Quality of Service end-to-end at any time;

NOTE: A single Service Provider may not completely control the provision of a given service. But it should have the possibility to monitor the Quality of the Service it offers, because it is responsible to its customers for this service.

- to support handover with the same QoS between networks;
- to renegotiate QoS offered to a user;
- to minimise the number of different qualities for the same service;
- to support QoS changes;
- to co-operate on Quality of Service issues with other Network Management Systems.

Charging may be based on different QoS levels.

QoS management also has impacts on Network Management, eg reclamation of blocked circuits/equipment may be possible if calls/services requiring lower QoS but that have been set up using high QoS circuits/equipment are moved to other low QoS circuits/equipment etc. when the equipment becomes available.

It should be noted that Quality of Service management may result in new messages being required between network elements to control/change/configure QoS parameters in the network elements.

QoS parameters required to be managed are given in Ref 12.

4.4.4 Service and Business Areas

This subclause describes service management requirements, from a UMTS Operator point of view, for the following aspects:

- subscriber and user administration,
- charging and billing (e.g. collection of charges from subscribers),
- inter-operator accounting (i.e. collection of revenue from other operators),
- terminal administration

4.4.4.1 Subscriber and User Administration

Service management should include the management functions associated with the administration of data (possibly distributed over several databases) related to the provision of UMTS services to subscribers and users. The use of a unique user identification and of a unique equipment identification is necessary.

4.4.4.2 Charging and Billing

Call charges may be billed in a number of ways, (eg by the Network Operator/Service Provider, directly to the subscriber, prepaid etc.). Service management shall provide flexibility to support multiple billing arrangements. This may require :

- the capability of performing usage metering in originating, transit and terminating networks.
- the capability of categorising certain types of handover to allow Network Operators to be able to charge for them.
- the capability of allowing Network Operators to charge for the usage of location management procedures.
- To enable different charging techniques during the call (e.g. directly to the user), UMTS management should provide mechanisms to manage the exchange of charging information when an handover is invoked.

Additionally, service management shall support the billing requirements of the GSM MoU Association as specified in Ref 10. An example is given immediately below.

For basic services, it shall be possible in principle for the service provider to charge the subscriber/user according to one or more of the following factors:

- resource usage,(connection time, data transmitted)
- subscription basis

- requested and/or allocated QoS (throughput distribution, delay distribution, priority)
- network actual vs. expected load (i.e. it shall be possible to set tariffs dynamically based upon instantaneous network conditions).
- mobility e.g. number of handovers suffered within call;
- environment e.g. cordless, domestic, satellite etc.;
- temporal factors such as time of day;
- geographical factors such as location of calling and called parties;
- the role of the subscriber/user e.g. whether the calling or called party;

See also 4.4.3 Quality of Service Management.

Service management shall support the new charging and accounting mechanisms defined in Ref 6.

4.4.4.3 Inter-Operator Accounting

Inter-operator accounting shall be verifiable. This implies that when traffic over a given connection or link between two Network Operators is to be charged, usage metering needs to be done on both sides: outgoing (Operator A) and incoming traffic (Operator B).

Usage metering of signalling traffic (out of call procedures: e.g. interrogation, location updates) for the purpose of inter-operator accounting may also be needed.

See also Ref 6.

4.4.4.4 Terminal Administration

UMTS aims for offering service capabilities to enable for a wide variety of services, i.e. from simple services such as speech to complex multimedia services containing several simultaneous media components and putting totally different requirements for the systems and for the users' equipment. It can clearly be seen that a wide range of terminal types will prevail in UMTS environments, e.g. speech only terminals, data terminals, multi-band/multi-mode terminals and combinations of these. UMTS does not restrict the terminal functionalities in anyway, although a mandatory set of functions is required in order to ensure proper behaviour of the system. The mandatory functionalities are mainly related to the interaction between the terminal and the network. The network management requirements regarding to the terminal administration are :

- to provide terminal profile administration;
- to provide for network registration of mobile terminals;
- to provide for location update and authentication;
- to provide bearer services characteristics, (eg, information transfer attributes, access attributes and general attributes), to adapt to terminal capabilities. These may be network and/or service management related;
- software defined radio management. It is recognised that software defined radio will evolve over a number of phases and the evolution of its management should be comparable. The degree of management shall be optional.

Some aspects of services are dependent upon terminal characteristics eg bearer capability. With multimedia BCs it is expected that some terminals will only be able to handle a subset of services offered by an SP.

4.4.5 Requirements related to roaming

The following assumptions have been made in determining these requirements:

- Handover between different access networks is required in both directions (eg GSM to UMTS and UMTS to GSM).

- Handover between different access networks may apply to only a subset of UMTS services

Service management shall support handovers between different access networks (subject to the above assumptions). This may involve the export of subscriber data from the source network to the target network. The decision as to whether the source or target network is responsible for the transfer of this data is not a network management issue.

Service management shall support the automatic establishment of roaming agreements. This service is defined in Ref 9.

[The requirements for network authentication have an impact here]

5 Future ETSI Standardisation for Network & Service Management

UMTS network management standards should be developed according to the requirements defined in this TR.

Furthermore, these standards should allow manufacturers, network providers and service providers maximum flexibility in design, deployment and use. Where possible, use should be made of specifications, standards and expertise available in other fora.

As technology develops it will be possible to provide an increasing range of services to users; this evolution should not be ignored but rather taken advantage of. The standards developed should reflect this.

5.1 UMTS Management Standards

Referring to the management pyramid in Fig 1 above, several areas of standardisation have been initially identified :

- UMTS Network Management Functional Architecture;
- UMTS Service Management Functional Architecture;
- Network Management - Service Management Functional Information flows (vertical flows);
- Internal Functional Information Flows (horizontal flows).

Descriptions of some of the functionalities required to support this decomposition are given below.

Subscriber, Mobile Equipment and Service Data Administration - Management Functions associated with the administration of data (possibly distributed over several databases) related to UMTS subscribers (and possibly users), mobile equipments and services, specifically from the system management point of view. This data is also known as subscriber profile.

Subscriber Related Event and Call Data - Management Functions associated with the administration of subscriber related event and call data.

Security Management - Management Functions associated with the administration of security aspects of the UMTS (e.g. key management, access control management, operation and administration of security mechanisms).

Service Profile Management - Management functions associated with the service management and quality of service requirements as defined in this TR and service profile management as identified in Ref 11.

Performance Management - Management Functions associated with the management and the collection of performance measurement data within UMTS.

System Configuration Management and Administration - Management functions associated with the set-up and change of UMTS (which possibly includes a shared infrastructure). This includes spectrum management.

Maintenance of UMTS Infrastructure - Management functions associated with the maintenance of the UMTS (e.g. events and reactions reporting, maintenance actions).

This list is not conclusive.

It is not proposed at this stage that there will be one specification for each of the above areas.

5.2 Target time scales for the work

All areas of standardisation identified above would be developed in parallel and are dependent on other SMG/STC outputs. The earliest start date is 2Q98.

[The information in this subclause should be exported to UMTS 30.00 and referenced here. It is kept here temporarily].

Annex A: Optional NM Requirements

No optional requirements have been identified.

Annex B: Bibliography

The following material, though not specifically referenced in the body of the present document, gives supporting information.

MoU document TG20	Introduction to Third Generation Services
MoU document TG21	UMTS Service Requirements and Concepts
MoU document TG28	UMTS Quality of Service (QoS)
MoU document TG60	Evolution from GSM to UMTS
ITU-T X.460	Information Technology –MHS Management: Model and Architecture

History

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